Bulletin de veille du réseau d'écotoxicologie terrestre et aquatique N°44

Colette Bertrand, Christian Mougin, Annette Bérard, Céline Pelosi, Soizic Morin, Olivier Crouzet, Pascale Karmasyn-Veyrines

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Colette Bertrand, Christian Mougin (UMR 1402 EcoSys), Annette Berard, Céline Pélosi (UMR 1114 EMMAH), Soizic Morin (UR 1454 EABX), Olivier Crouzet (UPFS – OFB)
et Pascale Karmasyn-Veyrines (DipSO)
Destinataires : les membres de la liste : ecotox@inrae.fr

Edito

Voici notre 44ème bulletin de veille, très dense ! Faut-il y voir un effet du confinement, et/ou un renforcement de l'équipe de veilleurs ??? Vous y trouverez de très nombreuses informations en lien avec l'écotoxicologie et la toxicologie. Nous vous proposons en pages 102-106 une présentation épurée des articles cités. Merci de nous faire un retour sur votre perception de ce format ! Pas de rubrique « colloques », ceux-dont nous avions connaissance ont été annulés. Il en est ainsi du colloque de la SEFA reporté à 2021.

Nous vous proposons dans ce bulletin une tribune présentant la règlementation sur les ressources génétiques et ses conséquences pour les recherches en écotoxicologie. Le texte est également disponible sous forme de fiche thématique en téléchargement sur notre site ECOTOX :
https://www6.inrae.fr/ecotox/Productions/Fiches-thematiques/Fiche-thematique-N-26-avril-2020

N'oubliez pas de nous transmettre les informations que vous souhaitez diffuser, notamment vos publications que nous pourrions avoir oubliées.

L'équipe vous souhaite une bonne santé, un déconfinement sécurisé… et une bonne lecture de ce bulletin !

Contact : veille-ecotox@inrae.fr

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Tribune libre

La règlementation sur les ressources génétiques : quelles conséquences pour les recherches en écotoxicologie ?

Depuis 1992 et l'adoption de la Convention sur la Diversité Biologique (CDB), les questions de la conservation de la diversité biologique, de l'utilisation durable de ses composantes et du partage juste et équitable des avantages découlant de l'utilisation de ressources génétiques (RG) sont posées. Les RG prises en compte par la CDB comprennent tout matériel d'origine végétale, animale, microbienne ou autre, contenant des unités fonctionnelles de l'hérédité, ayant une valeur effective ou potentielle (à l'exception notamment des RG Humaines). Les RG s'étendent également aux produits dérivés que sont tous les composés biochimiques qui existent à l'état naturel résultant de l'expression génétique ou du métabolisme de ressources biologiques ou génétiques (par exemple des protéines). Enfin, la réglementation s'applique également aux connaissances traditionnelles associées (CTA) aux RG qui sont les « connaissances, innovations et pratiques » qui « incarnent des modes de vie traditionnels présentant un intérêt pour la conservation et l'utilisation durable de la diversité biologique ».

La CDB réaffirme la souveraineté des États sur leurs RG, et contient des engagements de leur part à coopérer et assurer la conservation et l'utilisation durable de la biodiversité, le partage des avantages issus de l'utilisation de connaissances traditionnelles des communautés locales et autochtones, et le respect des droits de propriété intellectuelle sur les innovations biotechnologiques. Les Etats doivent en outre faciliter l'accès aux ressources génétiques aux fins d'utilisation « écologiquement rationnelle ».

La CDB a conduit à la mise en place d'un mécanisme qui encadre la relation entre fournisseurs et utilisateurs de RG, dénommé APA ou « Accès aux ressources génétiques (et aux connaissances traditionnelles associées) et Partage juste et équitable des Avantages découlant de leur utilisation » (ou en anglais *Access and Benefit-Sharing – ABS*). Le Protocole de Nagoya, adopté lors de la conférence des parties (COP) de la CDB du 10 d'octobre 2010, et entré en vigueur en 2014, en précise les dispositions et le cadre réglementaire afin de sécuriser l'APA au plan juridique.

Le mécanisme de l'APA en quelques lignes

L'APA repose sur une relation bilatérale entre un Etat (ou une communauté autochtone et locale) fournisseur d'une RG (ou d'une CTA), et un utilisateur qui a l'intention de mener des travaux de recherche et de développement (R&D). L'accès à la ressource requiert le consentement préalable en connaissance de cause (CPCC ou *Prior Informed Consens Consent - PIC)* de l'État fournisseur (sauf si la législation de ce pays n'exige pas un tel accord), dans des conditions convenues d'un commun accord (CCCA ou *Mutually Agreed Terms - MAT).* Ces CCCA fixent le partage des avantages découlant de l'utilisation des RG ou CTA, c'est-à-dire les contreparties demandées par l'État fournisseur de la RG/CTA. Les avantages peuvent être monétaires (royalties…) ou non monétaires (transfert de technologies, partage de connaissances…).

Chaque Partie au protocole de Nagoya s'engage à mettre en place des dispositifs réglementaires pour définir les modalités d'accès aux RG/CTA relevant de sa souveraineté, le partage des avantages liés à l'accès et l'utilisation de ces RG/CTA, et à mettre en place les mesures destinées à s'assurer que l'utilisation de RG/CTA sous sa juridiction est conforme aux règles d'APA du pays fournisseur, notamment avec des points de contrôle.

Chaque Partie au protocole doit désigner une Autorité Nationale Compétente (ANC), qui reçoit les déclarations, délivre les autorisations, émet les permis internationaux, et un point focal qui informe les utilisateurs sur les exigences de son pays en matière d'APA.

Le protocole de Nagoya crée un centre d'échange sur l'APA (*ABS clearing house = ABS CH*). Chaque Partie lui transmet les informations pertinentes la concernant (réglementation, permis délivrés...). L'ABS CH édite et publie les certificats de conformité reconnus à l'échelle internationale (*IRCC*) sur la base des informations transmises par les Parties.

A noter que les RG humaines et, jusqu'à présent, les RG de haute mer (hors de toute juridiction nationale), sont exclues du champ d'application du protocole de Nagoya. Par ailleurs, le protocole ne s'applique pas aux instruments internationaux d'APA déjà existants ou à venir, ayant les mêmes objectifs que la CDB et le protocole. C'est le cas, à ce jour, du Traité International sur les Ressources phytogénétiques pour l'Alimentation et l'Agriculture (TIRPAA) et du cadre de préparation de l'OMS en cas de grippe pandémique (*WHO Pandemic Influenza Preparedness Framework*).

Si la mise en application de l'APA concerne en premier lieu les échanges internationaux de RG et les Centres de Ressources Biologiques qui les conservent et les distribuent, celle-ci peut impacter les recherches dans le champ de l'écotoxicologie, y compris dans le cadre de programmes nationaux.

Le cadre législatif et règlementaire de l'APA

Outre la CDB et le protocole de Nagoya au niveau international, le cadre règlementaire comprend un niveau européen, l'Union Européenne étant Partie au protocole, et un niveau français.

- **Au niveau européen**, trois textes précisent les modalités de l'APA. Ils portent sur la conformité de l'utilisation de ressources génétiques, dans l'Union, aux règles d'APA :

  - Le règlement UE N°511/2014 du Parlement européen et du Conseil relatif aux mesures concernant le respect par les utilisateurs dans l'Union du protocole de Nagoya sur l'accès aux ressources génétiques et le partage juste et équitable des avantages découlant de leur utilisation.

  - Son règlement d'exécution 2015/1866 du 13 octobre 2015 portant modalités d'application du règlement UE N°511/2014 du Parlement européen et du Conseil en ce qui concerne le registre des collections, la surveillance du respect des règles par l'utilisateur et les bonnes pratiques.

  - Le document d'orientation sur le champ d'application et les obligations essentielles du règlement UE N°511/2014 du Parlement européen et du Conseil.

Ainsi, les utilisateurs de RG ont obligation de diligence : ils doivent « faire preuve de la diligence nécessaire afin de s'assurer que l'accès aux ressources génétiques et aux connaissances traditionnelles associées aux ressources génétiques qu'ils utilisent s'est effectué conformément aux dispositions législatives ou réglementaires applicables en matière d'accès et de partage équitable des avantages, et que les avantages font l'objet d'un partage juste et équitable selon des conditions convenues d'un commun accord, conformément à toute disposition législative ou réglementaire applicable ».

- **Au niveau français**, l'APA est principalement encadrée par :

  - La loi N°2016-1087 du 8 août 2016 pour la reconquête de la biodiversité, de la nature et des paysages.

  - Le décret N°2017-848 du 9 mai 2017 relatif à l'accès aux ressources génétiques et aux connaissances traditionnelles associées et au partage des avantages découlant de leur utilisation.

La règlementation française concerne l'accès aux RG/CTA prélevées sur le territoire national (métropole et DROM) ainsi que la conformité de l'utilisation de RG/CTA collectées sur le territoire national ou à l'étranger. A noter qu'il existe pour certaines ressources des régimes spécifiques qui les placent hors champ des procédures de l'APA.

Sont exclues du champ d'application de la réglementation nationale : les RG humaines, les RG relevant du TIRPAA, les RG des espèces utilisées comme modèles dans la R&D (définies par arrêté), les CTA ne pouvant être attribuées à une ou plusieurs communautés d'habitants ou déjà bien connues, les RG échangées pour l'usage personnel ou au sein des communautés d'habitants entre elles, et enfin la R&D concourant à la sauvegarde des intérêts de la défense et de la sécurité nationale.

La réglementation définit un régime général avec obligation de déclaration pour la recherche fondamentale et demande d'autorisation pour la recherche ayant un objectif de valorisation, et des régimes spécifiques :

- RG végétales cultivées ou animales domestiquées, espèces végétales sauvages apparentées, RG objets de sylviculture, RG collectées par les laboratoires pour la prévention et la lutte contre les dangers sanitaires et pour la sécurité sanitaire des aliments (au sens du code rural et de la pêche maritime), RG collectées par les laboratoires pour la prévention et la maîtrise des risques graves pour la santé humaine, RG micro-organismes domestiqués et cultivés.
- Les RG des micro-organismes prélevés sur le territoire métropolitain sont exemptées des procédures APA pendant 3 ans jusqu'au 2 septembre 2022 (loi PACTE), mais en contrepartie il faut répondre à une enquête du MTES chaque année.

Les RG contenues dans des échantillons prélevés dans l'environnement découlent chacune de leur régime respectif.

La loi désigne le MTES comme point focal national, comme autorité compétente pour les déclarations aux RG et les demandes d'autorisations d'accès aux RG et CTA, ainsi que pour la déclaration de diligence nécessaire au stade du développement final d'un produit.

Le MESRI est autorité compétente pour la déclaration de diligence nécessaire au stade de financement des projets de recherche et pour les demandes d'inscription des collections au registre européen.

Enfin, les Provinces de Nouvelle-Calédonie et la Polynésie française sont autorités compétentes sur leurs territoires respectifs.

Tous les organismes de recherche et chercheurs français sont soumis, depuis 2017, à l'ensemble de ces textes !

Le non-respect des procédures APA est passible de sanction. Si les instituts de recherche et universités sont des personnes morales directement passibles de sanctions, leurs personnels reconnus responsables de mauvaise pratiques peuvent être condamnés au civil et au pénal (jusqu'à un an d'emprisonnement et 150 000 € d'amende, portée à 1 M€ en cas d'utilisation commerciale). En outre leur image et leur réputation (reconnaissance de bio-piratage) seront très fortement dégradées avec un impact important sur les partenariats, des difficultés en vue de l'obtention de permis de recherche/autorisations pour l'accès aux ressources, le remboursement des aides publiques perçues, une méfiance dans les négociations contractuelles, une perte de certifications/labellisations pour leurs outils, un risque de se voir refuser la publication d'articles par les éditeurs scientifiques…

Il ne faut pas oublier dans la mise en œuvre des projets de recherche les autres règlementations en vigueur concernant : la propriété des échantillons, les contraintes associées aux matériels de quarantaine, le respect des données personnelles (CNIL, RGPD…), l'open science, ainsi que les exigences des financeurs (ANR…)…

Comment la règlementation APA impacte-t-elle les travaux de recherche en écotoxicologie ?

La règlementation APA concerne toute personne physique ou morale, française ou étrangère et travaillant pour le secteur public ou privé, qui utilise des RG (ou dérivés) pour des activités de R&D sur la composition génétique ou biochimique des RG, notamment par l'application de la biotechnologie, y compris pour la valorisation de ces RG, les applications et la commercialisation qui en découlent, ainsi que des CTA correspondant à leur étude et à leur valorisation.

- **Les programmes de recherche menés directement par les chercheurs des unités de recherche**, qui portent sur l'évaluation des effets biologiques des contaminants chimiques sur les organismes de l'environnement, sont concernés, dès lors que sont impliqués :
  - ✓ Des échantillons prélevés dans les milieux naturels (sols, eaux, air) visant une utilisation de leur biote, par exemple des travaux portant sur l'abondance, la diversité et l'activité des organismes,
  - ✓ Des prélèvements en vue de la mise en place d'élevages (par exemples arthropodes…) au laboratoire,
  - ✓ Des échantillons acquis auprès de collections tierces, qui, tous, renferment des RG !

Il convient d'examiner, au cas par cas, quelle est l'origine de la RG, la date de sa collecte (les textes ne sont pas rétroactifs), quelles sont la traçabilité, les informations et la documentation associées à chaque échantillon, quel régime s'applique à la RG en cas de collecte sur le territoire national.

Des outils sont disponibles pour aider à décortiquer les différentes situations (lien autodiagnostic sur le sharepoint APA intranet INRAE).

- **Lorsque les programmes de recherche s'appuient sur des CRBs et collections** (par exemple ceux du pilier Environnement BRC4Env de l'IR AgroBRC-RARe), les gestionnaires des CRBs et collections doivent également se poser ces questions avant tout transfert de RG à un utilisateur, et déterminer s'ils sont en mesure de transférer toutes les informations et tous les documents requis (consulter là encore le sharepoint APA intranet INRAE).

Les CRB ont la possibilité de se faire inscrire au registre des collections de l'UE :

https://ec.europa.eu/environment/nature/biodiversity/international/abs/pdf/Register of Collections.pdf.

- ✓ **Avantages :** visibilité au niveau européen et international, solide réputation de sérieux auprès de la communauté scientifique et notamment des utilisateurs potentiels, représente un point d'appui pour les futurs projets car lorsqu'il se procure une RG auprès d'une collection inscrite au registre européen, l'utilisateur est réputé avoir fait preuve de diligence nécessaire en ce qui concerne l'obtention de toutes les informations et documents relatifs à la RG ce qui représente pour lui une simplification, une sécurité et un gain de temps notoires.
- ✓ **Contraintes :** adaptation du système d'information, analyse du statut des RG de la collection vis-à-vis de l'APA, investissement humain pour le montage du dossier, adaptation du système qualité.

Les recherches en écotoxicologie et l'APA : quelle conduite adopter ?

Lors de la réflexion préalable à la construction d'un projet de recherche en écotoxicologie, puis de sa mise en œuvre, il convient de s'interroger sur les points suivants.

- **Pour les projets utilisant des RG prélevées en France :**
  - ✓ Tout d'abord vérifier si la RG (ou CTA) utilisée est soumise à un régime d'APA, selon sa nature, l'origine, la date d'accès, et l'utilisation qui en est faite.
  - ✓ Le cas échéant, vérifier quelle procédure règlementaire sera à mettre en œuvre : par exemple déclaration ou autorisation pour les échantillons prélevés sur le territoire national (sauf pour la Nouvelle-Calédonie et la Polynésie française qui ont leurs propres réglementations).
    La signature des procédures de déclaration relève de la compétence des **directeurs d'unité** (pour INRAE). Elle s'applique dans les cas de l'utilisation de RG à des fins de connaissance sur la biodiversité,

de conservation en collection ou de valorisation sans objectif direct de développement commercial, en situation d'urgence relative à la santé humaine, à la santé animale ou à la santé végétale. Les détenteurs de collections scientifiques peuvent, à leur demande, bénéficier d'une procédure de déclaration annuelle simplifiée.

https://www.demarches-simplifiees.fr/commencer/apa-declaration-pmorale

La signature des procédures d'autorisation relève de la compétence des **présidents de centres** (pour INRAE). Elle concerne toutes les autres utilisations de ressources génétiques et notamment avec un objectif direct de développement commercial, ainsi que l'utilisation de connaissances traditionnelles associées. L'autorisation précise les conditions d'utilisation des RG et des CT associées et les conditions de partage des avantages dans une convention entre demandeur et ANC. Le délai d'instruction est de 2 mois à compter de l'accord sur le partage des avantages entre le demandeur et l'ANC. Le refus doit être motivé.

https://www.demarches-simplifiees.fr/commencer/apa-autorisation-pmorale

- **Pour les projets de recherche utilisant des RG prélevées dans des pays de l'UE ou d'autres pays tiers :**
  - ✓ Vérifier si le pays est Partie au protocole de Nagoya, et consulter sa réglementation APA en vigueur.
  - ✓ Eventuellement préciser la répartition des démarches entre partenaires.
- **Pour tous les projets :** il sera sans doute nécessaire en cours de projet, si le protocole de Nagoya et la réglementation européenne s'appliquent et en fonction de la date d'accès à la RG, de faire preuve de diligence nécessaire : déclaration de *due diligence* et transmission du récépissé au financeur (ou INPI ou autorité compétente pour la mise sur le marché, selon le cas, s'il y a valorisation commerciale).

Où trouver les informations pratiques ?

- **Au sein d'INRAE, le site intranet APA** https://sites.inra.fr/site/maj/APA fournit de nombreuses ressources et outils pratiques notamment un autodiagnostic, des arbres de décision, une base pays, les démarches APA à INRAE, une FAQ, des liens utiles… qui vous guideront pour la gestion de l'APA dans les projets de recherche et lors de transferts d'échantillons. **La cellule APA** apa@inrae.fr peut également être contactée si ces outils ne vous permettent pas de réaliser les démarches adéquates. **La NS 2019-66** précise également les modalités d'instruction, de gestion et de suivi des dossiers de déclaration et d'autorisation administrative pour l'accès aux ressources génétiques et aux connaissances traditionnelles qui leur sont associées en vue de leur utilisation.
- **En dehors d'INRAE**, les scientifiques doivent se rapprocher de leur ANC et/ou de leur cellule APA institutionnelle.

En conclusion, l'APA : contrainte ou opportunité ?

Les principes de l'APA visent à préserver la biodiversité. Ils s'appliquent à l'accès et à l'utilisation des RG (et produits dérivés) ainsi qu'aux connaissances traditionnelles associées aux ressources génétiques. Le protocole de Nagoya établit des mécanismes pour mettre en œuvre l'APA, sur la base d'accords bilatéraux. Ils offrent au fournisseur et à l'utilisateur de ressources génétiques et CTA une sécurité juridique. Les États élaborent et mettent en œuvre des réglementations nationales en matière d'APA. Tous les utilisateurs de RG doivent se conformer à ces réglementations. Malgré des contraintes évidentes, le protocole de Nagoya doit être considéré comme une opportunité d'améliorer les pratiques de recherche et de partenariat, en impliquant réellement tous les porteurs d'enjeux, et en reconnaissant leurs droits et devoirs. Les institutions ont mis en place les structures et outils d'accompagnement à la mise en œuvre de l'APA. Le projet ABS4BRCs diffusera prochainement via son site internet (à venir) un certain nombre de documents utiles.

Contacts

- Cellule APA INRAE : Didier Bouchel et Micaël Aliouat
- Pilier Environnement BRC4ENv de l'IR RARe, Plateforme Biochem-Env : Christian Mougin

Pour en savoir plus

• Sites web

- ABSCH : https://absch.cbd.int/
- FAO : http://www.fao.org/plant-treaty/areas-of-work/the-multilateral-system/overview/fr/
- BDD : https://ssl.fao.org/glis/entity/search ; https://www.genesys-pgr.org/
- Europe : https://ec.europa.eu/environment/nature/biodiversity/international/abs/
- MESRI : https://www.enseignementsup-recherche.gouv.fr/pid37627/utilisation-de-ressources-genetiques-ou-de-connaissances-traditionnelles-associees.html
- INRAE sharepoint APA : https://sites.inra.fr/site/maj/APA/
- ABS4BRCs : projet-abs4brcs.fr (à venir)

• Guides

- APA pas à pas : https://www.fondationbiodiversite.fr/lapa-pas-a-pas/
- Code de conduite et le guide des bonnes pratiques du « Consortium of European Taxonomic Facilities » : https://cetaf.org/services/natural-science-collections-and-access-and-benefit-sharing

• Autres

- Document d'orientation sur le champ d'application et les obligations essentielles du règlement (UE) no 511/2014 : https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R0511
- Arrêté sur les espèces modèles : https://cache.media.enseignementsup-recherche.gouv.fr/file/Encadrement_des_pratiques_de_recherche/86/2/Liste_especes_modeles_1191862.pdf
- INRAE NS 2019-66 : Instruction, gestion et suivi des dossiers de déclaration et d'autorisation administrative pour l'accès aux ressources génétiques et aux connaissances traditionnelles qui leur sont associées en vue de leur utilisation.

ERA / PUBLICATIONS SCIENTIFIQUES / COMMUNAUTES MICROBIENNES AQUATIQUES

Mechanism of lead bioaccumulation by freshwater algae in the presence of organic acids

Authors: Que WY, Wang BH, Li FL, Chen XJ, Jin H, Jin ZF

Source: CHEMICAL GEOLOGY 540:UNSP 119565, 2020, DOI: 10.1016/j.chemgeo.2020.119565

Abstract: The accumulation of heavy metals by freshwater algae becomes more complex in the presence of dissolved organic matter but it is unclear how and to what extent. In this study, we comparatively assessed the effects of malic acid and citric acid on the bioaccumulation of Pb by Chlorella pyrenoidosa. A 6 h exposure experiment showed that adding organic acid (OA) to an algae-Pb binary system prolonged the adsorption equilibrium time and that the extended time was related to the concentration and number of carboxyl groups of the OA. A pseudo-second-order model fit the kinetic data well in the presence of OAs. The normality of carboxyl groups was negatively correlated with the bioaccumulation rate, k(2), but positively correlated with the maximum bioaccumulation capacity, q(max), of Pb following a linear equation, Y = 121.3x + 52.2, R-2 = 0.9877. Neither the Freundlich model nor the Langmuir model could fit the isotherm data in the presence of OA, suggesting that a new mechanism might exist. The quantitative relationship between bioaccumulated Pb and carboxyl group of OA indicated a stoichiometric relationship, which seemed to support the theory of a ternary complex of Pb, OA, and algal surface. Our results have added clarity to the current understanding of the accumulation of heavy metals by algae in freshwater ecosystems.

Accès au document

Age-related physicochemical differences in ZnO nanoparticles in the seawater and their bacterial interaction

Authors: Baysal A, Saygin H, Ustabasi GS

Source: ENVIRONMENTAL MONITORING AND ASSESSMENT 192(5):276, 2020, DOI: 10.1007/s10661-020-08254-w

Abstract: To assess the fate and behavior of engineered nanoparticles in the environment, it is important to examine the physicochemical and toxicological transformation of nanoparticles as they age in seawater. In this study, we investigated how aging and seawater conditions altered the physiochemical structure of nanoparticles and affected their interactions with bacteria. For this purpose, zinc oxide nanoparticles were aged under different seawater conditions by keeping them in 1%, 10%, and 100% seawater for 1 day and 20 days. The main physicochemical parameters (surface chemistry, chemical composition, particle size, and zeta potential) and toxicity of aged nanoparticles towards gram-negative *Pseudomonas aeruginosa* and gram-positive *Staphylococcus aureus* were examined. The results indicated that aged zinc oxide nanoparticles in various concentrations of seawater changed their surface chemistry, chemical composition, particle size, and zeta potentials. Growth inhibition results were observed in that the inhibition of gram-negative (*Pseudomonas aeruginosa*) bacteria was higher compared with the gram-positive (*Staphylococcus aureus*) bacteria, and Staphylococcus aureus activated with the aged zinc oxide nanoparticles. Also, the results showed that the key biochemical factors affected by the aging and seawater concentration.

Accès au document

Biofilms grown in aquatic microcosms affect mercury and selenium accumulation in *Daphnia*

Authors: Issa S, Ciesielski TM, Mikkelsen Ø, Einum S, Jaspers VLB

Source: ECOTOXICOLOGY 29: 485-492, 2020, doi: 10.1007/s10646-020-02194-4

Abstract: Experiments examining mercury (Hg) toxicity in Daphnia are usually conducted in highly standardized conditions that prevent the formation of biofilm. Although such standardization has many advantages, extrapolation of results to natural conditions and inference of ecological effects is challenging. This is especially true since biofilms can accumulate metals/metalloids and play a key role in their transfer to higher trophic level organisms. In this study, we experimentally tested the effects of spontaneously appearing biofilm in Daphnia cultures on accumulation of Hg and its natural antagonist selenium (Se) in Daphnia magna. We added Hg (in the form of mercury (II) chloride) at two concentrations (0.2 µg/L and 2 µg/L) to experimental microcosms and measured the uptake of Hg and Se by D. magna in the presence and absence of biofilm. To test for consistent and replicable results, we ran two identical experimental sets one week apart. Biofilm presence significantly reduced the accumulation of Hg, while increasing the tissue Se content in D. magna, and these findings were reproducible across experimental sets. These findings indicate that highly standardized tests may not be adequate to predict the bioaccumulation and potential toxicity of metals/metalloids under natural conditions.

Accès au document

Portable Microalgal Biosensor for Herbicide Monitoring

Authors: Boroni, Juarez A, Battaglini F

Source: CHEMELECTROCHEM 7(7):1623-1630, 2020, DOI: 10.1002/celc.202000210

Abstract: The need for in-situ and real-time tools to monitor the fate of pesticides in extensive areas is of great concern to preserve the environment in countries where agroindustry represents an essential part of its economy. In this work, we present the construction of a portable system based on the reversible photosynthesis inhibition produced by herbicides on microalgae, using atrazine as a model compound. The decrease in oxygen production due to the photosynthesis inhibition is electrochemically detected using an automated flow system. The system presented here involves the immobilization of microalgae in a polyelectrolyte-surfactant-carbon nanotube self-assembled material cast on a screen-printed graphite electrode; these components contribute to the stability and sensitivity of the whole device. The system presents a limit of detection of 0.11 µM, showing an excellent performance in river samples. The sensor maintains its integrity after five months immersed in a freshwater algae medium at room temperature. These features are key to install this system along the course of a river at a low cost, allowing early detection of polluted areas and long term environmental studies.

Accès au document

Enhanced production of laccase from gamma irradiated endophytic fungus: A study on biotransformation kinetics of aniline blue and textile effluent decolourisation

Authors: Navada KK, Kulal A

Source: JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING 8(2):UNSP 103550, 2020, DOI: 10.1016/j.jece.2019.103550

Abstract: Managing triphenylmethane class of dyes such as aniline blue present in the effluents is a nightmare for the industries and environmentalists. There are physical and chemical approaches available for degrading these recalcitrant dyes. However, these methods become expensive process and also degraded products are not ecofriendly in nature. Laccase from white rot fungi had been used for biotransformation of triphenylmethane class of dyes except for aniline blue. This study focussed on laccase from gamma irradiated endophytic fungus (*Phomopsis sp.*) and its enhanced activity

in degrading aniline blue as well as textile dye effluent. Laccase production was increased in 1.2 kGy gamma irradiated endophytic fungus (2 fold) and hence dye degradation was enhanced when compared to the non-irradiated (wild) fungus. The laccase activity exhibited appreciable stability for metal ions (Zn2+, Cu2+, Cr2+ and Ca2+) up to 10 mM concentration. The highest laccase activity and dye decolourisation rate was observed around 30 degrees C temperature at pH 5. The degraded intermediates were identified and a mechanism of degradation was proposed based on UV-vis, FTIR and LC-MS analysis. The aniline blue degradation kinetics strictly followed Michaelis-Menten model. The degraded aniline blue dye samples had reduced COD and were non-toxic to plants and microorganisms. To substantiate the industrial application, textile effluent was treated with laccase from the endophytic fungus and found 99 % decolourisation within 2.5 h. There was a 67 % reduction in COD and a 47 % reduction in BOD in laccase mediated textile effluent treatment.

Accès au document

The combined toxicity influence of microplastics and nonylphenol on microalgae *Chlorella pyrenoidosa*

Authors: Yang WF, Gao XX, Wu YX, Wan L, Tan LC, Yuan SM, Ding HJ, Zhang WH

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 195:110484, 2020, DOI: 10.1016/j.ecoenv.2020.110484

Abstract: Microplastics and nonylphenol (NP) are considered as emerging pollutant and have attracted wide attention, while their combined toxicity on aquatic organisms is barely researched. Therefore, the combined toxicity influence of NP with three types of microplastics containing polyethylene (PE1000, 13 μm and PE, 150 μm), polyamide (PA1000, 13 μm and PA, 150 μm) polystyrene (PS, 150 μm) on microalgae Chlorella pyrenoidosa was analyzed. Both growth inhibition, chlorophyll fluorescence, superoxide dismutase (SOD), malondialdehyde (MDA), and catalase (CAT) were determined. We found that single microplastics and NP both inhibited algal growth, thereby causing oxidative stress. The order of inhibition effect in single microplastics experiment was PE1000 > PA1000 > PE approximate to PS > PA. The combined toxicity experiment results indicated that the presence of microplastics had positive effect in terms of alleviating NP toxicity to C. pyrenoidosa, and the microplastics adsorption capacity to NP was the dominant contributing factor for this effect. According to the independent action model, the combined toxicity was antagonistic. Because the negative effect of smaller size microplastics on algal growth was aggravated with prolonged exposure time, the optimum effect of microplastics alleviated NP toxicity was PA1000 at 48 h, while this effect was substituted by PA at 96 h during combined toxicity. Thus, the toxicity of smaller size microplastics has a nonnegligible influence on combined toxicity. This study confirms that microplastics significantly affected the toxicity of organic pollutants on microalgae. Further research on the combined toxicity of smaller size microplastics with pollutants in chronic toxicity is needed.

Accès au document

Insights Into the Biodegradation of Lindane (gamma-Hexachlorocyclohexane) Using a Microbial System

Authors: Zhang WP, Lin ZQ, Pang SM, Bhatt P, Chen SH

Source: FRONTIERS IN MICROBIOLOGY 11:522, 2020, DOI: 10.3389/fmicb.2020.00522

Abstract: Lindane (gamma-hexachlorocyclohexane) is an organochlorine pesticide that has been widely used in agriculture over the last seven decades. The increasing residues of lindane in soil and water environments are toxic to humans and other organisms. Large-scale applications and residual toxicity in the environment require urgent lindane removal. Microbes, particularly Gram-negative bacteria, can transform lindane into non-toxic and environmentally safe metabolites. Aerobic and anaerobic microorganisms follow different metabolic pathways to degrade lindane. A variety of enzymes participate in lindane degradation pathways, including dehydrochlorinase (LinA), dehalogenase (LinB), dehydrogenase (LinC), and reductive dechlorinase (LinD). However, a limited number of reviews have been published regarding

the biodegradation and bioremediation of lindane. This review summarizes the current knowledge regarding lindane-degrading microbes along with biodegradation mechanisms, metabolic pathways, and the microbial remediation of lindane-contaminated environments. The prospects of novel bioremediation technologies to provide insight between laboratory cultures and large-scale applications are also discussed. This review provides a theoretical foundation and practical basis to use lindane-degrading microorganisms for bioremediation.

Accès au document

Comparison of the Level and Mechanisms of Toxicity of Carbon Nanotubes, Carbon Nanofibers, and Silicon Nanotubes in Bioassay with Four Marine Microalgae

Authors: Pikula K, Chaika V, Zakharenko A, Markina Z, Vedyagin A, Kuznetsov V, Gusev A, Park S, Golokhvast K

Source: NANOMATERIALS 10(3):485, 2020, DOI: 10.3390/nano10030485

Abstract: Nanoparticles (NPs) have various applications in medicine, cosmetics, optics, catalysis, environmental purification, and other areas nowadays. With an increasing annual production of NPs, the risks of their harmful influence to the environment and human health is rising. Currently, our knowledge about the mechanisms of interaction between NPs and living organisms is limited. Additionally, poor understanding of how physical and chemical characteristic and different conditions influence the toxicity of NPs restrict our attempts to develop the standards and regulations which might allow us to maintain safe living conditions. The marine species and their habitat environment are under continuous stress due to anthropogenic activities which result in the appearance of NPs in the aquatic environment. Our study aimed to evaluate and compare biochemical effects caused by the influence of different types of carbon nanotubes, carbon nanofibers, and silica nanotubes on four marine microalgae species. We evaluated the changes in growth-rate, esterase activity, membrane polarization, and size changes of microalgae cells using flow cytometry method. Our results demonstrated that toxic effects caused by the carbon nanotubes strongly correlated with the content of heavy metal impurities in the NPs. More hydrophobic carbon NPs with less ordered structure had a higher impact on the red microalgae P. purpureum because of higher adherence between the particles and mucous covering of the algae. Silica NPs caused significant inhibition of microalgae growth-rate predominantly produced by mechanical influence.

Accès au document

Co-metabolism of sulfamethoxazole by a freshwater microalga *Chlorella pyrenoidosa*

Authors: Xiong Q, Liu YS, Hu LX, Shi ZQ, Cai WW, He LY, Ying GG

Source: WATER RESEARCH 175:115656, 2020, DOI: 10.1016/j.watres.2020.115656

Abstract: Microalgae-mediated biodegradation of antibiotics has recently gained increased attention from international scientific community. However, limited information is available regarding microalgae-mediated biodegradation of SMX in a co-metabolic system. Here we investigated the biodegradation of sulfamethoxazole (SMX) by five algal species (*Pseudokirchneriella subcapitata, Scenedesmus quadricauda, Scenedesmus obliquus, Scenedesmus acuminatus* and *Chlorella pyrenoidosa*), and its transformation pathways by *C. pyrenoidosa* in a sodium acetate (3 mM) co-metabolic system. The results showed that the highest SMX dissipation (14.9%) was detected by *C. pyrenoidosa* after 11 days of cultivation among the five tested algal species in the absence of other carbon sources. The addition of sodium acetate (0-8 mM) significantly enhanced the dissipation efficiency of SMX (0.4 μM) from 6.05% to 99.3% by C. pyrenoidosa after 5 days of cultivation, and the dissipation of SMX followed the first-order kinetic model with apparent rate constants (k) ranging from 0.0107 to 0.9811 d(-1). Based on the results of mass balance analysis, biodegradation by *C. pyrenoidosa* was the main mechanism for the dissipation of SMX in the culture medium. Fifteen phase I and phase II

metabolites were identified, and subsequently the transformation pathway was proposed, including oxidation, hydroxylation, formylation and side chain breakdown, as well as pterin-related conjugation. The majority of metabolites of SMX were only observed in the culture medium and varied with cultivation time. The findings of the present study showed effective co-metabolism of a sulfonamide by microalgae, and it may be applied in the aquatic environment remediation and wastewater treatment in the future.

Accès au document

Treatment enhances the prevalence of antibiotic-resistant bacteria and antibiotic resistance genes in the wastewater of Sri Lanka, and India

Authors: Kumar M, Ram B, Sewwandi H, Sulfikar, Honda R, Chaminda T

Source: ENVIRONMENTAL RESEARCH 183:109179, 2020, DOI: 10.1016/j.envres.2020.109179

Abstract: Wastewater treatment plants (WWTPs) are being debated for being the hot spots for the development of antibiotic resistance in pathogenic microbial communities. We observed the prevalence of antibiotic-resistant bacteria (ARB), antibiotic resistance genes (ARG), and multidrug resistance (MDR) in two municipal WWTPs and one hospital WWTP in Western and Southern Sri Lanka, and compared the results with particular reference to Indian and the World scenario to trace the imprints of treatment on ARB and ARG. Result suggests that although wastewater treatment resulted in higher than 1.06 log *Escherichia coli* (*E. coli*) reduction at all WWTPs, yet the percent of *E. coli* resistant to most of the antibiotics increased from influent to effluent. Higher prevalence of ARB, ARG, and MDR were noted in hospital WWTP owing to the higher antibiotic concentrations used and excreted by the patients. With reference to India, the WWTPs in Sri Lanka showed more ARB and a consistent increase in its percentages after the treatment but were less resistant to Fluoroquinolone (FQ). E. coli strains isolated from each location of both countries showed multidrug resistance, which has increased after the treatment and was strongly correlated with FQ in every WWTP. Resistant genes for Fluoroquinolone (FQ) (aac(6')-1b-cr, qnrB, qnrS), beta-lactams (ampC), and sulphonamides (sul1) were common in all the wastewaters except additional parC gene in the hospital effluent of Sri Lanka, implying much higher resistance for quinolones, especially for Ciprofloxacin. Multivariate statistical treatments suggest that effluent showed higher loadings and association for MDR/ARB, where pH change and more extensive interaction with metals during the treatment processes seem to have profound effects.

Accès au document

Phytochemical Compounds as Cleaning Agents on Granite Colonized by Phototrophic Subaerial Biofilms

Authors: Genova C, Fuentes E, Sanmartin P, Favero G, Prieto B

Source: COATINGS 10(3): 295, 2020, DOI: 10.3390/coatings10030295

Abstract: The society has become increasingly interested in using natural products over chemicals for cleaning activities. In this study, the cleaning potential of formulations embedded in a hydrogel matrix and composed respectively of essential oils (EOs) of *Origanum vulgare*, *Thymus vulgaris*, and *Calamintha nepeta*, and their respective main active components (EO-ACs), viz., Carvacrol, Thymol, and Pulegone, on a phototropic biofilm growing on granite was investigated. In addition, and for comparative purposes, analysis with the combination of the three EOs, the combination of the three EO-ACs, and Preventol RI-80 (R) (one of the most effective commercial cleaning agents based on quaternary ammonium salts) in all three cases embedded in a hydrogel matrix, as well as only the hydrogel matrix, distilled water, and Preventol RI-80 (R), in both latter cases applied with brush, were also studied. The cleaning effect of the treatments was assessed immediately after the treatment and after one and two weeks by color spectrophotometry, a reliable tool to evaluate the presence and vitality of the phototrophs and the cleaning effectiveness in granite. C. nepeta and its active component Pulegone proved to be the

most effective and yielded similar results, comparable to those of uncolonized granite, and better than those obtained with Preventol RI-80 (R) applied with brush (most common way), especially at the end of the experiment. These promising first results support the suitable use of the phytochemical compounds used on phototrophs field where there are still few published studies and encourage further investigation toward the evaluation of their exhibited biocidal activity.

Accès au document

Phycoremediation potential of microalgae species for ethidium bromide removal from aqueous media

Authors: de Almeida HC, Salomao ALD, Lambert J, Teixeira LCRS, Marques M

INTERNATIONAL JOURNAL OF PHYTOREMEDIATION Early Access, 2020, DOI: 10.1080/15226514.2020.1743968

Abstract: Ethidium Bromide (EtBr) is an organic compound used in molecular biology investigations. EtBr ability of intercalating in the DNA molecule makes it a toxic substance. The objective was to evaluate the phycoremediation potentials of *Chlorella vulgaris, Desmodesmus subspicatus* and *Raphidocelis subcapitata* tested separately and in a mixture (Mix) for EtBr removal from the aqueous medium. Experiments were conducted using an initial algae biomass of 10(6) cell/mL, exposed to 500 µg/L of EtBr. The removal efficiency (µg EtBr L-1) after 3 h in each treatment were: Mix (72.8 µg.L-1) *D. subspicatus* (48.4 µg.L-1) *R. subcapitata* (24.6 µg.L-1) C. vulgaris (19.9 µg.L-1). However, when EtBr mass reduction per microalgae density is considered (ng.algae-1), the efficiency ranking changes to: *D. subspicatus* (1.9 x 10(-5)ng.algae-1) *C. vulgaris* (1.4 x 10(-5)ng.algae-1) Mix (9.8 x 10(-6)ng.algae-1) R. subcapitata (2.8 x 10(-6)ng.algae-1). The results suggest that initial algal population density is a determinant factor for efficient EtBr removal by microalgae species in short term treatments. In order to obtain 100% of EtBr removal, it should be necessary 10(10), 10(10) and 10(11) algae.mL-1 of C. vulgaris, D. subspicatus and R. subcapitata, respectively. The results strongly suggest phycoremediation can be explored as an alternative method for EtBr removal.

Accès au document

Role of bacterial cell surface sulfhydryl sites in cadmium detoxification by *Pseudomonas putida*

Authors: Yu Q, Mishra B, Fein JB

Source: JOURNAL OF HAZARDOUS MATERIALS 391:122209, 2020, DOI: 10.1016/j.jhazmat.2020.122209

Abstract: Understanding bacterial metal detoxification systems is crucial for determining the environmental impacts of metal pollution and for developing advanced bioremediation and water disinfection strategies. Here, we explore the role of cell surface sulfhydryl sites in bacterial detoxification of Cd, using Pseudomonas putida with surface sulfhydryl sites mostly on its EPS molecules as a model organism. Our results show that 5 and 20 ppm Cd in LB growth medium affects the lag phase of P. putida, but not the overall extent of cell growth at stationary phase, indicating that P. putida can detoxify Cd at these concentrations. EXAFS analysis of Cd bound to biomass from the different growth stages indicates that Cd binds to both sulfhydryl and non-sulfhydryl sites, but that the importance of Cd-sulfhydryl binding increases from early exponential to stationary phase. Cell growth is positively correlated to the measured sulfhydryl concentration on different biomass samples, but is independent of the measured non-sulfhydryl binding site concentration on the cell surfaces. Taken together, our results demonstrate that the sulfhydryl binding sites on EPS molecules can play an important role in binding and detoxifying toxic metals, significantly decreasing the bioavailability of the metal by sequestering it away from the bacterial cells.

Accès au document

The Response of Microalgae *Chlorella* sp. to Free and Immobilized ZrO2 and Mg(OH)(2) Nanoparticles: Perspective from the Growth Characteristics

Authors: Fu MW, Liang J, Wang SF, Geng C, Zhang WY, Wu T

Source: ENVIRONMENTAL ENGINEERING SCIENCE Early Access, 2020, DOI: 10.1089/ees.2019.0367

Abstract: The biological response of *Chlorella* to nanometal oxides is the basis for expanding the engineering application of *Chlorella* and inorganic metal oxide nanoadsorbents in the treatment of nitrogen and phosphorus wastewater. The objective of this study was to ascertain the response of *Chlorella* to nano-ZrO2 and nano-Mg(OH)(2) either free or immobilized to anion exchange resin D301. Our results show that immobilization of ZrO2 and Mg(OH)(2) to D301 was significantly less harmful (p < 0.05) to *Chlorella* than free nano-ZrO2 and nano-Mg(OH)(2). *Chlorella* has greater tolerance and positive biological response to fixed nanometal oxides, especially to D301-ZrO2 (nano-ZrO2 immobilized on D301), which can significantly stimulate the growth of *Chlorella*. Scanning electron microscopy observations indicated that most of algal cells treated with free nano-Mg(OH)(2) and nano-ZrO2 were entrapped in the aggregates of nanoparticles and were both deformed and atrophied in appearance. In contrast, D301-Mg [nano-Mg(OH)(2) immobilized on D301] immobilized beads demonstrated relatively few malformed algal cells on the surface, and D301-Zr showed no indications of deformed or atrophied cells either within or on the immobilized beads. Therefore, immobilization appears to have obvious effect on reducing the toxicity of powder nanoparticle and carrier, and the immobilization of ZrO2 and Mg(OH)(2) on D301 might provide a novel application to *Chlorella* wastewater treatment to improve algae wastewater treatment efficiency, as well as these sorts of immobilized nanoadsorbent might be regenerated using Chlorella.

Accès au document

Integrated assessment of west coast of South Korea by use of benthic bacterial community structure as determined by eDNA, concentrations of contaminants, and in vitro bioassays

Authors: Lee AH, Lee J, Hong S, Kwon BO, Xie YW, Giesy JP, Zhang XW, Khim JS

Source: ENVIRONMENT INTERNATIONAL 137:UNSP 105569, 2020, DOI: 10.1016/j.envint.2020.105569

Abstract: During the past few decades, contamination of sediments by persistent toxic substances (PTSs) has been observed in estuarine and coastal areas on the west coast of South Korea. The contaminants are suspected to cause toxicities in aquatic biota, but little is known about their ecological effects, particularly on benthic microbial communities. In this study, an eDNA-based assessment was applied along with classic assessments of exposure, such as chemistry and in vitro bioassays, to evaluate condition of benthic bacterial communities subjected to PTSs. Two strategies were adopted for the study. One was to conduct a comprehensive assessment in space (by comparing seawater and freshwater sites at five coastal regions) and in time (by following change over a 5-y period). Although we found that bacterial composition varied among and within years, some phyla, such as Proteobacteria (28.7%), Actinobacteria (13.1%), Firmicutes (12.7%), and Chloroflexi (12.5%) were consistently dominated across the study regions. Certain bacterial groups, such as Firmicutes and Verrucomicrobia have been linked to contamination at some sites in the study area and at specific points in time. Bacterial communities were not significantly correlated with salinity or AhR- and ER-mediated potencies, whereas concentrations of PAHs, APs, and certain metals (Cd and Hg) exhibited significant associations to the structure of bacterial communities at the phylum level. In fact, the relative abundance of microbes in the phylum Planctomycetes was significantly and negatively correlated with concentrations of PAHs and metals. Thus, the relative abundance of Planctomycetes could be used as an indicator of sedimentary contamination by PAHs and/or metals. Based on our correlation analyses, Cd and ER-mediated potencies were

associated more with bacterial abundances at the class taxonomic level than were other PTSs and metals. Overall, the eDNA-based assessment was useful by augmenting more traditional measures of exposure and responses in a sediment triad approach and has potential as a more rapid screening tool.

Accès au document

Limited effects of pesticides on stream macroinvertebrates, biofilm nematodes, and algae in intensive agricultural landscapes in Sweden

Authors: Bighiu MA, Hoss S, Traunspurger W, Kahlert M, Goedkoop W

Source: WATER RESEARCH 174:115640, 2020, DOI: 10.1016/j.watres.2020.115640

Abstract: Pesticides are frequently detected in surface waters, sometimes at levels exceeding ecotoxicological guidelines. We screened for almost 100 pesticides in 32 streams from intense agricultural areas in Southern Sweden, in concert with water chemistry parameters. In addition, we investigated the communities of benthic macroinvertebrates, biofilm nematodes and algae and calculated multiple bioassessment metrics. The number of pesticides found in each stream ranged between 2 and 52, but the sum of Toxic Units (Sigma TU) for the mixtures was generally low, and exceeded the European Uniform Principles only in a single sample for algae and in 2% of the samples for Daphnia. Only nematode communities were significantly correlated with the Sigma TU, potentially due to their higher pesticide exposure in biofilms. Diatom metrics showed that most streams were impacted by eutrophication and macroinvertebrate metrics showed good status in most streams, whereas the SPEAR(pesticides) (SPEcies At Risk) index, specifically designed to indicate pesticide effects, showed that about half of the samples were at risk. Interestingly, SPEAR(pesticides) was not correlated to Sigma TUDaphnia and this discrepancy suggests that redefining the boundaries for quality classes might be necessary for this index. Moreover, SPEAR(pesticides) was positively correlated with the commonly used macroinvertebrate index ASPT, although disparate results were found for several streams. We argue that this questions the scaling of both metrics and the specificity of their responses. We discuss that the overall good/moderate status of the streams, despite the intense agriculture in the catchments, can be due to the fact that i) a sampling strategy with repeated grab samples did not capture peak pesticide concentrations, thus underestimating acute exposure, ii) pesticide run-off indeed was low, due to measures such as buffer strips, and iii) the nutrient-rich conditions and high sediment loads counteracted pesticide toxicity. We conclude that agricultural land use was the overriding stressor in the investigated streams, including strong effects of nutrients, less apparent effects of pesticides and likely impact of hydromorphological alterations (not specifically addressed in this study).

Accès au document

Assessing the effects of metal mining effluents on freshwater ecosystems using biofilm as an ecological indicator: Comparison between nanofiltration and nanofiltration with electrocoagulation treatment technologies

Authors: Vendrell-Puigmitja L, Abril M, Proia L, Angona CE, Ricart M, Oatley-Radcliffe DL, Williams PM, Zanain M, Llenas L

Source: ECOLOGICAL INDICATORS 113:106213, 2020, DOI: 10.1016/j.ecolind.2020.106213

Abstract: Abandoned mines cause serious environmental damage to their surroundings with considerable impacts on freshwater ecosystems. These impacts occur mainly due to the uncontrolled discharge of polluted effluents, which may contain high concentrations of heavy metals. Currently, no real solution exists for this important environmental problem, leaving a legacy of global pollution. This study aimed to assess the impact of a metal mining effluent from an abandoned mine on freshwater ecosystems, using aquatic biofilms as an ecological indicator.

At the same time, the efficiency of different innovative treatment technologies in reducing the ecological impacts caused by mining effluents was evaluated, consisting of nanofiltration and nanofiltration combined with electrocoagulation. To do that, aquatic biofilms obtained from a pristine stream, were exposed, under microcosms conditions, to a metal mining effluent, untreated or treated by the innovative treatment technologies and responses were compared with unexposed biofilm which served as control. The structural and functional responses of the biofilm were measured with throughout time. Biofilms that were exposed to the untreated mining effluent showed significant differences respect to the rest of treatments and the control, particularly exhibiting inhibitory effects on photosynthetic efficiency just after 24 h of exposure and a progressive shift of the photosynthetic community composition throughout the exposure period. The treatment technologies significantly reduced the ecological impact caused by the metal mining effluent. However, metal bioaccumulation in biofilm revealed a potential long-term impact. These observations evidenced the biofilm as a useful ecological indicator to assess the ecological impact caused by metal mining effluents on freshwaters and the efficiency of different treatment technologies to reduce it.

Accès au document

Metatranscriptomic Insights Into the Response of River Biofilm Communities to Ionic and Nano-Zinc Oxide Exposures

Authors: Bergsveinson J, Roy J, Maynard C, Sanschagrin S, Freeman CN, Swerhone GDW, Dynes JJ, Tremblay J, Greer CW, Korber DR, Lawrence JR

Source: FRONTIERS IN MICROBIOLOGY 11:267, 2020, DOI: 10.3389/fmicb.2020.00267

Abstract: Manufactured Zn oxide nanoparticle (ZnO-NP) are extensively used world-wide in personal care and industrial products and are important contaminants of aquatic environments. To understand the overall impact of ZnO-NP contamination on aquatic ecosystems, investigation of their toxicity on aquatic biofilms is of particular consequence, given biofilms are known sinks for NP contaminants. In order to assess alterations in the functional activity of river microbial biofilm communities as a result of environmentally-relevant ZnO-NP exposure, biofilms were exposed to ionic zinc salt or ZnOPs that were uncoated (hydrophilic), coated with silane (hydrophobic) or stearic acid (lipophilic), at a total concentration of 188 µg l-1 Zn. ICP-MS analyses of biofilms indicated ZnO-NP concentrated in the biofilms, with hydrophilic, hydrophobic, and lipophilic treatments reaching 0.310, 0.250, and 0.220 µg Zn cm-2 of biofilm, respectively, while scanning transmission X-ray microspectroscopy (STXM) analyses of biofilms confirmed that Zn was extensively- and differentially-sorbed to biofilm material. Microbial community composition, based on taxonomic affiliation of mRNA sequences and enumeration of protozoa and micrometazoa, was not affected by these treatments, and the total transcriptional response of biofilms to all experimental exposures was not indicative of a global toxic-response, as cellular processes involved in general cell maintenance and housekeeping were abundantly transcribed. Transcripts related to major biological processes, including photosynthesis, energy metabolism, nitrogen metabolism, lipid metabolism, membrane transport, antibiotic resistance and xenobiotic degradation, were differentially expressed in Zn-exposures relative to controls. Notably, transcripts involved in nitrogen fixation and photosynthesis were decreased in abundance in response to Zn-exposure, while transcripts related to lipid degradation and motility-chemotaxis were increased, suggesting a potential role of Zn in biofilm dissolution. ZnO-NP and ionic Zn exposures elicited generally overlapping transcriptional responses, however hydrophilic and hydrophobic ZnO-NPs induced a more distinct effect than that of lipophilic ZnO-NPs, which had an effect similar to that of low ionic Zn exposure. While the physical coating of ZnO-NP may not induce specific toxicity observable at a community level, alteration of ecologically important processes of photosynthesis and nitrogen cycling are an important potential consequence of exposure to ionic Zn and Zn oxides.

Accès au document

Influence of polystyrene microplastics on the growth, photosynthetic efficiency and aggregation of freshwater microalgae *Chlamydomonas reinhardtii*

Authors: Li SX, Wang PP, Zhang C, Zhou XJ, Yin ZH, Hu TY, Hu D, Liu CC, Zhu LD

Source: SCIENCE OF THE TOTAL ENVIRONMENT 714:136767, 2020, DOI: 10.1016/j.scitotenv.2020.136767

Abstract: Microplastics are ubiquitous in aquatic ecosystems worldwide, but knowledge on their impacts on phytoplankton, especially freshwater microalgae, is still limited. To investigate this issue, miaoalgae *Chlamydomonas reinhardtii* was exposed to polystyrene (PS) microplastics with 4 concentration gradients (5, 25, 50 and 100 mg/L), and the growth, chlorophyll a fluorescence, photosynthetic activities (Fv/Fm), the contents of malondialdehydes (MDA), soluble proteins, extracellular polymeric substances (EPS) and settlement rate were accordingly measured. Results showed that the density of microalgae decreased as the increase of PS microplastics concentrations, and the highest inhibitory rate (IR) was 45.8% on the 7th day under the concentration of 100 mg/L The high concentration (100 mg/L) of microplastics evidently inhibited the content of EPS released by microalgae into the solution. PS under all dosages tested could reduce both the chlorophyll a fluorescence yields and photosynthetic activities. The scanning electron microscope (SEM) images demonstrated that microplastic beads were wrapped on the surface of microalgae and damaged their membranes, which could suggest the reduction of photosynthetic activities and the increase of soluble proteins and MDA content. The results also showed that PS microplastics could inhibit the settlement of microalgae at the later stage, which also indicated the recovery of miaoalgae from the toxic environment. Our findings will contribute to understanding the effects of microplastics on freshwater microalgae, as well as evaluating the possible influences of microplastics on aquatic ecosystems.

Accès au document

Urbanization drives riverine bacterial antibiotic resistome more than taxonomic community at watershed scale

Authors: Peng F, Guo YY, Isabwe A, Chen HH, Wang YM, Zhang YP, Zhu ZX, Yang J

Source: ENVIRONMENT INTERNATIONAL 137:UNSP 105524, 2020, DOI: 10.1016/j.envint.2020.105524

Abstract: Although the occurrence and distribution of antibiotic resistance genes (ARGs) in various aquatic ecosystems are well explored, understanding of the ecological processes and mechanisms governing the composition and dynamics of bacterial ARGs still remains limited across space and time. Here, we used high-throughput approaches to detect spatial patterns of bacterial ARGs and operational taxonomic units (OTUs) in an urbanizing subtropical watershed, Xiamen, southeast China over a five-year period. At watershed scale, the OTU profiles were undergoing a directional change, but the ARG profiles showed a high stability or stochastic change over time. Compared with the upstream and midstream, the richness, absolute abundance, normalized abundance and diversity of ARGs were significantly higher in the downstream waters. Our results revealed a clear rural-urban disparity in ARG and OTU profiles which were mainly governed by deterministic and stochastic assembly processes, respectively. With the increase of urban building area along the river, the ecological processes of ARG profiles shifted from stochastic to deterministic. In downstream waters, the bacterial ARG profiles were much more stable than bacterial OTUs. Further, our results indicated that both human-dominated environment (e.g., land use) and mobile genetic elements (MGEs) played an important role in shaping the ARG profiles and dynamics. Overall, this was a response to spatially extensive human-landscape interactions that included urban development in the river downstream region, which were common across subtropical coastal cities of China and can alter the ARG profile dynamics along rural-urban gradient. Therefore, watershed management actions aiming at reducing threats posed by ARGs in urbanizing watershed should first consider the surrounding urbanization level and the mode and intensity of human activity. Our findings also

imply that due to the decoupling of bacterial function and taxonomy, both aspects should be studied separately.

Accès au document

Characterization of antibiotic resistance genes and bacterial community in selected municipal and industrial sewage treatment plants beside Poyang Lake

Authors: Ding HJ, Qiao M, Zhong JY, Zhu YG, Guo CJ, Zhang QQ, Yang P, Han L, Zhang WH, Wu YX, Liu JT, Zhang LT, Sun JH

Source: WATER RESEARCH 174:115603, 2020, DOI: 10.1016/j.watres.2020.115603

Abstract: Sewage treatment plants (STPs) are significant reservoirs of antibiotic resistance genes (ARGs) and antibiotic-resistant bacteria (ARB). Municipal STPs (MSTPs) and industrial STPs ([STPs) are the two most important STP types in cities. In this study, the ARGs, mobile genetic elements (MGEs), and bacterial communities of selected STPs, including two MSTPs and one ISTP, in the vicinity of Poyang Lake were comprehensively investigated through high-throughput qPCR and high-throughput Illumina sequencing. The results showed that the profiles of ARGs, MGEs and bacteria differed between the ISTP and the two MSTPs, most likely due to differences in influent water quality, such as the Pb that characterized in the ISTP's influent. The longer hydraulic retention times (HRTs) of the two MSTPs than of the ISTP may also have accounted for the different profiles. Thus, a prolonged HRT in the CASS process seems to allow a more extensive removal of ARGs and bacteria in ISTPs with similar treatment process. By providing comprehensive insights into the characteristics of ARGs, MGEs and the bacterial communities of the selected MSTPs and ISTP, our study provides a scientific basis for controlling the propagation and diffusion of ARGs and ARB in different types of STPs.

Accès au document

The roles of silicon in combating cadmium challenge in the Marine diatom *Phaeodactylum tricornutum*

Authors: Ma J, Zhou BB, Tan QG, Zhang L, Pan K

Source: JOURNAL OF HAZARDOUS MATERIALS 389:121903, 2020, DOI: 10.1016/j.jhazmat.2019.121903

Abstract: Marine phytoplankton possess a sophisticated homeostatic network to counteract metal toxicity. Changes in environmental conditions such as ambient nutrient concentrations can significantly impact their intrinsic metal sensitivity. In this study, we evaluated the role of silicon (Si) in counteracting cadmium (Cd) toxicity in the marine diatom *Phaeodactylum tricornutum*. We first demonstrated that Si enrichment dramatically enhanced Cd tolerance and changed the Cd accumulation in the diatom. Our modeling suggested that Si-enriched cells adsorbed more Cd but had a higher Cd elimination rate than the Si-starved cells. Examinations by atomic force microscopy and X-ray photoelectron spectroscopy revealed that the Si-enriched cells had better silification and more SiO- in the cell walls, which markedly lowered the surface potential of the diatom cells and allowed them to attract more Cd. Although the Si-enriched cells tended to have a high Cd burden when facing Cd stress, they suppressed the increase of intracellular Cd by both down-regulating the influx transporter ZIP and up-regulating the efflux transporter ATPase5-1B. Our study shows the significant roles Si plays in maintaining metal homeostasis and combating Cd challenge in marine diatoms.

Accès au document

In vivo toxicities of nine engineered nano metal oxides to the marine diatom *Skeletonema costatum* and rotifer *Brachionus koreanus*

Authors: Wong SWY, Zhou GJ, Kwok KWH, Djurisic AB, Han J, Lee JS, Leung KMY

Source: MARINE POLLUTION BULLETIN 153:110973, 2020, DOI: 10.1016/j.marpolbul.2020.110973

Abstract: This study compared in vivo acute toxicities of nine engineered nano metal oxides to the marine diatom *Skeletonema costatum* and rotifer *Brachionus koreanus*. The sequence of their toxicities to *S. costatum*, based on growth inhibition, was: nano zinc oxide (nZnO) nTiO(2) (rutile) nMgO Annealed nMgO nTiO(2) (anatase) gamma-nAl(2)O(3) nIn(2)O(3) alpha-nAl(2)O(3) nSnO(2). Similarly, nZnO was also the most toxic to B. koreanus, but the other nano metal oxides were non-lethal. nMgO and nZnO were confirmed to trigger reactive oxygen species (ROS) mediated toxicity to the two marine organisms, while nTiO(2) (both anatase and rutile forms) likely induced oxidative stress as shown by their acellular ROS production. nZnO may also cause damage in the endocrine system *of B. koreanus*, as indicated by the increased transcription of retinoid X receptor. Annealed nMgO reduces its toxicity via removal of O-2 and impurities from its surface.

Accès au document

Changes in sediment microbial diversity following chronic copper-exposure induce community copper-tolerance without increasing sensitivity to arsenic

Authors: Ahmed AM, Tardy V, Bonnineau C, Billard P, Pesce S, Lyautey E

Source: JOURNAL OF HAZARDOUS MATERIALS 391:122197, 2020, DOI: 10.1016/j.jhazmat.2020.122197

Abstract: Sediment microbial communities were exposed for 21 days to an environmental concentration of copper to assess Cu-induced composition changes and resulting effects on microbial sensitivity to acute Cu and As toxicity. Chronic Cu exposure reduced the diversity of the bacterial and archaeal communities from Day 0 to Day 21. The pollution-induced community tolerance concept (PICT) predicts that loss of the most sensitive taxa and gain of more tolerant ones should increase the capacity of Cu-exposed communities to tolerate acute Cu toxicity. Although diversity loss and functional costs of adaptation could have increased their sensitivity to subsequent toxic stress, no increased sensitivity to As was observed. PICT responses varied according to heterotrophic activity, selected as the functional endpoint for toxicity testing, with different results for Cu and As. This suggests that induced tolerance to Cu and As was supported by different species with different metabolic capacities. Ecological risk assessment of contaminants would gain accuracy from further research on the relative contribution of tolerance acquisition and co-tolerance processes on the functional response of microbial communities.

Accès au document

Microbial Degradation of Plastic in Aqueous Solutions Demonstrated by CO2 Evolution and Quantification

Authors: Rose RS, Richardson KH, Latvanen EJ, Hanson CA, Resmini M, Sanders IA

Source: INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES 21(4):1176, 2020, DOI: 10.3390/ijms21041176

Abstract: The environmental accumulation of plastics worldwide is a consequence of the durability of the material. Alternative polymers, marketed as biodegradable, present a potential solution to mitigate their ecological damage. However, understanding of biodegradability has been hindered by a lack of reproducible testing methods. We developed a novel method to evaluate the biodegradability of plastic samples based on the monitoring of bacterial respiration in aqueous media via the quantification of CO2 produced, where the only carbon source available is from the polymer. *Rhodococcus rhodochrous* and *Alcanivorax borkumensis* were used as model organisms for soil and marine systems, respectively. Our results demonstrate that this approach is reproducible and can be used with a variety of plastics, allowing comparison of the relative biodegradability of the different materials. In the case of low-density polyethylene, the study demonstrated a clear correlation between the molecular weight of the sample and CO2 released, taken as a measure of biodegradability.

Accès au document

Toxicological effects of ciprofloxacin and chlorhexidine on growth and chlorophyll a synthesis of freshwater cyanobacteria

Authors: Azevedo FCR, Vaz ICD, Barbosa FAR, Magalhaes SMS

Source: BRAZILIAN JOURNAL OF PHARMACEUTICAL SCIENCES 55:e17661, 2019, DOI: 10.1590/s2175-97902019000217661

Abstract: Cyanobacteria are phytoplanktonic microorganisms that are susceptible to the deleterious effects of pharmaceutical residues in the aquatic environment, which poses a challenge to the environment exposed to diverse pharmaceutical products and their potential effects. The objective of this study was to evaluate the effects of the antibiotic substances ciprofloxacin and chlorhexidine in pharmaceutical preparations on the growth and production of chlorophyll of two cyanobacterial strains, *Microcystis aeruginosa* and *Microcystis panniformis*, isolated from a lake in a Brazilian environmental protection area. The EC50 and EC10 of chlorhexidine for M. aeruginosa were 206.4 µg/L and 108.5 µg/L, respectively, and for M. panniformis were 171.4 µg/L and 116.6 µg/L, respectively. The EC50 and EC10 of ciprofloxacin for *M. aeruginosa* were 17.24 µg/L and 3.21 µg/L, respectively, and for *M. panniformis* were 13.56 µg/L and 1.50 µg/L, respectively. The toxicity of the antibiotic ciprofloxacin (drug) and chlorhexidine (standard solution) to the Microcystis species was demonstrated, and these species were both very sensitive to ciprofloxacin. Our results suggest that the strains of *M. aeruginosa* and *M. panniformis* may be affected by exposure to residues of ciprofloxacin (1.5 µg/L), which may represent a risk to the survival of aquatic species.

Accès au document

Biotransformation of Phthalate Plasticizers and Bisphenol A by Marine-Derived, Freshwater, and Terrestrial Fungi

Authors: Carstens L, Cowan AR, Seiwert B, Schlosser D

Source: FRONTIERS IN MICROBIOLOGY 11:317, 2020, DOI: 10.3389/fmicb.2020.00317

Abstract: Phthalate esters (PEs, Phthalates) are environmentally ubiquitous as a result of their extensive use as plasticizers and additives in diverse consumer products. Considerable concern relates to their reported xenoestrogenicity and consequently, microbial-based attenuation of environmental PE concentrations is of interest to combat harmful downstream effects. Fungal PE catabolism has received less attention than that by bacteria, and particularly fungi dwelling within aquatic environments remain largely overlooked in this respect. We have compared the biocatalytic and biosorptive removal rates of di-n-butyl phthalate (DBP) and diethyl phthalate (DEP), chosen to represent two environmentally prominent PEs of differing structure and hydrophobicity, by marine-, freshwater-, and terrestrial-derived fungal strains. Bisphenol A, both an extensively used plastic additive and prominent environmental xenoestrogen, was included as a reference compound due to its well-documented fungal degradation. Partial pathways of DBP metabolization by the ecophysiologically diverse asco- and basidiomycete strains tested were proposed with the help of UPLC-QTOF-MS analysis. Species specific biochemical reaction steps contributing to DBP metabolism were also observed. The involved reactions include initial cytochrome P450-dependent monohydroxylations of DBP with subsequent further oxidation of related metabolites, de-esterification via either hydrolytic cleavage or cytochrome P450-dependent oxidative O-dealkylation, transesterification, and demethylation steps - finally yielding phthalic acid as a central intermediate in all pathways. Due to the involvement of ecophysiologically and phylogenetically diverse filamentous and yeast-like fungi native to marine, freshwater, and terrestrial habitats the results of this study outline an environmentally ubiquitous pathway for the biocatalytic breakdown of plastic additives. Beyond previous research into fungal PE metabolism which emphasizes hydrolytic de-esterification as the primary catabolic step, a prominent role of cytochrome P450 monooxygenase-catalyzed reactions is established.

Accès au document

Response of Algae to Heavy Metal Removing with Particular Reference to pH

Authors: Aladdin LM, Aziz F

Source: POLISH JOURNAL OF ENVIRONMENTAL STUDIES 29(3):2041-2053, 2020, DOI: 10.15244/pjoes/110446

Abstract: The accumulation capacity of heavy metals by algae as affected by the pH of fresh water is the main objective of this work, which is the first unitary study in Akre-Dhouk Province of Iraq's Kurdistan region. The water samples of 10 selected sites in the months of August and November 2016 were analyzed using atomic absorption spectrometry in order to determine the bioaccumulation factor for taxa *Scytonema subcynatum, Nostoc muscarum, Batracospermum boryanum, Batracospermum atrum, Batracospermum moniliform, Spirogyra subsalsa, Oedogonium tumidulum*, and *Chara bruunii*. In water, we recorded the values of heavy metals content at permissible levels. For Chlorophyta and Cyanophytathe accumulation value positively correlated with pH, while in Rhodophyta it was negative. Consequently, the highest concentrations were registered by *Oedogonium tumidulum* for Ti (1019.361 µg.l-1), Cr (65.678 µg.l-1), Fe (2.380 µg.l-1), Co (7.846 µg.l-1), Ni (205.527 µg.l-1), As (12.591 µg.l-1), *Batracospermum boryanum* for Cu (196.257 µg.l-1), *Batracosoermu atrum* for Hg (0.069 µg.l-1), Pb (134.510 µg.l-1), *Batracospermum moniliform* for Zn (334.508 µg.l-1), Se (0.773 µg.l-1), *Spirogyra subsalsa*, for Mn (425.292 µg.l-1) and *Scytonema subcynatum* for Cd (0.075 µg.l-1).

Accès au document

Rapid Physicochemical Changes in Microplastic Induced by Biofilm Formation

Authors: McGivney E, Cederholm L, Barth A, Hakkarainen M, Hamacher-Barth E, Ogonowski M, Gorokhova E

Source: FRONTIERS IN BIOENGINEERING AND BIOTECHNOLOGY 8: 205, 2020, DOI: 10.3389/fbioe.2020.00205

Abstract: Risk assessment of microplastic (MP) pollution requires understanding biodegradation processes and related changes in polymer properties. In the environment, there are two-way interactions between the MP properties and biofilm communities: (i) microorganisms may prefer some surfaces, and (ii) MP surface properties change during the colonization and weathering. In a 2-week experiment, we studied these interactions using three model plastic beads (polyethylene [PE], polypropylene [PP], and polystyrene [PS]) exposed to ambient bacterioplankton assemblage from the Baltic Sea; the control beads were exposed to bacteria-free water. For each polymer, the physicochemical properties (compression, crystallinity, surface chemistry, hydrophobicity, and surface topography) were compared before and after exposure under controlled laboratory conditions. Furthermore, we characterized the bacterial communities on the MP surfaces using 16S rRNA gene sequencing and correlated community diversity to the physicochemical properties of the MP. Significant changes in PE crystallinity, PP stiffness, and PS maximum compression were observed as a result of exposure to bacteria. Moreover, there were significant correlations between bacterial diversity and some physicochemical characteristics (crystallinity, stiffness, and surface roughness). These changes coincided with variation in the relative abundance of unique OTUs, mostly related to the PE samples having significantly higher contribution of *Sphingobium, Novosphingobium*, and uncultured Planctomycetaceae compared to the other test materials, whereas PP and PS samples had significantly higher abundance of Sphingobacteriales and Alphaproteobacteria, indicating possible involvement of these taxa in the initial biodegradation steps. Our findings demonstrate measurable signs of MP weathering under short-term exposure to environmentally relevant microbial communities at conditions resembling those in the water column. A systematic approach for the characterization of the biodegrading capacity in different systems will improve the risk assessment of plastic litter in aquatic environments.

Accès au document

Interaction between glyphosate and dissolved phosphorus on bacterial and eukaryotic communities from river biofilms

Authors: Carles L, Artigas J

Source: SCIENCE OF THE TOTAL ENVIRONMENT 719:137463, 2020, DOI: 10.1016/j.scitotenv.2020.137463

Abstract: Since the capacity of river biofilms to degrade glyphosate has been proven to increase when the availability of dissolved phosphorus (P) in water decreases, the present study investigates the diversity responses of bacterial and eukaryotic microbial communities from biofilms in a search for glyphosate-degrader candidates. Glyphosate and P interactions were observed for eukaryotic communities, the highest community richness and diversity being preserved at low concentrations of glyphosate and P. This trend marked by glyphosate was also observed in the structure of eukaryotic communities. Therefore, phosphorus and glyphosate had a synergistic effect in decreasing the richness and diversity of eukaryotes species in biofilms. However, species richness and diversity in bacterial communities were not affected by glyphosate, though shifts in the structure of these communities were concomitant with the degradation of the herbicide. Bacterial communities capable of using glyphosate as P source were characterized by increases in the relative abundance of certain Bacteroidetes, Chloroflexi, Cyanobacteria, Planctomycetes and alpha-Proteobacteria members. Glyphosate-degrader candidates found in natural river biofilms can be further isolated for better understanding of glyphosate degradation pathways, and used as bioremediation strategies in heavily contaminated sites.

Accès au document

The response of *Prorocentrum sigmoides* and its associated culturable bacteria to metals and organic pollutants

Authors: D'Costa PM, Kunkolienkar RSS, Naik AG, Naik RK, Roy R

Source: JOURNAL OF BASIC MICROBIOLOGY 59(10):979-991, 2020, DOI: 10.1002/jobm.201900244

Abstract: This study investigates the effect of metals (cadmium, lead, mercury, and tellurium) and organic pollutants (benzene, diesel, lindane, and xylene) on a dinoflagellate-*Prorocentrum sigmoides* Bohm-and its associated culturable bacteria. Two bacterial cultures (*Bacillus subtilis* strain PD005 and *B. xiamensis* strain PD006) were isolated from *P. sigmoides* and characterized by scanning electron microscopy, 16S ribosomal RNA sequencing, biochemical analyses, and growth curve studies. This study points to a mutualistic relationship between *P. sigmoides* and its associated *Bacillus* isolates. *P. sigmoides* enhanced the growth of its associated Bacillus spp., through the secretion of extracellular exudates. In return, both *Bacillus* isolates contributed to the resistance of *P. sigmoides* to metals and organic pollutants. *P. sigmoides* and both Bacillus isolates exhibited concentration-dependent responses to metals and organic pollutants. An intriguing feature was the similar response of *P. sigmoides* and its associated *Bacillus* isolates to mercury and cadmium, indicating a co-selection of mercury and cadmium resistance. This provides support to the "dinoflagellate host-phycosphere bacteria" behaving as a single functional unit. However, the sensitivity profiles of *P. sigmoides* and its associated *Bacillus* isolates are different with respect to metals versus organic pollutants. These aspects need to be addressed in future studies to unravel the effect of metal and organic pollutants on dinoflagellates, an important component of the phytoplankton community, and to discern the influence of associated "phycosphere" bacteria on the response of dinoflagellates to pollutants.

Accès au document

Effects of microplastic biofilms on nutrient cycling in simulated freshwater systems

Authors: Chen XC, Chen XF, Zhao YH, Zhou H, Xiong X, Wu CX

Source: SCIENCE OF THE TOTAL ENVIRONMENT 719:137276, 2020, DOI: 10.1016/j.scitotenv.2020.137276

Abstract: Microplastic surfaces could be colonized by microorganisms and form biofilms in aquatic ecosystem, which can participate in the nitrogen (N) and phosphorus (P) cycles. In this work, polypropylene squares were deployed in a pond for 30 clays for microplastic biofilms colonization and then were transported to indoor microcosms at an environmental relevant level to study their effects on N and P cycling. Results showed that microplastic biofilms could accelerate ammonia and nitrite oxidation as well as denitrification. Presence of microplastic biofilms accumulated P temporarily and increased alkaline phosphatase activities (APA) in the system. Later in the experiment, disintegration of matured biofilms released N and P into the water. Mass balance calculation suggested possible N input caused by biological nitrogen fixation. Our results demonstrated that microplastics associated biofilms have the ability to alter the N and P cycling processes in aquatic system. However, additional works are required to further quantify the extent of such impact.

Accès au document

Diatom mediated heavy metal remediation: A review

Authors: Marella TK, Saxena A, Tiwari A

Source: BIORESOURCE TECHNOLOGY 305:123068, 2020, DOI: 10.1016/j.biortech.2020.123068

Abstract: Exposure to heavy metals is a major threat to aquatic bodies and is a global concern to our four main spheres of the earth viz. atmosphere, biosphere, hydrosphere, and lithosphere. The biosorption of pollutants using naturally inspired sources like microalgae has considerable advantages. Diatoms are the most dominant and diverse group of phytoplankton which accounts for 45% oceanic primary productivity. (…) The diatoms play a significant role in degradation, speciation, and detoxification of chemical wastes and hazardous metals from polluted sites. Herein, an overview is presented about the ability of diatom algae to phycoremediate heavy metals by passive adsorption and active assimilation from their aqueous environments with an emphasis on extracellular and intracellular mechanisms involved in contaminant uptake through the frustules for preventing heavy metal toxicity.

Accès au document

Characterization of indigenous bacteria from radon-rich groundwater and their tolerance to physicochemical stress

Authors: Nayak T, De D, Barman C, Karmakar P, Deb A, Dhal PK

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY 17(3):1627-1636, 2020, DOI: 10.1007/s13762-019-02445-w

Abstract: Radiation exposure and heavy metal (HM) exposure are serious health hazards causing DNA mutation, oxidative damage and may also be responsible for various life-threatening human diseases, while bacteria can withstand such toxicity easily. This study attempted to identify inhabitant bacterial isolates from radon-contaminated groundwater of Tantloi, India, and effort has also been made to characterize their response against radiation, oxidative stress as well as heavy metal tolerance and removal. Total sixteen (16) bacterial isolates were identified as *Bacillus* spp., *Stenotrophomonas* spp., *Brevibacillus* sp., *Chryseobacterium* sp., *Escherichia* sp. and *Microbacterium* sp., which showed less number of distinct carbohydrates utilization potential but high salinity tolerance properties. In addition, Gram-positive Bacillus spp. can tolerate 1 kGy of gamma radiation, 10 mM H2O2, 7 days of desiccation and different heavy metals (Cu, Pb, Cr, Zn and As). Four Bacillus spp. and *Microbacterium* sp., which showed total maximum tolerable concentration (MTC) 8 out of 5 heavy metals, were considered for their HM removal property analysis. Five multimetal resistance strains had strong removal capacity of Pb and Zn (89-94%) followed by Cr (49-56%) and Cu/As (0.4-22%). This investigation may provide baseline information of radon-contaminated groundwater microbiology, thus could be used to formulate an appropriate strategy for radon and radionuclides remediation.

Accès au document

Highlighting of the antialgal activity of organic extracts of Moroccan macrophytes: potential use in cyanobacteria blooms control

Authors: Tazart Z, Douma M, Caldeira AT, Tebaa L, Mouhri K, Loudiki M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, Early Access, 2020, DOI: 10.1007/s11356-020-08440-w

Abstract: Many studies have demonstrated the effectiveness of algicidal compounds produced by macrophytes against microalgae. The aim of this study was to assess the algicidal activity of seven Moroccan macrophyte ethyl acetate extracts (MEA) to control harmful algal blooms (HABs). The response and sensitivity of prokaryotic toxic cyanobacteria (*Microcystis aeruginosa*) and eukaryotic microalgae (*Chlorella* sp.) were highlighted. The algicidal effect of MEA extracts against the two microalgae was assessed using both the paper disc diffusion and microdilution methods. This last was used in order to evaluate the minimum inhibitory concentrations (MIC) and minimum algicidal concentrations (MAC). Results showed that the growth of both microalgae was significantly inhibited by all MEA extracts. *Myriophyllum spicatum* organic extract shows the highest growth inhibition activity against *M. aeruginosa* (35.33 ± 1.53) and *Chlorella* sp. (30.33 ± 1.15 mm). This stronger inhibitory activity was confirmed by the low MIC (6.25, 12.5 mg/L) and MAC (6.25, 12.5 mg/L) values. Furthermore, results showed different sensitivity between the prokaryotic and eukaryotic microalgae into MEA extracts. Based on the MIC and MAC values, we can distinguish two groups of plants. The first one, including *M. spicatum*, *Ranunculus aquatilis*, and *Enteromorpha* sp., can be considered as a preferable anti-prokaryotic group with a stronger inhibitory activity on M. aeruginosa growth. The second group, constituted by *Potamogeton natans*, *Nasturtium officinale*, *Elodea* sp., and *Ceratophyllum* sp., has a preferable and stronger inhibitory effect against eukaryotic algae (*Chlorella* sp.). Overall the results reveal the potential algicidal activity of macrophytes and suggested that MEA extracts could play an important role in biocontrol of HABs.

Accès au document

Toxicity evaluation of iron oxide nanoparticles and accumulation by microalgae *Coelastrella terrestris*

Authors: Saxena P, Sangela V, Harish

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access, 2020, DOI: 10.1007/s11356-020-08441-9

Abstract: Uses of iron oxide nanoparticles have increased in the last decade. The increased application marked a concern regarding their fate and behavior in the environment. Especially towards the aquatic ecosystems, as the ultimate descend of these iron oxide nanoparticles are aquatic bodies. The greater surface area per mass compared with larger-sized materials of the same chemistry renders these nanoparticles biologically more active. (…) In the present study, comparative assessment of iron oxide nanoparticles and their bulk counterpart have been monitored using *Coelastrella terrestris* up to 40 days. Interestingly, study reveals the potential of *Coelastrella terrestris* as tool for the bioremediation of iron nanoparticles to combat nano-pollution. Adsorption/absorption kinetics measured after 25 days of treatments with iron oxide nanoparticle and its bulk counterpart revealed higher absorption levels in comparison to the adsorption with maximum accumulation factor (AF) of 2.984 at 50 mg L-1 in nano-form. Iron oxide absorption was found linearly related with concentration in both cases (y = 11.313x-12.165, R-2 = 0.8691 in nano; y = 6.35x-5.74, R-2 = 0.8128 in bulk). However, 50-mg L-1 nanoparticle concentration was perceived sub-lethal for the algae with 33.33% algal growth reduction under nano and 27.77% under bulk counterpart. Other biochemical parameters, i.e., SOD, CAT, MDA, and lipid quantification, were also quantified to correlate the state of metabolism of treated algal cells in comparison to the control and these exhibited reduction in algal growth due to oxidative stress. Morphological changes were monitored through SEM and TEM.

Accès au document

Pollution shapes the bacterial community of a river: a case study

Authors: Yadav N, Sharma S

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY 17(4):2003-2016, 2020, DOI: 10.1007/s13762-019-02474-5

Abstract: Bacteria are involved in many vital biogeochemical functions in aquatic ecosystems. Owing to their small size and high growth rates, they tend to be highly responsive to any changes in their environment. This potential to reflect any kind of environmental change makes them sensitive indicators towards the effect of pollutants in aquatic systems. The present study focused on investigation of change in the bacterial community structure of Hindon River in Ghaziabad in North India, in relation to the river's pollution levels. Both spatial and temporal variation in the resident as well as active bacterial community was determined using 16S rRNA gene and transcript as molecular markers through denaturing gradient gel electrophoresis. Sequence analysis of eluted bands showed that Bacteroidetes followed by gamma-proteobacteria, Actinobacteria, beta-proteobacteria, delta-proteobacteria, epsilon-proteobacteria and Nitrospirae, represented the dominant phyla. Moreover, the effect of pollutants on the bacterial diversity was more conspicuous at RNA level. In addition, when assessing the diversity of culturables, 8 bacterial strains, having minimum inhibitory concentrations in the range of 200-250 mg l-1 for Ni, 75-200 mg l-1 for Co and 75-200 mg l-1 for Cd, were isolated and characterized. The identified bacteria have the potential to be used as sensitive biomarkers for the development of bioremediation strategies and their monitoring.

Accès au document

pH affects the hormesis profiles of personal care product components on luminescence of the bacteria *Vibrio qinghaiensis* sp.-Q67

Authors: Xu YQ, Liu SS, Chen F, Wang ZJ

Source: SCIENCE OF THE TOTAL ENVIRONMENT 713:136656, 2020, DOI: 10.1016/j.scitotenv.2020.136656

Abstract: Hormesis describes a specific phenomenon in a biphasic concentration-response curve: low concentrations stimulate a response, while high concentrations suppress it. Hormesis could be influenced by several environmental factors, e.g. pH. In this study, the concentration-response/bioluminescence inhibition profiles (CRP5) of six components in personal care products to Vibrio qinghaiensis sp.-Q67 were measured at five different pH levels. When the exposure lasted for 0.25 h, CRPs of the six components at various pH levels were S-shaped, except ascorbic add 2-glucoside (AA2G) at pH 10.5. When it lasted for 12 h, the CRPs were J-shaped, except AA2G at pH 6.5, 7.5, and 9.5. To rationally explain these changes in hormesis expressed by J-shaped CRP, four characteristic parameters, the minimum effect (E-min) and its corresponding concentration (ECmin), the median effective concentration (EC50), and the zero effect concentration point (ZEP, where the effect is 0 and the concentration is ZEP), were used to quantify the J-shaped CRP. The results indicated that these parameters vary with pH. Additionally, ZEP showed an excellent linear relationship with EC10 (R-2 - 0.9994) at all pH levels, indicating that EC(10) could replace the no-observed effective concentration (NOEC) in ecological risk assessment. Furthermore, to elucidate the possible mechanism of hormesis, the binding of the components to the luciferase receptors was analyzed using molecular docking technology. The results showed that the components displaying hormesis bind more easily to the alpha subunit of luciferase than to the beta subunit.

Accès au document

Multistressor negative effects on an experimental phytoplankton community. The case of glyphosate and one toxigenic cyanobacterium on Chlorophycean microalgae

Authors: Hernandez-Garcia CI, Martinez-Jeronimo F

Source: SCIENCE OF THE TOTAL ENVIRONMENT 717:137186,2020, DOI: 10.1016/j.scitotenv.2020.137186

Abstract: Aquatic ecosystems face serious pollution issues. Discharges of toxic substances and eutrophication may lead to changes in the phytoplankton community and foster cyanobacterial blooms. Glyphosate-based herbicides are chemical stressors of microalgae that may affect the structure of phytoplankton communities, and also stimulate the synthesis of cyanotoxins by cyanobacteria. The simultaneous presence of glyphosate and toxigenic cyanobacteria increases the stress on microalgae, jointly affecting their growth and development. This study evaluated the combined effect of a toxigenic cyanobacterium and glyphosate in the development of an experimental microalgal community. We studied the effect of *Microcystis aeruginosa* on the population growth of the microalgae *Ankistrodesmus fakatus, Chlorella vulgaris, Pseudokirchneriella subcapitata*, and *Scenedesmus incrassatulus*. We also evaluated the combined effect of sub-inhibitory glyphosate (Faena (R)) concentrations on the content of macromolecules and the enzymes superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), as well as on the concentration ofTBARS. These effects were evaluated through the integrated biomarker response (IBR). In individual experiments, microalgae showed lower growth rates versus *M. aeruginosa*. In the mixed bioassays, both *M. aeruginosa* and microalgae showed reduced growth. IC50 values for Faena (R) ranged from 1.022 to 2.702 mg L-1. In the microalgae cyanobacteria bioassays, the herbicide lowered the growth rates of microalgae but stimulated the proliferation of *M. aeruginosa*. The joint action of both stressors affected growth rate and population dynamics, macromolecule content, and led to increased CAT and GPx levels. Faena (R) influenced growth rate and caused oxidative stress. On the other hand, the herbicide stimulated the synthesis of cyanotoxins, which further affected microalgal development. The experimental community was not only affected by the herbicide, but the mixed culture with cyanobacteria magnified the effects chemical stress. These results illustrate the potential damage to phytoplankton expected in anthropically eutrophic water bodies that are also polluted by glyphosate.

Accès au document

Bacteria-nanoparticle interactions in the context of nanofouling

Authors: Deschenes L, Ells T

Source: ADVANCES IN COLLOID AND INTERFACE SCIENCE 277:102106, 2020, DOI: 10.1016/j.cis.2020.102106

Abstract: The attachment of microbial communities to surfaces is a well-known problem recognized to be involved in a variety of critical issues in the sectors of food processing, chronic wounds, infection from implants, clogging of membranes and corrosion of equipment. Considering the importance of the detrimental impact of biofouling, it has received much attention in the scientific community and from concerned stakeholders. With the development of nanotechnology and the nowadays widespread use of engineered nanoparticles (ENPs), concerns have been raised regarding their fate in terrestrial and aquatic environments. Safety aspects and public health issues are critical in the management of handling nanomaterials and their nanowastes. The interactions of various types of nanoparticles (NPs) with planktonic bacteria have also received attention due to their antimicrobial properties. However, their behavior in regard to biofilms is not well understood although, in the environment, most of the bacteria prefer living in sessile communities. The question appears relevant considering the need to build knowledge on the fate of nanoparticles and the fact that no one can exclude the risk of accumulation of nanoparticles in biofilms and on surfaces leading to a form of nanofouling involving both engineered nanoparticles (ENPs) and nanoplastics. The present analysis of recent research accounts allows in identifying that (1) research activities related to water remediation systems have been mostly oriented on the impact of NPs on pre-existing biofilms, (2) experimental designs are restricted to few scenarios of exposure, usually limited to relative short-time periods although nanofouling could favour the development of multi-resistant bacterial species through sub-lethal exposures over prolong periods of time (3) nanofouling in other systems in which biofilms develop remains to be addressed, and (4) new research directions are required for investigating the mechanisms involved and the subsequent impact of nanofouling on bacterial consortium responses encountered in a variety of environments such as those prevailing in food

production/processing settings. Finally, this review aims at providing recent information and insights on nanoparticle-bacterial interactions in the context of biofilms in order to supply an updated outlook of research perspectives that could help establish the framework for production, use and fate of nanomaterials as well as future research directions.

Accès au document

Effect of trace metals on growth performance and accumulation of lipids, proteins, and carbohydrates on the green microalga *Scenedesmus obliquus*

Authors: de Oliveira CYB, Viegas TL, da Silva MFO, Fracalossi DM, Lopes RG,Derner RB

Source: AQUACULTURE INTERNATIONAL Early Access, 2020, DOI: 10.1007/s10499-020-00533-0

Abstract: Microalgae biomass is considered one of the most promising raw materials for the development of high commercial value products, mainly because they are potential sources of proteins, lipids, carbohydrates, and vitamins. In this way, the optimization of culture medium of these microorganisms can help to reduce production costs, making final products more accessible. In this sense, the present study aimed to investigate the effect of different trace metal concentrations on growth and biochemical composition of *Scenedesmus obliquus*. Cultures of S. obliquus were performed using the LCA-AD medium (pH 7.6), in 2-L cylindrical borosilicate glass flasks that were constantly stirred by bubbling 0.7% CO2 enriched air (v/v), irradiance ranging from 520 to 1200 µmols m-2 s-1, and temperature at 22 ± 1 degrees C. Four trace metal concentrations were tested: control (standard concentration used on Bold's Basal Medium), ten (10(-1)), hundred (10(-2)), and thousand (10(-3)) times less than control. The trace metal concentration did not significantly affect the growth of *S. obliquus* - all treatments have reached about 4.2 g L-1 on the tenth day of cultivation. As well for growth performance, no significant differences were observed among the treatments for biomass composition percentages. The dry *S. obliquus* biomass was mainly composed of carbohydrates (about 65%), crude protein (about 20%), and finally lipids (about 12%). These findings suggest that up to 1000-fold reduction in trace metal concentration does not affect the growth and biochemical composition of the green microalga *S. obliquus*.

Accès au document

Effects of elutriates from contaminated coastal sediments on different life cycle phases of planktonic diatoms

Authors: Pelusi A, Rotolo F, Gallo A, Ferrante MI, Montresor M

Source: MARINE ENVIRONMENTAL RESEARCH 155:UNSP 104890, 2020, DOI: 10.1016/j.marenvres.2020.104890

Abstract: We assessed the effects of elutriates from sediments collected at three stations in the polluted Bay of Bagnoli-Coroglio along the Campania coast (Tyrrhenian Sea, Italy) using three planktonic diatoms regularly occurring In the area, *Pseudo-nuzschia multismiata, P. arenysensis* and *Chaetoceros socialis*. Specifically, we tested the production of sexual stages in the heterothallic Pseudo-niizschia species with the hypothesis that pollutants could Impair sexual reproduction. We also tested the seeding capacity of spores of *C. socialis* after up to six months of storage in elutriates, assuming that pollutants could affect the capability of resting stages to germinate. Elutriate from station 56, with the highest concentrations of pollutants, impaired growth, sexual reproduction and spore germination. Elutriates from stations 25 and 84 caused moderate enhancement of growth and sexual reproduction in Pseudo-nitzschia as compared with control conditions, and also had intermediate effect on spore seeding capacity.

Accès au document

Quantitative proteomic analysis provides insights into the algicidal mechanism of Halobacillus sp. P1 against the marine diatom *Skeletonema costatum*

Authors: Zhang SF, Han BB, Wu FX, Huang HH

Source: SCIENCE OF THE TOTAL ENVIRONMENT 717:137048, 2020, DOI: 10.1016/j.scitotenv.2020.137048

Abstract: Algicidal behavior is a common interaction between marine microalgae and bacteria, especially in the dissipationphase of algal blooms. The marine bacterium *Halobacillus* sp. P1 was previously isolated and exhibits high algicidal activity against the diatom *Skeletonema costatum*. However, little is known about the mechanism underlying this algicidal process. Here, a tandem mass tag (TMT)-based proteomic approach was coupled with physiological analysis to investigate the cellular responses of *S. costatum* when treated with P1 culture supernatant. Among the 4582 proteins identified, 82 and 437 proteins were differentially expressed after treatment for 12 and 24 h, respectively. The proteomic results were in accordance with the results of verification by parallel reaction monitoring (PRM) assays. Proteins involved in reactive oxygen species scavenging, protein degradation and transport were upregulated, while proteins participating in nitrogen metabolism, protein translation, photosynthetic pigment biosynthesis and cell cycle regulation were significantly downregulated (p-value =0.05), corresponding to the increasing malondialdehyde content and the decreasing nitrogen, protein and chlorophyll a contents. A nutrient competitive relationship might exist between the bacterium P1 and *S. costatum*, and the inhibition of nitrogen metabolism by the P1 culture supernatant might be the key lethal factor that results in the dysfunction of *S. costatum* metabolism. Our study sheds light on the algicidal mechanism of P1 at the molecular level and provides new insights into algae-bacteria interactions.

Accès au document

Influence of multi-walled carbon nanotubes on the microbial biomass, enzyme activity, and bacterial community structure in 2,4-dichlorophenol-contaminated sediment

Authors: Song B, Gong JL, Tang WW, Zeng GM, Chen M, Xu P, Shen MC, Ye SJ, Feng HP, Zhou CY, Yang Y

Source: SCIENCE OF THE TOTAL ENVIRONMENT 713:136645, 2020, DOI: 10.1016/j.scitotenv.2020.136645

Abstract: The rise in manufacture and use of carbon nanotubes has aroused the concern about their potential risks associated with coexisting pollutants in the aquatic environment. 2,4-dichlorophenol (2,4-DCP), with a high toxicity to many aquatic organisms, is a widespread pollutant resulting from the extensive use of pesticides and preservatives. In this article, the adsorption of 2,4-DCP by riverine sediment and the responses of sediment microbial community to 2,4-DCP were studied in the presence of multi-walled carbon nanotubes (MWCNTs). Adding MWCNTs significantly increased the adsorption amount of sediment for 2,4-DCP from 0.541 to 1.44 mg/g as the MWCNT concentration increased from 0 to 15 mg/g. The responses of sediment microbial community were determined after one-month exposure to MWCNTs at different concentrations (0.05, 0.5, 5, and 50 mg/g). The microbial biomass carbon in the sediment contaminated with 2,4-DCP increased in the presence of 5 mg/g of MWCNTs (from 0.06 to 0.11 mg/g), but not significantly changed at other MWCNT concentrations. For the sediments contaminated with 2,4-DCP, the presence of MWCNTs made no difference to urease activity, while the dehydrogenase activity slightly increased with the addition of 5 mg/g of MWCNTs and decreased in the presence of 50 mg/g of MWCNTs. The changes of sediment bacterial communities were further determined by 16S rRNA gene sequencing. Based on the weighted UniFrac distance between communities, the clustering analysis suggested that the contamination of 2,4-DCP affected the bacterial community structure in a greater degree than that caused by MWCNTs at relatively low concentrations (≤ 5 mg/g). Bacteroidetes, Planctomycetes, and Nitrospirae were feature

bacterial phyla to reflect the effects of MWCNTs and 2,4-DCP on sediment bacterial community. These results may contribute to the understanding of microbial community response to co-exposure of MWCNTs and 2,4-DCP and the assessment of associated ecological risks.

Accès au document

Periphytic biofilm: An innovative approach for biodegradation of microplastics

Authors: Shabbir S, Faheem M, Ali N, Kerr PG, Wang LF, Kuppusamy S, Li Y

Source: SCIENCE OF THE TOTAL ENVIRONMENT 717:137064, 2020, DOI: 10.1016/j.scitotenv.2020.137064

Abstract: Microplastics (MPs) have been gaining the attention of environmental researchers since the 1960s anecdotal reports of plastic entanglement and ingestion by marine creatures. Due to their increasing accretion in aquatic environments, as well as resistance towards degradation, marine litter research has focused on microplastics more recently. In the present study, a relatively new method of biodegradation was implemented for the biodegradation of three structurally different MPs i.e. polypropylene (PP), polyethylene (PE) and polyethylene terephthalate (PET). Periphytic biofilm was used for this purpose in various backgrounds of carbon sources (glucose, peptone, and glucose and peptone). Biodegradation of MPs was estimated in terms of weight loss. It was observed that the addition of glucose enhanced the biodegradation of MI's by periphyton biofilm for all MPs (from 9.52%-18.02%, 5.95%-14.02% and 1324-19.72% for PP, PE and PET respectively) after 60 days compared to natural biofilm alone. To the contrary, peptone, and glucose and peptone together, were inhibitory. Biodegradation was further confirmed by morphological changes observed using SEM, MR spectra and GPC lent further support to the results whereby new peaks appeared along with reduction in old peaks and decrease in peak intensities. MiSeq sequencing shows that *Deinococcus-thermus*; Proteobacteria; Cyanobacteria are the dominant phyla in natural biofilms, and their relative abundances increase after the addition of glucose. However, the abundances shifted to *Deinococcus-thermus*; Cyanobacteria; Firmicutes; Bacteroidetes, when the biofilms were treated with either peptone alone, or with glucose and peptone together. Therefore, the change in biodegradation capability also be due to the change in the microbial community structures after addition of the C-sources. These experiments provide an innovative approach towards effective biodegradation of MPs using a relatively new environment-friendly method.

Accès au document

Ecotoxicity of polyethylene nanoplastics from the North Atlantic oceanic gyre on freshwater and marine organisms (microalgae and filter-feeding bivalves)

Authors: Baudrimont M, Arini A, Guegan C, Venel Z, Gigault J, Pedrono B, Prunier J, Maurice L, Ter Halle A, Feurtet-Mazel A

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3746-3755, 2020, DOI: 10.1007/s11356-019-04668-3

Abstract: Each year, 5 to 10 million tons of plastic waste is dumped in the oceans via freshwaters and accumulated in huge oceanic gyres. Under the effect of several abiotic factors, macro plastic wastes (or plastic wastes with macro sizes) are fractionated into microplastics (MP) and finally reach the nanometric size (nanoplastic NP). To reveal potential toxic impacts of these NPs, two microalgae, *Scenedemus subspicatus* (freshwater green algae), and *Thalassiosira weissiflogii* (marine diatom) were exposed for up to 48 h at 1, 10, 100, 1000, and 10,000 µg/L to reference polyethylene NPs (PER) or NPs made from polyethylene collected in the North Atlantic gyre (PEN, 7th continent expedition in 2015). Freshwater filter-feeding bivalves, *Corbicula fluminea*, were exposed to 1000 µg/L of PER and PEN for 48 h to study a possible modification of their filtration or digestion capacity. The results show that PER and PEN do not influence the cell growth of *T. weissiflogii*, but the PEN exposure causes growth inhibition of *S. subspicatus* for all exposure concentrations tested. This growth inhibition is enhanced for a higher concentration

of PER or PEN (10,000 µg/L) in *S. subspicatus*. The marine diatom T. weissiflogii appears to be less impacted by plastic pollution than the green algae *S. subspicatus* for the exposure time. Exposure to NPs does not lead to any alteration of bivalve filtration; however, fecal and pseudo-fecal production increased after PEN exposure, suggesting the implementation of rejection mechanisms for inedible particles.

Accès au document

Evolution and distribution of resistance genes and bacterial community in water and biofilm of a simulated fish-duck integrated pond with stress

Authors: Zhou M, Xu YB, Ouyang PQ, Ling JY, Cai QJ, Huang L, Zhou X, Zheng L

Source: CHEMOSPHERE 245:UNSP 125549, 2020, DOI: 10.1016/j.chemosphere.2019.125549

Abstract: Integrated fish-duck pond is a common circular farming model in South China, besides, it is also hot-spot for the co-selection of antibiotic resistance genes (ARGs). The aim of this study was to investigate the effects of duck manure, As and cefotaxime on the bacterial community, and the evolution and distribution of ARGs and metal(loid) resistance genes (MRGs) in water and biofilm. Five groups of fish tanks included a control and four test groups. The experimental period lasted for 100 days. Six ARGs (CIT, DHA, EBC, FOX, MOX, TEM), two MRGs (arsB, arsC), and two integron genes (intI1, intI2) were tracked and detected in water and biofilm. The results showed that duck manure brought ARGs and MRGs into fish tanks. Stress factors (cefotaxime, As) increased the relative abundance of resistance genes, and this was positively correlated with stress concentrations. The biofilm was visible significantly at the end of stage 3, and the total relative abundance of resistance genes in biofilm was higher than water from stage 5 onwards. Evolution of AmpC beta-lactamase resistance genes was more obvious than MRGs, especially for MOX, which increased by 3 orders of magnitude. The abundance of Flavobacterium was higher in biofilm than in water. Moreover, correlation analysis showed that both arsB and MOX were significantly correlated with intI1 (p < 0.05), which suggested a potentially dissemination risk of resistance genes. Study provides a reference for health risk assessment in integrated aquaculture environment contaminated with duck manure, antibiotics and metalloids.

Accès au document

A global metabolomic insight into the oxidative stress and membrane damage of copper oxide nanoparticles and microparticles on microalga *Chlorella vulgaris*

Authors: Wang L, Huang XL, Sun WL, Too HZ, Laserna AKC, Li SFY

Source: ENVIRONMENTAL POLLUTION 258:113647, 2020, DOI: 10.1016/j.envpol.2019.113647

Abstract: To compare aquatic organisms' responses to the toxicity of copper oxide (CuO) nanoparticles (NPs) with those of CuO microparticles (MPs) and copper (Cu) ions, a global metabolomics approach was employed to investigate the changes of both polar and nonpolar metabolites in microalga *Chlorella vulgaris* after 5-day exposure to CuO NPs and MPs (1 and 10 mg/L), as well as the corresponding dissolved Cu ions (0.08 and 0.8 mg/L). Unchanged growth, slight reactive oxygen species production, and significant membrane damage (at 10 mg/L CuO particles) in *C. vulgaris* were demonstrated. A total of 75 differentiated metabolites were identified. Most metabolic pathways perturbed after CuO NPs exposure were shared by those after CuO MPs and Cu ions exposure, including accumulation of chlorophyll intermediates (max. 2.4-5.2 fold), membrane lipids remodeling for membrane protection (decrease of phosphatidylethanolamines (min. 0.6 fold) and phosphatidylcholines (min. 0.2-0.7 fold), as well as increase of phosphatidic acids (max. 1.5-2.9 fold), phosphatidylglycerols (max. 2.2-2.3 fold), monogalactosyldiacylglycerols (max. 1.2-1.4 fold), digalactosylmonoacylglycerols (max. 1.9-3.8 fold), diacylglycerols (max. 1.4 fold), lysophospholipids (max. 1.8-3.0 fold), and fatty acids (max. 3.0-6.2 fold)), perturbation of glutathione metabolism induced by oxidative stress, and accumulation of osmoregulants (max.

1.3-2.6 fold) to counteract osmotic stress. The only difference between metabolic responses to particles and those to ions was the accumulation of fatty acids oxidation products: particles caused higher fold changes (particles/ions ratio 1.9-3.0) at 1 mg/L and lower fold changes (particles/ions ratio 0.4-0.7) at 10 mg/L compared with ions. Compared with microparticles, there was no nanoparticle-specific pathway perturbed. These results confirm the predominant role of dissolved Cu ions on the toxicity of CuO NPs and MPs, and also reveal particle-specific toxicity from a metabolomics perspective.

Accès au document

Toxicity, Biodegradation, and Metabolic Fate of Organophosphorus Pesticide Trichlorfon on the Freshwater Algae *Chlamydomonas reinhardtii*

Authors: Wan L, Wu YX, Ding HJ, Zhang WH

Source: JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY 68(6):1645-1653, 2020, DOI: 10.1021/acs.jafc.9b05765

Abstract: This study investigated the toxicity of trichlorfon (TCF) to the freshwater algae *Chlamydomonas reinhardtii*, as well as its biodegradation and metabolic fate. The growth of *C. reinhardtii* decreased with increasing TCF concentration, and the maximum inhibition ratio was 51.3% at 200 mg L-1 TCF compared to the control. (…) The variations in pH during cultivation suggested that photosynthetic microalgae have innate advantages over bacteria and fungi in remediating TCF. A 100% biodegradation rate was achieved at a maximum concentration of 100 mg L-1 TCF. Ten metabolites were identified by GC-MS, and the degradation pathways of TCF by the algae were proposed. This research demonstrated that *C. reinhardtii* is highly tolerant to and can efficiently degrade TCF. Thus, *C. reinhardtii* can be used to remove traces of TCF from natural water environments and to treat TCF-contaminated wastewater.

Accès au document

Differential responses of two cyanobacterial species to R-metalaxyl toxicity: Growth, photosynthesis and antioxidant analyses

Authors: Hamed SM, Hassan SH, Selim S, Wadaan MAM, Mohany M, Hozzein WN, AbdElgawad H

Source: ENVIRONMENTAL POLLUTION 258:113681, 2020, DOI: 10.1016/j.envpol.2019.113681

Abstract: Metalaxyl is a broad-spectrum chiral fungicide that used for the protection of plants, however extensive use of metalaxyl resulted in serious environmental problems. Thus, a study on the detoxification mechanism in algae/cyanobacteria and their ability for phycoremediation is highly recommended. Here, we investigated the physiological and biochemical responses of two cyanobacterial species; *Anabaena laxa* and *Nostoc muscorum* to R-metalaxyl toxicity as well as their ability as phycoremediators. Two different levels of R-metalaxyl, at mild (10 mg/L) and high dose (25 mg/L), were applied for one-week. We found that *A. laxa* absorbed and accumulated more intracellular R-metalaxyl compared to N. muscorum. R-metalaxyl, which triggered a dose-based reduction in cell growth, photosynthetic pigment content, and photosynthetic key enzymes activities i.e., phosphoenolpyruvate carboxylase (PEPC) and ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCo). These decreases were significantly less pronounced in *A. laxa*. On the other hand, R-metalaxyl significantly induced oxidative damage markers, e.g., H2O2 levels, lipid peroxidation (MDA), protein oxidation and NADPH oxidase activity. However, these increases were also lower in A. laxa compared to *N. muscorum*. To alleviate R-metalaxyl toxicity, *A. laxa* induced the polyphenols, flavonoids, tocopherols and glutathione (GSH) levels as well as peroxidase (POX), glutathione peroxidase (GPX), glutathione reductase (GR) and glutathione-s-transferase (GST) enzyme activities. On the contrary, the significant induction of antioxidants in *N. muscorum* was restricted to ascorbate, catalase (CAT) and ascorbate peroxidase (APX), dehydroascorbate reductase (DHAR) enzyme activities. Although *A. laxa* accumulated more R-metalaxyl, it experienced less stress due to subsequent induction of antioxidants. Therefore, *A. laxa* may

be a promising R-metalaxyl phycoremediator. Our results provided basic data for understanding the ecotoxicology of R-metalaxyl contamination in aquatic habitats and the toxicity indices among cyanobacteria.

Accès au document

Aluminium triggers oxidative stress and antioxidant response in the microalgae *Scenedesmus* sp

Authors: Ameri M, Baron-Sola A, Khavari-Nejad RA, Soltani N, Najafi F, Bagheri A, Martinez F, Hernandez LE

Source: JOURNAL OF PLANT PHYSIOLOGY 246:153114, 2020, DOI:10.1016/j.jplph.2020.153114

Abstract: Aluminium (Al) water pollution is an increasing environmental problem and comprehensive analysis of toxic responses of aquatic primary producer organisms is imperative. We characterized the antioxidant response of Scenedesmus sp. microalga to Al-induced oxidative stress. After 72 h of exposure to Al (0, 10, and 100 μM) in a modified Bold Basal Medium (pH 5.0), we observed cell aggregation and alterations in the subcellular structure, strong lipid peroxidation and oxidative stress induction (detected with the fluorescent probe 2',7'-dichlorodihydrofluorescein diacetate) in parallel with Al accumulation in cells. At the same time, Al toxicity caused depletion of important macronutrients like Ca, which is important for cell-wall structure. Analysis of antioxidant enzymatic activities in Al-treated Scenedesmus cells revealed that catalase, ascorbate peroxidase, as well as different isoforms of superoxide dismutase were inhibited especially at the highest Al dose (100 μM), cells that accumulated the highest concentration of Al. On the other hand, glutathione reductase activity increased at that Al concentration. Immunodetection after Western-blotting confirmed that only ascorbate peroxidase inhibition was apparently due to a decrease in enzyme levels. However, the inhibition of catalase and activation of glutathione reductase activities seemed related with post-translational modifications in protein function as protein expression decreased or increased, respectively under Al stress. Our results may help to understand toxic mechanisms triggered by Al in freshwater microalgae, which in turn could aid to select suitable biomarkers of Al contamination in aquatic ecosystems.

Accès au document

Spatial distribution characteristics of bacterial community structure and gene abundance in sediments of the Bohai Sea

Authors: Chen QR, Fan JF, Su J, Ming HX, Sun ZH, Li MF, Zhao XH, Wang YT, Zhang YX, Zhang HZ, Jin Y, Ma XW,Wang B

Source: ACTA OCEANOLOGICA SINICA 39(2):69-78, 2020, DOI: 10.1007/s13131-020-1554-8

Abstract: This study investigated differences in the community structure and environmental responses of the bacterial community in sediments of the Bohai Sea. (…) The results showed that sediments at the majority of the 13 sampling stations were contaminated by heavy metal mercury. The main phyla of bacteria recorded included Proteobacteria (52.92%), Bacteroidetes (11.76%), Planctomycetes (7.39%), Acidobacteria (6.53%) and Chloroflexi (4.97%). The genus with the highest relative abundance was Desulfobulbus (4.99%), which was the dominant genus at most sampling stations, followed by Lutimonas and Halioglobus. The main factors influencing bacterial community structure were total organic carbon, followed by depth and total phosphorus. The content of lead, cadmium, chromium, copper and zinc had a consistent effect on community structure. Arsenic showed a negative correlation with bacterial community structure in most samples, while the impact of mercury on community structure was not significant. The bacterial community in sediment samples from the Bohai Sea was rich in diversity and displayed an increase in diversity from high to low latitudes. The data indicated that the Bohai Sea had abundant microbial resources and was rich in bacteria with the potential to metabolize many types of pollutants.

Accès au document

Silver nanoparticle and Ag+-induced shifts of microbial communities in natural brackish waters: Are they more pronounced under oxic conditions than anoxic conditions?

Authors: Zou XY, Li PH, Wang XD, Zheng SH, Dai FQ, Zhang HW

Source: ENVIRONMENTAL POLLUTION 258:113686, 2020, DOI: 10.1016/j.envpol.2019.113686

Abstract: With the burst of silver nanoparticles (AgNPs) applications, their potential entry into the environment has attracted increasing concern. To date, researches about the impacts of AgNPs on microbial communities have been scarcely conducted in the brackish waters. Here, the effects of interactions of AgNPs and Ag+ (as a positive control) with dissolved oxygen on natural brackish water microbial communities were investigated for 30 d. The introduction of AgNPs and Ag+ in natural brackish waters resulted in distinct bacterial community composition and structure as well as reduction of the richness and diversity, effects that were not eliminated completely during the tested periods. Anoxic conditions could attenuate the effects of AgNPs and Ag+ on the community, and dissolved oxygen made more contributions to community compositions for short-term exposure. High doses of AgNPs had more pronounced long-term impacts than Ag+ amendment. Compared with the controls, two general AgNP and Ag+ responses, namely, sensitivity and resistance, were observed. Sensitive species mainly included those of the genera Synechococcus and unclassified_f_Rhodobacteraceae, while resistant species mostly belonged to the phylum Bacteroidetes and participated in carbon metabolic processes. Our results indicated that the microbial communities that were involved in nutrient cycles (such as carbon, nitrogen, and sulfide) and photoautotrophic bacteria that contained bacteriochlorophyll were adversely affected by AgNPs and Ag+. In addition, dissolved oxygen could further change the microbial communities. These results implied that under different oxygen conditions AgNPs possibly resulted in varying microbial survival strategies and affected the biogeochemical cycling of nutrients in natural brackish waters.

Accès au document

Enhanced bactericidal effect of ceftriaxone drug encapsulated in nanostructured lipid carrier against gram-negative *Escherichia coli* bacteria: drug formulation, optimization, and cell culture study

Authors: Ebrahimi S, Farhadian N, Karimi M, Ebrahimi M

Source: ANTIMICROBIAL RESISTANCE AND INFECTION CONTROL 9(1):28, 2020, DOI: 10.1186/s13756-020-0690-4

Abstract: Background Ceftriaxone is one of the most common types of antibiotics used to treat most deadly bacterial infections. One way to alleviate the side effects of medication is to reduce drug consumption by changing the ordinary drug forms into nanostructured forms. In this study, a nanostructured lipid carrier (NLC) containing hydrophilic ceftriaxone sodium drug is developed, and its effect on eliminating gram-negative bacteria Escherichia coli death is investigated. Methods Double emulsion solvent evaporation method is applied to prepare NLC. Mathematical modeling based on the solubility study is performed to select the best materials for NLC preparation. Haftyzer-Van Krevelen and Hoy's models are employed for this purpose. Drug release from optimized NLC is examined under in vitro environment. Then, the efficacy of the optimized sample on eliminating gram-negative bacteria Escherichia coli is investigated. Results Mathematical modeling reveals that both methods are capable of predicting drug encapsulation efficiency trends by chaining solid and liquid lipids. However, Haftyzer-Van Krevelen's method can precisely predict the particle size trend by changing the surfactant types in water and oily phases of emulsions. The optimal sample has a mean particle size of 86 nm and drug entrapment efficiency of 83%. Also, a controlled drug release

in prepared nanostructures over time is observed under in-vitro media. The results regarding the effectiveness of optimized NLC in killing Escherichia coli bacteria suggests that by cutting drug dosage of the nanostructured form in half, an effect comparable to that of free drug can be observed at longer times. Conclusion Results confirm that NLC structure is an appropriate alternative for the delivery of ceftriaxone drug with a controlled release behavior.

Accès au document

Combating the prevalence of water-borne bacterial pathogens using anisotropic structures of silver nanoparticles

Authors: Ali HR, Emam AN, Koraney NF, Hefny EG, Ali SF

Source: JOURNAL OF NANOPARTICLE RESEARCH 22(2):47, 2020, DOI: 10.1007/s11051-020-4760-6

Abstract: The current study aimed to investigate the antibacterial activity of different anisotropic structures of silver nanoparticles in the hexagon and spherical shapes against MDR-bacteria isolated from water sources in Egypt. The water samples collected from four different dairy farm-related sites were tested bacteriologically, followed by identification of the antibiotic-resistant profile for the isolates. The result revealed that Enterococcus spp, Proteus spp, and *E. coli* spp are the most common organisms in all tested water samples, and the antibiotic-resistant profile identified 11/13 waterborne isolates as MDR-bacteria. Herein, spherical and hexagonal silver nanoparticles were prepared with an average size of 26 ± 6 nm and 375 ± 80 nm, respectively, through the chemical reduction method. Further, MDR gram-positive (Enterococcus) and MDR gram-negative (E. coli) were selected for studying the antibacterial property of the synthesized AgNPs using agar well diffusion method. In another experiment, microdilution broth assay coupled with XTT assay is optimized for facilitating the testing of a broad range of AgNPs concentrations efficiently without the need for laborious preparation of the colony counting method. Our results indicated that AgNPs in spherical and hexagonal shapes are potent antibacterial against the MDR-waterborne bacteria in a dose and shape-dependent manner. The hexagonal AgNPs (h-AgNPs) express higher bactericidal activity when compared to spherical AgNPs (AgNSs) against the two tested MDR-bacteria, but the E. coli isolate more sensitive to both tested shapes of AgNPs than the Enterococus isolate. The results recommend that AgNPs can be used as efficient growth inhibitors for water-borne bacterial pathogens, making them applicable to various water filters and antimicrobial applications.

Accès au document

Insights into the transcriptional responses of a microbial community to silver nanoparticles in a freshwater microcosm

Authors: Lu T, Qu Q, Lavoie M, Pan XJ, Peijnenburg WJGM, Zhou ZG, Pan XL, Cai ZQ, Qian HF

Source: ENVIRONMENTAL POLLUTION 258:113727, 2020, DOI: 10.1016/j.envpol.2019.113727

Abstract: Silver nanoparticles (AgNPs) are widely used because of their excellent antibacterial properties. They are, however, easily discharged into the water environment, causing potential adverse environmental effects. Meta-transcriptomic analyses are helpful to study the transcriptional response of prokaryotic and eukaryotic aquatic microorganisms to AgNPs. In the present study, microcosms were used to investigate the toxicity of AgNPs to a natural aquatic microbial community. It was found that a 7-day exposure to 10 μg L-1 silver nanoparticles (AgNPs) dramatically affected the structure of the microbial community. Aquatic micro eukaryota (including eukaryotic algae, fungi, and zooplankton) and bacteria (i.e., heterotrophic bacteria and cyanobacteria) responded differently to the AgNPs stress. Meta-transcriptomic analyses demonstrated that eukaryota could use multiple cellular strategies to cope with AgNPs stress, such as enhancing nitrogen and sulfur metabolism, over-expressing genes related to translation, amino acids biosynthesis, and promoting bacterial-eukaryotic algae interactions. By contrast, bacteria were negatively affected by AgNPs with less signs of detoxification than in case of eukaryota: various

pathways related to energy metabolism, DNA replication and genetic repair were seriously inhibited by AgNPs. As a result, eukaryotic algae (mainly Chlorophyta) dominated over cyanobacteria in the AgNPs treated microcosms over the 7-d exposure. The present study helps to understand the effects of AgNPs on aquatic microorganisms and provides insights into the contrasting AgNPs toxicity in eukaryota and bacteria.

Accès au document

Growth inhibition of eutrophication water by white-rot fungus

Authors: Zeng GM, Zhang ML, Wang YL, Wang P, Wu P, Li X, Wen X

Source: FRESENIUS ENVIRONMENTAL BULLETIN 29(2):743-748, 2020

Abstract: It is important to inhibit Algal blooms by efficacy methods, which is caused water stench and threaten human health seriously. The strain of white-rot fungus may be one of the bio-treatment ways to do this, in particular, the Phanerochaete chrysosporim. Its algicidal ability on algae was studied by three main influence factors: white rot fungus dosage, pH value and DO. The results showed that the chlorophyll-a content of eutrophication water decreased 92.24% within 24 h under the optimum conditions that 250 mg/L at pH 7.0 for 7.0 mg/L. Pre-treated eutrophication water was investigated by algal cells dehydrogenase activity, soluble protein content and malondialdehyde. It was seen that decrease in algal cells dehydrogenase activity and soluble protein content and an increase in MDA content, which were associated with the decrease in chlorophyll-a content. These results indicated that the fungus could destroy the algal cell and inhibit the algae blooms.

Accès au document

Inhibitory efficacy of white-rot fungus against harmful freshwater algal bloom species

Authors: Zeng GM, Zhang ML, Wang YL, Wang P, Wu P, Li X, Wen X

Source: FRESENIUS ENVIRONMENTAL BULLETIN 29(2):749-755, 2020

Abstract: Eutrophication and frequent algal blooms have become serious ecological problems. White-rot fungi have been considered as possible microorganisms for controlling algal blooms. In this study, *Cryptomonas obovata* FACHB-1301, *Oscillatoria* sp. FACHB-1083, and *Scenedesmus quadricauda* FACHB-507 co-cultured with the white-rot fungus *Phanerochaete chrysosporium*. All algal cells were damaged within 48 h of coculture. *P. chrysosporium* apparently decreased the chlorophyll-a content, dehydrogenase activity, and soluble protein content but increased the malondialdehyde content of the algal cells. These results indicate that the algae were greatly inhibited and severely damaged by the fungus. In conclusion, P. chrysosporium can effectively remove algal cells and inhibit algal blooms.

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Microbial Colonization in Marine Environments: Overview of Current Knowledge and Emerging Research Topics

Author: Caruso G

Source: JOURNAL OF MARINE SCIENCE AND ENGINEERING 8(2):78, 2020, DOI: 10.3390/jmse8020078

Abstract: Microbial biofilms are biological structures composed of surface-attached microbial communities embedded in an extracellular polymeric matrix. In aquatic environments, the microbial colonization of submerged surfaces is a complex process involving several factors, related to both environmental conditions and to the physical-chemical nature of the substrates. Several studies have addressed

this issue; however, more research is still needed on microbial biofilms in marine ecosystems. After a brief report on environmental drivers of biofilm formation, this study reviews current knowledge of microbial community attached to artificial substrates, as obtained by experiments performed on several material types deployed in temperate and extreme polar marine ecosystems. Depending on the substrate, different microbial communities were found, sometimes highlighting the occurrence of species-specificity. Future research challenges and concluding remarks are also considered. Emphasis is given to future perspectives in biofilm studies and their potential applications, related to biofouling prevention (such as cell-to-cell communication by quorum sensing or improved knowledge of drivers/signals affecting biological settlement) as well as to the potential use of microbial biofilms as sentinels of environmental changes and new candidates for bioremediation purposes.

Accès au document

Marine Actinobacteria: Screening for Predation Leads to the Discovery of Potential New Drugs against Multidrug-Resistant Bacteria

Authors: Ibrahimi M, Korichi W, Hafidi M, Lemee L, Ouhdouch Y, Loqman S

Source: ANTIBIOTICS-BASEL 9(2):91, 2020, DOI: 10.3390/antibiotics9020091

Abstract: Predatory bacteria constitute a heterogeneous group of prokaryotes able to lyse and feed on the cellular constituents of other bacteria in conditions of nutrient scarcity. In this study, we describe the isolation of Actinobacteria predator of other bacteria from the marine water of the Moroccan Atlantic coast. Only 4 Actinobacteria isolates showing strong predation capability against native or multidrug-resistant Gram-positive or Gram-negative bacteria were identified among 142 isolated potential predatory bacteria. These actinobacterial predators were shown to belong to the Streptomyces genus and to inhibit the growth of various native or multidrug-resistant micro-organisms, including *Micrococcus luteus*, *Staphylococcus aureus* (native and methicillin-resistant), and *Escherichia coli* (native and ampicillin-resistant). Even if no clear correlation could be established between the antibacterial activities of the selected predator Actinobacteria and their predatory activity, we cannot exclude that some specific bio-active secondary metabolites were produced in this context and contributed to the killing and lysis of the bacteria. Indeed, the co-cultivation of Actinobacteria with other bacteria is known to lead to the production of compounds that are not produced in monoculture. Furthermore, the production of specific antibiotics is linked to the composition of the growth media that, in our co-culture conditions, exclusively consisted of the components of the prey living cells. Interestingly, our strategy led to the isolation of bacteria with interesting inhibitory activity against methicillin-resistant *S. aureus* (MRSA) as well as against Gram-negative bacteria.

Accès au document

Water environments: metal-tolerant and antibiotic-resistant bacteria

Author: Squadrone S

Source: ENVIRONMENTAL MONITORING AND ASSESSMENT 192(4):238, 2020, DOI: 10.1007/s10661-020-8191-8

Abstract: The potential threat of both metals and antibiotics to the environment and human health has raised significant concerns in the last decade. Metal-resistant and antibiotic-resistant bacteria are found in most environments, including water, and the risk posed to humans and animals due to the spread of antibiotic-resistant bacteria and antibiotic-resistant genes in the environment is increasing. Bacteria have developed the ability to tolerate metals even at notable concentrations. This ability tends to favor the selection of antibiotic-resistant strains, even in pristine water environments, with the potential risk of spreading this resistance to human pathogens. In this mini-review, we focus on investigations performed in marine and freshwater environments worldwide, highlighting the presence of co-resistance to metals and antibiotics.

Accès au document

Simultaneous enhancement of heavy metal removal and electricity generation in soil microbial fuel cell

Authors: Zhang JR, Cao X, Wang H, Long XZ, Li XN

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 192, 2020, DOI: 10.1016/j.ecoenv.2020.110314

Abstract: As an environmentally sustainable bioelectrochemical technology, the microbial fuel cell (MFC) has attracted great attention. In this study, a three-chamber MFC (TC-MFC) was enhanced with different auxiliary reagents to remove heavy metals from soil. The results showed that the removal efficiency of heavy metals from soil increased with increasing auxiliary reagent concentration. When 1 mol/L citric acid, HCl, or acetic acid were used as an auxiliary reagent, the total copper (500 mg/kg) removal efficiency after 74 days of TC-MFC treatment was 3.89, 5.01 and 2.01 times that of the control group, respectively. The highest soil electrical conductivity (15.29 ms/cm), ionic heavy metal content (94.78%), electricity generation performance (363.04 mW h), and desorption stability of heavy metals were obtained when using 1 mol/L HCl as an auxiliary reagent, indicating that HCl was more suitable for the remediation of heavy metals in soil using a TC-MFC. Correlation analysis showed that the electricity generation of the TC-MFC was linearly related to the removal efficiency of heavy metals from soil (R-2 = 0.9296). At the same time, higher content of ionic heavy metals in the soil led to better migration of heavy metals under the internal electric field of the TC-MFC.

Bioremediation of heavy metals using microalgae: Recent advances and mechanisms

Authors: Leong YK, Chang JS

Source: BIORESOURCE TECHNOLOGY 303:122886, 2020, DOI: 10.1016/j.biortech.2020.122886

Abstract: Five heavy metals namely, arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb) and mercury (Hg) are carcinogenic and show toxicity even at trace amounts, posing threats to environmental ecology and human health. There is an emerging trend of employing microalgae in phycoremediation of heavy metals, due to several benefits including abundant availability, inexpensive, excellent metal removal efficiency and eco-friendly nature. This review presents the recent advances and mechanisms involved in bioremediation and biosorption of these toxic heavy metals utilizing microalgae. Tolerance and response of different microalgae strains to heavy metals and their bioaccumulation capability with value-added by-products formation as well as utilization of non-living biomass as biosorbents are discussed. Furthermore, challenges and future prospects in bioremediation of heavy metals by microalgae are also explored. This review aims to provide useful insights to help future development of efficient and commercially viable technology for microalgae-based heavy metal bioremediation.

Accès au document

Bacterial Disinfection by CuFe2O4 Nanoparticles Enhanced by NH2OH: A Mechanistic Study

Authors: Gu Y, Xiao FR, Luo LM, Zhou XY, Zhou XD, Li J, Li Z

Source: NANOMATERIALS 10(1):18, 2020, DOI: 10.3390/nano10010018

Abstract: Many disinfection technologies have emerged recently in water treatment industry, which are designed to inactivate water pathogens with extraordinary efficiency and minimum side effects and costs. Current disinfection processes, including chlorination, ozonation, UV irradiation, and so on, have their inherent drawbacks, and have been proven ineffective under certain scenarios. Bacterial inactivation by noble metals has been traditionally used, and copper is an ideal candidate as a bactericidal agent owing to its high abundance and low cost. Building on previous findings, we explored the bactericidal efficiency of Cu(I) and attempted to develop it into a novel water disinfection platform. Nanosized copper ferrite was synthesized, and it was reduced by hydroxylamine to form surface bound Cu(I) species. Our results showed that the generated Cu(I) on copper ferrite surface could inactivate E.

coli at a much higher efficiency than Cu(II) species. Elevated reactive oxygen species' content inside the cell primarily accounted for the strong bactericidal role of Cu(I), which may eventually lead to enhanced oxidative stress towards cell membrane, DNA, and functional proteins. The developed platform in this study is promising to be integrated into current water treatment industry.

Accès au document

Hierarchical Cluster Analysis of Medical Chemicals Detected by a Bacteriophage-Based Colorimetric Sensor Array

Authors: Kim C, Lee H, Devaraj V, Kim WG, Lee Y, Kim Y, Jeong NN, Choi EJ, Baek SH, Han DW, Sun H, Oh JW

Source: NANOMATERIALS 10(1):121, 2020, DOI: 10.3390/nano10010121

Abstract: M13 bacteriophage-based colorimetric sensors, especially multi-array sensors, have been successfully demonstrated to be a powerful platform for detecting extremely small amounts of target molecules. Colorimetric sensors can be fabricated easily using self-assembly of genetically engineered M13 bacteriophage which incorporates peptide libraries on its surface. However, the ability to discriminate many types of target molecules is still required. In this work, we introduce a statistical method to efficiently analyze a huge amount of numerical results in order to classify various types of target molecules. To enhance the selectivity of M13 bacteriophage-based colorimetric sensors, a multi-array sensor system can be an appropriate platform. On this basis, a pattern-recognizing multi-array biosensor platform was fabricated by integrating three types of sensors in which genetically engineered M13 bacteriophages (wild-, RGD-, and EEEE-type) were utilized as a primary building block. This sensor system was used to analyze a pattern of color change caused by a reaction between the sensor array and external substances, followed by separating the specific target substances by means of hierarchical cluster analysis. The biosensor platform could detect drug contaminants such as hormone drugs (estrogen) and antibiotics. We expect that the proposed biosensor system could be used for the development of a first-analysis kit, which would be inexpensive and easy to supply and could be applied in monitoring the environment and health care.

Accès au document

Quantifying the Mineralization of C-13-Labeled Cations and Anions Reveals Differences in Microbial Biodegradation of Herbicidal Ionic Liquids between Water and Soil

Authors: Wilms W, Wozniak-Karczewska M, Niemczak M, Lisiecki P, Zgola-Grzeskowiak A, Lawniczak L, Framski G, Pernak J, Owsianiak M, Vogt C, Fischer A, Rogers RD, Chrzanowski L

Source: ACS SUSTAINABLE CHEMISTRY & ENGINEERING 8(8):3412-3426, 2020, DOI: 10.1021/acssuschemeng.9b07598

Abstract: Characterization of the biodegradability of herbicidal ionic liquids (HILs) using the industry standard activated sludge methodology is thought to be insufficient to fully understand the biodegradation of HILs in the environment because cations and anions of the HILs may have different potential for biodegradation in aquatic and terrestrial systems. To test this hypothesis, we conducted laboratory microcosm experiments using C-13-labeled cations and anions forming benzyldodecyldimethylammonium 4-chloro-2-methylphenoxyacetate ([C-12-BA][MCPA]) and evaluated their biodegradation potential in soil with a known history of herbicide exposure, and in water (mineral medium) augmented with microorganisms present in activated sludge. The biodegradability of the cation and anion was found to depend on the test system (water or soil). The cation was mineralized in water, whereas the anion was fully utilized in soil. These results suggest that performing biodegradation tests using differently C-13-labeled species of the target HIL and mimicking various environmental compartments (e.g., soil, activated sludge) is needed to provide a better understanding of the fate of HILs in the environment. They also indicate

that biodegradation kinetic parameters of HILs derived from experiments performed in aqueous systems should not be used to estimate biodegradation rates in terrestrial environments.

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Heavy metal resistance and metallothionein induction in bacteria isolated from Seybouse River, Algeria

Authors: Benhalima L, Amri S, Bensouilah M, Ouzrout R

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH 18(1):1721-1737, 2020, DOI: 10.15666/aeer/1801_17211737

Abstract: Heavy metal pollution is a serious and widespread environmental problem that destroys microbial ecology. In this study, determination of copper and cadmium concentrations and heavy metal-resistant bacteria identification in water samples obtained from four sites at Seybouse River in Algeria were carried out. The minimum inhibition concentration (MIC) and minimum bactericidal concentration (MBC) were determined in culture media with 12.5-3600 µg/mL of cadmium and copper salts. Metallothionein (MT) production was evaluated by spectrophotometry methodology. Trace metal element concentrations determined in the water samples revealed spatial variations for Cu and Cd. A total of 12 copper- and cadmium-resistant bacteria (KZ1-KZ12) were isolated from surface water in Seybouse River. Five isolates KZ2, KZ5, KZ8, KZ10 and KZ11 showed high values of minimum inhibitory concentration (MIC = 3600 µg/mL) for each heavy metal. High MBC of the strain toward Cu and Cd was found to be 3600 µg/mL. The MT concentration in five best isolates which showed high resistances increased with increasing metal concentration (r = 0.936, p = 0.006). High levels of MT are detected in bacterial strains exposed to Cd (51.66-90.53 nmol MT/g bacterial biomass). These indicated that the isolates can be used efficiently in removal of heavy metals in contaminated sites.

Accès au document

A novel Cyphos IL 104-based polymer inclusion membrane (PIM) probe to mimic biofilm zinc accumulation

Authors: Antico E, Fontas C, Vera R, Mostazo G, Salvado V, Guasch H

Source: SCIENCE OF THE TOTAL ENVIRONMENT 715:136938, 2020, DOI: 10.1016/j.scitotenv.2020.136938

Abstract: The presence of Zn in surface waters from abandoned mining zones is a critical issue since excess Zn concentrations may affect aquatic life and whole ecosystems. We present, for the first time, a simple tool based on a polymer inclusion membrane (PIM) intended to monitor Zn in river water by mimicking metal accumulation in the biofilm. The PIM-based probe contains a polymeric membrane prepared using cellulose triacetate (CFA, 50% w/ w) as the base polymer, nitrophenyloctyl ether (NPOE) as the plasticizer (20% w/w). and the ionic liquid (IL) Cyphos 104 as the extractant (30% w/w).The accumulation of Zn in the acceptor phase (0.01 M HNO3) was evaluated for different free metal concentrations at 4 h accumulation time resulting in a good correlation between the free metal concentration and the accumulated one. We also found that the metal accumulated agrees with the free metal fraction upon addition of EDTA in the donor solution. The results for Zn accumulation with the PIM-based probe were found to be comparable to those obtained for a biofilm that was grown in a stream from an abandoned mine area and subsequently translocated to the laboratory and put in contact with Zn polluted stream water, so confirming the effectiveness of this new probe in mimicking Zn accumulation in the biofilm.

Accès au document

Amoxicillin removal by pre-denitrification membrane bioreactor (A/O-MBR): Performance evaluation, degradation by-products, and antibiotic resistant bacteria

Authors: Matsubara ME, Helwig K, Hunter C, Roberts J, Subtil EL, Coelho LHG

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 192:110258, 2020, DOI: 10.1016/j.ecoenv.2020.110258

Abstract: Membrane bioreactors (MBRs) are one of the treatment technologies with the potential to remove emerging compounds from wastewater. The present work evaluated the efficiency of an MBR pilot system in removing amoxicillin from synthetic wastewater using a continuous flow pre-denitrification MBR (A/O-MBR) pilot unit. The system operated in three phases: (1) synthetic wastewater and hydraulic retention time (HRT) of 40 h; (2) adding amoxicillin 100 μg L-1 to the influent, and (3) varying flowrate to HRT of 20 h. Liquid chromatography coupled to high resolution mass spectrometry analysis confirmed the presence of five amoxicillin degradation by-products in the effluent. The addition of amoxicillin did not affect chemical oxygen demand (COD) or dissolved organic carbon (DOC) removal efficiencies. Respirometry showed that amoxicillin level did not inhibit heterotrophic bacteria metabolism. The change in HRT reduced the DOC removal (from 84% to 66%) but did not influence COD (94%) or total nitrogen (72%). The amoxicillin and by-products removal decreased from 80% to 54% with HRT change. Adsorption and biodegradation represented the largest removed fraction of the antibiotic in the A/O-MBR system (68%). Ecotoxicity assays showed P. fluorescens was more resistant and E. coli less resistant to amoxicillin residues at effluent sample matrix.

Accès au document

Effects of soil chemical properties and fractions of Pb, Cd, and Zn on bacterial and fungal communities

Authors: Pan XM, Zhang SR, Zhong QM, Gong GS, Wang GY, Guo X, Xu XX

Source: SCIENCE OF THE TOTAL ENVIRONMENT 715:136904, 2020, DOI: 10.1016/j.scitotenv.2020.136904

Abstract: Heavy metal contamination in soils poses a serious threat to microorganisms, which play important roles in soil biogeochemical process. However, the key fractions of heavy metals affecting soil microorganisms are still unclear. In this study, DNA sequencing, redundancy and variance partition analysis were performed to investigate the combined effects of heavy metal fractions and soil chemical properties on microbial communities in Pb, Cd, and Zn co-contaminated soils. The results showed that long-term exposure of microorganisms to these metals changed the richness, diversity, and structure of their communities. The bacterial and fungal Chao richness indexes decreased, but only the bacterial Shannon index improved with increasing metal concentrations. Moreover, soil available potassium and add-extractable Pb made the greatest contributions to variations in the bacterial community structure, while soil pH, water-extractable Pb and Zn were the dominant factors influencing the fungal community structure. In addition, Marmoricola, Nocardioides, and Gibberella were sensitive to these metals. Overall, the effects of different heavy metal fractions on microorganisms varied significantly, and these metal fractions together with soil chemical properties determined the soil microbial communities.

Accès au document

Microbial degradation and other environmental aspects of microplastics/plastics

Authors: Yuan JH, Ma J, Sun YR, Zhou T, Zhao YC, Yu F

Source: SCIENCE OF THE TOTAL ENVIRONMENT 715:136968, 2020, DOI: 10.1016/j.scitotenv.2020.136968

Abstract: Microplastic (MP) pollution is a significant environmental concern due to the persistence of MPs and their potential adverse effects on biota. Most scientific studies have examined the distribution, ingestion, fate, behavior, amount, and effect of MPs. However,

few studies have described the development of methods for the removal and remediation of MPs. Therefore, in this review, we summarize the recent literature regarding the microbial-mediated degradation of MPs and discuss the associated degradation characteristics and mechanisms. Different types and combinations of microorganisms, such as bacteria, fungi, bacterial consortia, and biofilms, that can degrade different MN are categorized. This article summarizes approximately 50 recent papers. Twelve and 6 papers reported that bacteria and fungi, respectively, can degrade MN. Nine articles indicated that bacterial consortia have the ability to degrade MN, and 6 articles found that biofilms can also utilize MN. Furthermore, to evaluate their associated degradation effects, the corresponding structural changes (i.e., macro size, surface morphology, and functional groups) in MPs after microbial degradation are examined. In addition, MP biodegradation is affected by microbial characteristics and environmental factors; therefore, the environmental factors (i.e., temperature, pH and strain activity) influencing MP degradation and the associated degradation effects (i.e., weight loss, degradation rate, and molecular weight change) are generalized. Furthermore, the mechanisms associated with the microbial-mediated degradation of MPs are briefly discussed. Finally, prospects for the degradation of MPs using microbes and future research directions are envisioned. This review provides the first systematic summary of the microbial-mediated degradation of MN and provides a reference for future studies investigating effective means of MP pollution control.

Accès au document

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Long-term application of Swedish sewage sludge on farmland does not cause clear changes in the soil bacterial resistome

Authors: Rutgersson et al.

Source: Environment International, 137, 2020, doi: 10.1016/j.envint.2019.105339.

Abstract: The widespread practice of applying sewage sludge (...) provides a potential route for human exposure to chemical contaminants (...) and dissemination of antibiotic resistant bacteria or resistance genes. To assess such risks, (...) an agricultural field trial (...) amended with semi-digested and digested sludge every four years since 1981 (...).

Antimicrobials or bioavailable metals (Cu and Zn) did not accumulate to levels of concern for environmental selection of antibiotic resistance, and no coherent signs, neither on short or long time scales, of enrichment of antibiotic-resistant bacteria or resistance genes were found (...). Only very few and slight differences in microbial community composition were observed after sludge amendment. (...)

Accès au document

Fifteen-Year Application of Manure and Chemical Fertilizers Differently Impacts Soil ARGs and Microbial Community Structure

Authors: Wang F, Han W, Chen S, Dong W, Qiao M, Hu C and Liu B

Source: Front. Microbiol. 11:62, 2020, doi: 10.3389/fmicb.2020.00062

Abstract: (...) High-throughput quantitative PCR and sequencing technologies were employed to assess the effects of long-term manure or chemical fertilizer application on the distribution of ARGs and microbial communities. A total of 114 unique ARGs were successfully amplified from all soil samples. Manure application markedly increased the relative abundance and detectable numbers of ARGs, with up to 0.23 copies/16S rRNA gene and 81 unique ARGs. (...) In contrast, chemical fertilizers only moderately affected the diversity of ARGs and had no significant effect on

the relative abundance of the total ARGs. (...) Furthermore, the application of manure and chemical fertilizers significantly affected microbial community structure, and variation partitioning analysis showed that microbial community shifts represented the major driver shaping the antibiotic resistome. (...)

Accès au document

Do combined nanoscale polystyrene and tetracycline impact on the incidence of resistance genes and microbial community disturbance in *Enchytraeus crypticus*?

Authors: Ma et al.

Source: Journal of Hazardous Materials, 387, 2020, doi: 10.1016/j.jhazmat.2019.122012

Abstract: (...) The combined toxic effects of nanoplastic and its adsorbed pollutant on the soil fauna are still not well known. We used high-throughput quantitative PCR to explore the effects of oral nanoscale polystyrene and tetracycline exposure on antibiotic resistance genes in the soil invertebrate *Enchytraeus crypticus*, and used bacterial 16S rRNA gene amplification sequencing to examine the response of the microbiome of *E. crypticus*. (...) Results showed that the number of ARGs, especially macrolide-lincosamide-streptogramin B (MLSB), tetracycline ARGs, as well as multidrug ARGs, increased with exposure to nanoscale polystyrene and tetracycline. (...). The exposure significantly perturbed the the microbial community of *E. crypticus*. (...) After terminating exposure for 14 days, the diversity and abundance of ARGs were not completely restored, while the microbiome was not permanently changed but reversibly impacted.

Accès au document

Trophic transfer of pesticides: The fine line between predator-prey regulation and pesticide-pest regulation

Authors: Baudrot, V, Fernandez-de-Simon, J, Coeurdassier, M, Couval, G, Giraudoux, P, Lambin, X.

Source: J Appl Ecol. (57)4:806-818, 2020, doi: 10.1111/1365-2664.13578

Abstract: Understanding pesticide impacts on populations of target/non-target species and communities is a challenge to applied ecology. When predators that otherwise regulate pest densities ingest prey contaminated with pesticides, this can suppress predator populations by secondary poisoning. It is, however, unknown how species relationships and protocols of treatments (e.g. anticoagulant rodenticide [AR]) interact to affect pest regulation. To tackle this issue, we modelled a heuristic non-spatialized system including montane water voles, specialist vole predators (stoats, weasels) and a generalist predator (red fox) (...) we explored the impact of five farmer functional responses (defined by both AR quantity and threshold vole density above which AR spreading is prohibited) (...).

(...) Keeping vole density below acceptable bounds by spreading AR while maintaining sufficient voles as prey resources led to less AR being applied and extended periods without AR in the environment, benefiting predators while avoiding episodes with high vole density. (...)

(...) Our model reveals the need to maintain refuges with sufficient non-poisoned voles for sustaining specialist mustelids, (...). We suggest that long periods without pesticide treatment are essential to maintain predator populations, and that practices of pesticides use that attempt to permanently suppress a pest over a large scale are counterproductive.

Accès au document

Azoxystrobin dissipation and its effect on soil microbial community structure and function in the presence of chlorothalonil, chlortetracycline and ciprofloxacin

Authors: Han et al.

Source: Env. Poll. 257:113578, 2020, doi: 10.1016/j.envpol.2019.113578

Abstract: The residual characteristics and the adsorption-desorption behaviors of azoxystrobin (AZO) as well as the soil ecological effects in the individual repeated treatments of AZO and its combination with chlorothalonil (CTL), chlortetracycline (CTC) and ciprofloxacin (CIP) were systematically studied in organic manure (OM)-amended soil under laboratory conditions.

CTL, CTC and CIP decreased the adsorption affinity of AZO in soil. The dissipation of AZO was inhibited to different degrees in the combined and repeated treatments with other compounds. Repeated treatments altered soil microbial functional diversity.

Accès au document

Short-term application of mulch, roundup and organic herbicides did not affect soil microbial biomass or bacterial and fungal diversity

Authors: Bottrill et al

Source: Chemosphere 244:125436, 2020, doi: 10.1016/j.chemosphere.2019.125436

Abstract: Application of synthetic herbicides is currently the most widely used and cost-effective methods to assist with revegetation programs. However, the effects of short-term application of various conventional or biological herbicides or alternative strategies on soil microbiological diversity and functions need to be better characterized (...).

Soil microbial biomass was not affected by short-term herbicide application. Bacterial and fungal diversity (illumina sequencing) was not affected by short-term herbicide application. Basiodiomycota had one unidentified class found only in the mulch treatment.

Herbicides may have greater impact with long-term use. (...) We hypothesise that mulching may be a preferred treatment to facilitate weed control in riparian zone revegetation.

Accès au document

A safety type of genetically engineered bacterium that degrades chemical pesticides

Authors: Li Q, Li J, Kang KL, Wu YJ

Source: AMB EXPRESS 10(1), 2020, DOI: 10.1186/s13568-020-00967-y

Abstract: Chemical pesticides are used widely and their residues are found in the environment. Pesticide pollution has become a global problem. To find an economical, effective and safety way to degrade residues of pesticides in environment, we constructed a genetically engineered bacterium (GEB) having the ability to degrade pesticides, emit green fluorescence and has a containment system by using a dual plasmid expression system. One plasmid contains the genes of enhanced green fluorescent protein (EGFP) and carboxylesterase B1 (CarE B1), which were cloned downstream of lambda P-L promoter and expressed constitutively. The gene of CarE B1 encodes an insect-detoxifying enzyme possessing the degradability to organochloride pesticides, organophosphorus pesticides, carbamates, and pyrethoid insecticides. The other is the conditional suicide plasmid for containment system, in which the lethal gene used was the nuclease gene of Serratia marcescens without the leader-coding sequence and was placed downstream of T7 promoter. The GEB has wide prospects of application on cleanup of pesticide residues with its degradability to several pesticides and containment system.

Heavy Metals as a Factor Increasing the Functional Genetic Potential of Bacterial Community for Polycyclic Aromatic Hydrocarbon Biodegradation

Authors: Staninska-Pieta J, Czarny J, Piotrowska-Cyplik A... more

Source: MOLECULES 25(2), 2020, DOI: 10.3390/molecules25020319

Abstract: The bioremediation of areas contaminated with hydrocarbon compounds and heavy metals is challenging due to the synergistic toxic effects of these contaminants. On the other hand, the phenomenon of the induction of microbial secretion of exopolysaccharides (EPS) under the influence of heavy metals may contribute to affect the interaction between hydrophobic hydrocarbons and microbial cells, thus increasing the bioavailability of hydrophobic organic pollutants. The purpose of this study was to analyze the impact of heavy metals on the changes in the metapopulation structure of an environmental consortium, with particular emphasis on the number of copies of orthologous genes involved in exopolysaccharide synthesis pathways and the biodegradation of hydrocarbons. The results of the experiment confirmed that the presence of heavy metals at concentrations of 50 mgL(-1) and 150 mgL(-1) resulted in a decrease in the metabolic activity of the microbial consortium and its biodiversity. Despite this, an increase in the biological degradation rate of polycyclic aromatic hydrocarbons was noted of 17.9% and 16.9%, respectively. An assessment of the estimated number of genes crucial for EPS synthesis and biodegradation of polycyclic aromatic hydrocarbons confirmed the relationship between the activation of EPS synthesis pathways and polyaromatic hydrocarbon biodegradation pathways. It was established that microorganisms that belong to the Burkholderiales order are characterized by a high representation of the analyzed orthologs and high application potential in areas contaminated with heavy metals and hydrocarbons.

Accès au document

Adsorption performance of *Bacillus licheniformis* sp. bacteria isolated from the soil of the Tigris River on mercury in aqueous solutions

Authors: Baran MF, Yildirim A, Acay H... more

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY, 2020, DOI: 10.1080/03067319.2020.1746779

Abstract: Mercury is known to be one of the most toxic heavy metals in the environment and is released into the water systems in significant quantities through natural events and industrial process activities. Many chemical materials are used as adsorbents in the removal of toxic metals from the environment and wastewaters. (…). In this study, Bacillus licheniformis in the soil isolated from the Tigris River was used as bio-sorbent. The mercury (Hg(II)) absorption behaviour of *Bacillus licheniformis* bacteria (BLB) was investigated using inductively coupled plasma mass spectrometry. The effects of equilibrium of adsorption time, temperature, adsorbent dosage and pH on the adsorption of Hg (II) onto BLB were determined. The maximum adsorption capacity of Hg (II) onto BLB was determined as 82.12 mg/g (T = 25 degrees C, pH 5, Co = 50 mg/L, m = 25 mg). The BLB was characterised using Fourier transform infrared spectroscopy analysis, thermal gravimetric analysis/differential thermal analysis, scanning electron microscopy analysis and energy-dispersive X-ray spectroscopy analysis. In addition, pseudo-first-order and pseudo-second-order kinetic models were applied. The equilibrium data for the adsorption of Hg(II) onto BLB were examined by the Langmuir and Freundlich isotherm models. The activation energy was calculated using the pseudo-second-order rate constant. These results suggested the BLB can be used as an efficient adsorbent for the removal of Hg(II) metal ions from wastewater. When the results of bio-sorption studies were examined, it was found that the bio-sorbent could be reused easily. The present study suggests that microorganism bio-sorbents are useful for the efficient removal of mercury from aqueous solutions.

Accès au document

Biochar and bacteria inoculated biochar enhanced Cd and Cu immobilization and enzymatic activity in a polluted soil

Authors: Tu C, Wei J, Guan F, Liu Y... more

Source: ENVIRONMENT INTERNATIONAL,137, 2020, DOI: 10.1016/j.envint.2020.105576

Abstract: The application of biochar in the remediation of heavy metal contaminated soil has received increasing global attention during the past decade. Although there has been some review work on the mechanism of heavy metals stabilization by biochar, the effects and mechanisms of interaction between biochar and functional microbes such as heavy metal tolerant, adsorption and transformation microbial strains remains unclear. In this paper, maize biochar and a heavy metal-tolerant strain *Pseudomonas* sp. NT-2 were selected to investigate the dynamic effects and potential mechanisms of biochar and bacteria loaded biochar on the stabilization of Cd and Cu mixed contaminated soil by a 75-day pot experiment. The results showed that, compared to the single biochar amendment, the application of biochar inoculated with NT-2 strain at the rate of 5% significantly increased the soil pH at the initial stage of incubation, and followed by a slight decline to a neutral-alkaline range during the reaction. The addition of NT-2 loaded biochar could also significantly increase the proportion of residual fraction of Cd and Cu, thus reduce the proportion of exchangeable and carbonate bound species in the soil, which lead to the decreasing of plant and human bioavailability of the metal in the soil indicated by DTPA and simulated human gastric solution extraction (UBM), respectively. Finally, the application of bacterial loaded biochar also markedly enhanced soil urease and catalase activities during the later stage of the incubation, and improved soil microbial community at the end of incubation, which indicates a recovery of soil function after the metal stabilization. The research results may provide some new insights into the development of functional materials and technologies for the green and sustainable remediation of heavy metal contaminated soil by the combination of biochar and functional microorganisms.

Accès au document

Bacterial response to sharp geochemical gradients caused by acid mine drainage intrusion in a terrace: Relevance of C, N, and S cycling and metal resistance

Authors: Sun WM, Sun XX, Li BQ... more

Source: ENVIRONMENT INTERNATIONAL 138, 2020, DOI: 10.1016/j.envint.2020.105601

Abstract: A unique terrace with sharp gradient of environmental conditions was selected to study the microbial response and survival strategies to the extreme environments introduced by acid mine drainage (AMD) contamination. A combination of geochemical analyses, metagenomic sequencing, ex-situ microcosm setups, and statistical analyses were used to investigate the environment-microbe interactions. The microbial communities and metabolic potentials along the terrace were studied by focusing on the genes associated with important biogeochemical processes (i.e., C, N, S cycling and metal resistance). Results show that the variations of geochemical parameters substantially shaped the indigenous microbial communities. Sharp environmental gradients also impacted the microbial metabolic potentials, especially for C, N, and S cycling. Although the relative abundances of carbon fixing genes did not significantly vary along the environmental gradients, the taxa for carbon fixation varied significantly in more contaminated fields versus less contaminated fields, indicating the effects of AMD contamination on the autotrophic microbial communities. AMD input also influenced the N cycling, especially for nitrogen fixation and dissimilatory nitrate reduction to ammonium (DNRA). In addition, ex situ experiments were undertaken to evaluate the effects of AMD contamination on nitrogen fixation rates. Random Forest (RF) analysis indicated that nitrate, pH, total N, TOC exhibited positive correlations with the rates of nitrogen fixation while total Fe, Fe(III), and sulfate showed negative effects. Two co-occurrence networks at taxonomic and genomic levels indicated that geochemical parameters such as pH, TOC, total N, total S, and total Fe substantially influenced the innate microbial communities and their metabolic potentials. The current study provides an understanding for microbial response to AMD

contamination and lays the foundation for future potential AMD bioremediation.

Accès au document

Comparative assessment of polymeric and other nanoparticles impacts on soil microbial and biochemical properties

Authors: Xin XP, Zhao FL, Zhao HM... more

Source: GEODERMA 367, 2020, DOI: 10.1016/j.geoderma.2020.114278

Abstract: Interest has been generated in nanotechnology application in agricultural and food systems and understanding ecotoxicity of nanoparticles (NPs) is imperative for ecosystem health and food safety. This study compared the dose-effects of newly synthesized polysuccinimide NPs (PSI-NPs) with mull-walled carbon nanotubes (MWCNTs), nano-Ag and nano-TiO2, on soil microbiological and biochemical processes. The effects of NPs varied largely with the type and dose of NPs as well as soil properties. Of the tested NPs, PSI-NPs had no significant perturbance, while the rest of NPs decreased microbial biomass C and N (MBC and MBN), stimulated the microbial metabolic quotient (MMQ), and inhibited dehydrogenase (DA), urease (UA), and phosphatase (PA) activities. Significant dose-effects of MWCNTs, nano-Ag and nano-TiO2 occurred, and the influences were more intensive at higher application rate (500 ppm). Irrespective of NP type and dose, the effects were severer in Spodosol soil than Alfisol soil. Principle component analysis (PCA) also confirmed that most of the measured indicators were not affected by PSI-NPs, partly affected by MWCNTs, but intensively influenced by nano-Ag and nano-TiO2. These results highlight the advantages of PSI-NPs over the other NPs for agricultural applications and could facilitate the development of guidelines in regulating NPs application in agroecosystems.

Accès au document

Potency of Phlebia species of white rot fungi for the aerobic degradation, transformation and mineralization of lindane

Authors: Xiao PF, Kondo R

Source: JOURNAL OF MICROBIOLOGY, 2020, DOI: 10.1007/s12275-020-9492-x

Abstract: The widespread use of the organochlorine insecticide lindane in the world has caused serious environmental problems. The main purpose of this paper is to investigate the potency of several Phlebia species of white rot fungi to degrade, transform and mineralize lindane, and to provide the feasibility of using white rot fungi for bioremediation at contaminated sites. Based on tolerance experiment results, Phlebia brevispora and Phlebia lindtneri had the highest tolerance to lindane and were screened by degradation tests. After 25 days of incubation, P. brevispora and P. lindtneri degraded 87.2 and 73.3% of lindane in low nitrogen medium and 75.8 and 64.9% of lindane in high nitrogen medium, respectively. Several unreported hydroxylation metabolites, including monohydroxylated, dehydroxylated, and trihydroxylated products, were detected and identified by GC/MS as metabolites of lindane. More than 10% of [C-14] lindane was mineralized to (CO2)-C-14 by two fungi after 60 days of incubation, and the mineralization was slightly promoted by the addition of glucose. Additionally, the degradation of lindane and the formation of metabolites were efficiently inhibited by piperonyl butoxide, demonstrating that cytochrome P450 enzymes are involved in the fungal transformation of lindane. The present study showed that P. brevispora and P. lindtneri were efficient degraders of lindane; hence, they can be applied in the bioremediation process of lindane-contaminated sites.

Accès au document

Integration of earthworms and arbuscular mycorrhizal fungi into phytoremediation of cadmium-contaminated soil by *Solanum nigrum* L

Authors: Wang G, Wang L, Ma F, You YQ... more

Source: JOURNAL OF HAZARDOUS MATERIALS 389, 2020, DOI: 10.1016/j.jhazmat.2019.121873

Abstract: Arbuscular mycorrhizal fungi (AMF) and earthworms independently enhance plant growth, heavy metal (HM) tolerance, and HM uptake, thus they are potential key factors in phytoremediation. However, few studies have investigated their interactions in HM phytoextraction by hyperaccumulators. This study highlights the independent and interactive effects of earthworms and AMF on Solanum nigrum. Plants inoculated with either AMF or earthworms exhibited ameliorated growth via enhancement of productivity, metal tolerance, and phosphorus (P) acquisition. Co-inoculation with both had more pronounced effects on plant biomass and P acquisition in shoots, but not in roots, and in Cd-polluted soils it significantly promoted ($P < 0.05$) shoot biomass (20.7-134.6 %) and P content (20.4-112.0 %). AMF and earthworms increased Cd accumulation in plant tissues, but only AMF affected Cd partitioning between shoots and roots. Although AMF decreased root-to-shoot translocation of Cd at high Cd levels, this was counterbalanced by earthworms. Both AMF and its combination with earthworms enhanced Cd phytoavailability by altering Cd chemical fractions and decreasing pH. Co-inoculation increased Cd removal amounts up to 149.3 % in 120 mg kg(-1) Cd-spiked soils. Interactions between the two organisms were synergistic in Cd phytoextraction. Thus, earthworm-AMF-plant symbiosis potentially plays an essential role in phytoremediation of HM-polluted soils.

Accès au document

Evaluation of seven chemical pesticides by mixed microbial culture (PCS-1): Degradation ability, microbial community, and *Medicago sativa* phytotoxicity

Authors: Li HY, Qiu YZ, Yao T... more

Source: JOURNAL OF HAZARDOUS MATERIALS 389, 2020, DOI: 10.1016/j.jhazmat.2019.121834

Abstract: Environmental problems caused by the large-scale use of chemical pesticides are becoming more and more serious, and the removal of chemical pesticides from the ecological environment by microbial degradation has attracted wide attention. In this study, using enrichment screening with seven chemical pesticides as the sole carbon source, a mixed microbial culture (PCS-1) was obtained from the continuous cropping of strawberry fields. The microbial community composition, degradation ability, and detoxification effect of PCS-1 was determined for the seven pesticides. Inoculation with PCS-1 showed significant degradation of and tolerance to the seven pesticides. Microbial community composition analysis indicated that Pseudomonas, Enterobacter, Aspergillus, and Rhodotorula were the dominant genera for the degradation of the seven pesticides by PCS-1. The concentration of the seven pesticides was 10 mg L-1 in hydroponic and soil culture experiments. The fresh weight, plant height, and root length of PCS-1-inoculated alfalfa (*Medicago sativa*) significantly increased compared with those of non-PCS-1-inoculated M. sativa. PCS-1 not only effectively degraded the residual content of the seven pesticides in water and soil but also reduced the pesticide residues in the roots, stems, and leaves of *M. sativa*. This study shows that PCS-1 may be important in environmental remediation involving the seven pesticides.

Accès au document

Design of Bacterial Strain-Specific qPCR Assays Using NGS Data and Publicly Available Resources and Its Application to Track Biocontrol Strains

Authors: Hernandez I, Sant C, Martinez R, Fernandez C

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.00208

Abstract: Biological control is emerging as a feasible alternative to chemical pesticides in agriculture. Measuring the microbial biocontrol agent (mBCA) populations in the environment is essential for an accurate environmental and health risk assessment and for optimizing the usage of an mBCA-based plant protection product. We hereby show a workflow to obtain a large number of qPCR markers suitable for robust strain-specific quantification. The workflow starts from whole genome sequencing data and consists of four stages: (i) identifying the strain-specific sequences, (ii) designing specific primer/probe sets for qPCR, and (iii) empirically verifying the performance of the assays. The first two stages involve exclusively computer work, but they are intended for researchers with little or no bioinformatic background: Only a knowledge of the BLAST suite tools and work with spreadsheets are required; a familiarity with the Galaxy environment and next-generation sequencing concepts are strongly advised. All bioinformatic work can be implemented using publicly available resources and a regular desktop computer (no matter the operating system) connected to the Internet. The workflow was tested with five bacterial strains from four different genera under development as mBCAs and yielded thousands of candidate markers and a triplex qPCR assay for each candidate mBCA. The qPCR assays were successfully tested in soils of different natures, water from different sources, and with samples from different plant tissues. The mBCA detection limits and population dynamics in the different matrices are similar to those in qPCR assays designed by other means. In summary, a new accessible, cost-effective, and robust workflow to obtain a large number of strain-specific qPCR markers is presented.

Accès au document

Long-term application of Swedish sewage sludge on farmland does not cause clear changes in the soil bacterial resistome

Authors: Rutgersson C, Ebmeyer S, Lassen SB... more

Source: ENVIRONMENT INTERNATIONAL 137, 2020, DOI: 10.1016/j.envint.2019.105339

Abstract: The widespread practice of applying sewage sludge to arable land makes use of nutrients indispensable for crops and reduces the need for inorganic fertilizer, however this application also provides a potential route for human exposure to chemical contaminants and microbial pathogens in the sludge. A recent concern is that such practice could promote environmental selection and dissemination of antibiotic resistant bacteria or resistance genes. Understanding the risks of sludge amendment in relation to antibiotic resistance development is important for sustainable agriculture, waste treatment and infectious disease management. To assess such risks, we took advantage of an agricultural field trial in southern Sweden, where land used for growing different crops has been amended with sludge every four years since 1981. We sampled raw, semi-digested and digested and stored sludge together with soils from the experimental plots before and two weeks after the most recent amendment in 2017. Levels of selected antimicrobials and bioavailable metals were determined and microbial effects were evaluated using both culture-independent metagenome sequencing and conventional culturing. Antimicrobials or bioavailable metals (Cu and Zn) did not accumulate to levels of concern for environmental selection of antibiotic resistance, and no coherent signs, neither on short or long time scales, of enrichment of antibiotic-resistant bacteria or resistance genes were found in soils amended with digested and stored sewage sludge in doses up to 12 metric tons per hectare. Likewise, only very few and slight differences in microbial community composition were observed after sludge amendment. Taken together, the current study does not indicate risks of sludge amendment related to antibiotic resistance development under the given conditions. Extrapolations should however be done with care as sludge quality and application practices vary between regions. Hence, the antibiotic concentrations and resistance load of the sludge are likely to be higher in regions with larger antibiotic consumption and resistance burden than Sweden.

Microbial Degradation of Plastic in Aqueous Solutions Demonstrated by CO2 Evolution and Quantification

Authors: Rose RS, Richardson KH, Latvanen EJ…

Source: INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES 21(4), 2020, DOI: 10.3390/ijms21041176

Abstract: The environmental accumulation of plastics worldwide is a consequence of the durability of the material. Alternative polymers, marketed as biodegradable, present a potential solution to mitigate their ecological damage. However, understanding of biodegradability has been hindered by a lack of reproducible testing methods. We developed a novel method to evaluate the biodegradability of plastic samples based on the monitoring of bacterial respiration in aqueous media via the quantification of CO2 produced, where the only carbon source available is from the polymer. *Rhodococcus rhodochrous* and *Alcanivorax borkumensis* were used as model organisms for soil and marine systems, respectively. Our results demonstrate that this approach is reproducible and can be used with a variety of plastics, allowing comparison of the relative biodegradability of the different materials. In the case of low-density polyethylene, the study demonstrated a clear correlation between the molecular weight of the sample and CO2 released, taken as a measure of biodegradability.

Accès au document

Effect of cadmium contamination on the rhizosphere bacterial diversity of *Echinocactus platyacanthus*

Authors: Carabali MMS, Garcia-Oliva F, Paez LEC, Lopez-Lozano NE

Source: RHIZOSPHERE 13, 2020, DOI: 10.1016/j.rhisph.2020.100187

Abstract: To better understand the mechanism of tolerance to heavy metals, it is relevant to analyze the effects of Cd contamination on the rhizospheric microbiota of plants with high tolerance to environmental stress such as cacti species. In this work, the effects of soil contamination with Cd on bacterial diversity, microbial carbon, abundance of diazotrophs in the soil, and on the photosynthetic efficiency and absorption of Cd of the candy barrel cactus (Echinocactus platyacanthus) were evaluated. Experimental pots sown with E. platyacanthus were contaminated with different concentrations of Cd+2. Changes in rhizospheric soil community were evaluated after 30 days of contamination. In general, soil contamination with Cd significantly changes the structure of the rizospheric bacterial community which could have serious effects on the functioning of this community, especially in N mobilization. Despite the plant not showing signs of physiological stress reflected in the photosynthetic yield, revealing its high resistance to contamination with Cd, a slight increase in the electron transport rate at low Cd concentration was observed. This increase correlates with an increase in abundance of diazotrophs and microbial C, suggesting an interesting response by the entire system to the presence of low Cd concentration in the soil. In this work, we have demonstrated that the factors analyzed here can be indicators of the quality and health of the soil, being a complement to explaining the behavior of metals in the soil matrix, and thus be able to understand the mechanism of tolerance to Cd contamination in soil.

Accès au document

A new assay of bacterial selection with Pb reveals an unexpected effect of Pb on bacterial behavior: implications for remediation

Authors: Bouquet D, Lepinay A, Gaudin P, Jean-Soro L, Le Guern C, Lichtfouse E, Lebeau T

Source: ENVIRONMENTAL CHEMISTRY LETTERS, 2020, DOI: 10.1007/s10311-020-00986-y

Abstract: Soil pollution by lead (Pb) is a major health concern due to Pb toxicity. Phytoextraction could remove Pb, but this technique is limited by the low Pb mobility in soils. Pb mobility can be increased by bioaugmentation, which consists in adding selected bacteria in soil to increase Pb bioavailability. Nonetheless, many

bioaugmentation and phytoextraction experiments have failed because bacterial selections did not take into account the presence of metals. Therefore, we developed a microplate assay with Pb-enriched growth media for the rapid selection of bacterial strains. Selection criteria included the ability of bacteria to grow in soils, to promote plant growth and to increase Pb availability. Results show that 100-250 mu M Pb induced a decrease of production of indole acetic acid (IAA), a plant growth promotor, by up to 49% for *Cupriavidus metallidurans*, compared to the control without Pb. This finding implies that application in real soil conditions with *C. metallidurans* would have probably failed, thus strengthening the value of our selection method in the presence of Pb. By contrast, 100-250 mu M Pb induced a 8.5-11-fold higher degradation of aminocyclopropane carboxylic acid (ACC) by *C. metallidurans*. Surprisingly, *Pseudomonas putida* did not degrade ACC without Pb, but degraded ACC at 100-250 mu M Pb. This observation means that Pb activates ACC degradation, which should reduce plant stress because ACC is the precursor of the ethylene phytohormone. Overall, our selection method in the presence of Pb allows to reveal new bacterial properties, which would not have been disclosed by current methods that do not take into account the effect of metals. Our method allows also to test simultaneously about 200 bacterial isolates. In addition, our findings show for the first time that Pb changes the production of IAA and the degradation of ACC.

Accès au document

Cadmium Pollution Impact on the Bacterial Community of Haplic Cambisols in Northeast China and Inference of Resistant Genera

Authors: Duan CW, Liu Y, Zhang HG, Chen GY, Song, JF

Source: JOURNAL OF SOIL SCIENCE AND PLANT NUTRITION, 2020, DOI: 10.1007/s42729-020-00201-5

Abstract: Modern industry and agriculture has aggravated heavy metal pollution of soils, of which cadmium (Cd) is among the common most toxic and widely distributed pollutants. Bacteria are a major group of microorganisms and the most abundantly occurring in soils. In Northeastern China, many mining sites occur whose soils need reclamation and Cd pollution has commonly existed. Haplic Cambisols is the zonal forest soil here. Yet, how Cd contamination may affect the bacterial characteristics and chemical properties of Haplic Cambisols is still unknown. Here, we applied different concentrations of Cd contamination to Haplic Cambisols and monitored the resulting changes to bacterial community structure and diversity, as well as the general soil environments; we then inferred Cd-resistant bacteria to provide theoretical support for microbial remediation of Cd-contaminated Haplic Cambisols in Northeast China. Haplic Cambisols were treated with different concentrations of CdCl2 solutions (0 [CK], 1, 5, 25, 50, 75, 100 mg kg(-1), respectively expressed as T1, T2, T3, T4, T5, and T6) and incubated for 50 days, and then bacterial community composition was identified, and the pH, organic matter, hydrolytic nitrogen, available phosphorus, potassium, and cadmium contents of the soils were measured. Adding higher concentrations of Cd usually significantly increased the richness and diversity of the bacterial community in Haplic Cambisols in terms of both species and abundance with the effects of some treatments being not significant, and this effect varied with Cd concentration. Applying Cd significantly influenced the bacterial community's structure and its metabolic functioning. Cd also influenced bacterial diversity via several key soil environmental factors, namely the pH, organic matter, and hydrolytic nitrogen contents. Pseudolabrys, Ralstonia, Reyranella, Afipia, Pelomonas, Rhizomicrobium, and Bradyrhizobium within Proteobacteria; Rhodanobacter from Bacteroidetes; and Nitrobacter within Nitrospirae were the main resistant bacteria. Higher concentrations of Cd increased the bacterial community richness and diversity of Haplic Cambisols, as well as the relative abundance of their main bacterial populations. The Cd-resistant genera were inferred, and relative abundances of Ralstonia, Bradyrhizobium, Rhizomicrobium, and Afipia were the highest.

Accès au document

Bacteria affect Sb(III, V) adsorption and oxidation on birnessite

Authors: Du HH, Tao J, Yang RJ, Lei M, Tie BQ... more

Source: JOURNAL OF SOILS AND SEDIMENTS, 2020, DOI: 10.1007/s11368-020-02607-1

Abstract: Purpose The adsorption-oxidation of Sb on manganese oxide plays an important role in controlling Sb mobility and fate in soils and sediments. Widespread organic substances such as microbes may greatly affect this process, and deserve a careful investigation. This study examines the adsorption and oxidation of Sb(III, V) on birnessite, a typical manganese oxide, with and without Bacillus cereus cells. Materials and methods Adsorption isotherms were conducted to explore the adsorption capacity of Sb to the birnessite-bacteria composite. X-ray photoelectron spectroscopy (XPS) was applied to determine the valence state of Mn and the adsorbed Sb species. Results and discussion The SEM results show that birnessite adheres to the outer surface of bacterial cells, and the aggregation of minerals occurs to a lesser extent in the presence of cells. Batch adsorption results show a much larger Sb adsorption on individual birnessite than on bacteria, and the measured Sb adsorption to the birnessite-bacteria composite is larger than that predicted assuming additive, i.e., the sum of the end-member metal adsorptivities. On birnessite, Sb(III) is predominately oxidized to Sb(V) according to the XPS analysis, and the presence of bacteria hinders this oxidation reaction. Conclusions We propose that microbe-birnessite association favors the immobilization of Sb on solid phases, but can inhibit the oxidation of Sb(III) to Sb(V), which is of great significance for evaluating the toxicity, bio-availability, and mobility of Sb in both natural and contaminated environments.

Accès au document

Physiological responses of *Morus alba* L. in heavy metal(loid)-contaminated soil and its associated improvement of the microbial diversity

Authors: Zeng P, Huang FL, Guo ZH, Xiao XY, Peng C

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4): 4294-4308, 2020, DOI: 10.1007/s11356-019-07124-4

Abstract: Woody plants have considerable application potential in the phytoremediation schemes, owing to their long-lived large biomass and prosperous root systems in heavy metal(loid)-contaminated soil. Under greenhouse conditions, the physiological response characteristics and phytoremediation possibility of Morus alba L. and its associated improvement of the bacterial and arbuscular mycorrhizal fungal (AMF) diversities in heavy metal(loid) co-contaminated soils were investigated. The results showed that the cultivated *M. alba* L. plant exhibited significant tolerance against the heavy metal(loid)s in co-contaminated soil and that the microbial diversities were improved notably. The contents of malondialdehyde (MDA) in *M. alba* L. leaves decreased with cultivation from 90 to 270 days, while the superoxide dismutase, peroxidase and catalase activities were maintained at normal levels to eliminate the production of lipid peroxides. The chemical compositions (e.g. amino acids, carbohydrates and proteins) in the root of *M. alba* L. fluctuated slightly throughout the cultivation period. Meanwhile, Cd, Pb and Zn weremajorly concentrated in the *M. alba* L. roots, and the maximum contents were 23.4, 7.40 and 615.5 mg/kg, respectively. According to the polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) analysis results, the influence of *M. alba* L. on the rhizosphere AMF community was greater than that on the bacteria community. Meanwhile, the bacterial and AMF Shannon diversity indexes in the contaminated soil were enhanced by 18.7-22.0% and 7.14-16.4%, respectively, with the presence of *M. alba* L. Furthermore, the correlations between the availability of As, Cd, Pb, and Zn and Shannon diversity indexes of the bacterial and AMF communities were significantly (p < 0.05) positive with the phytoremediation of *M. alba* L.

Therefore, *M. alba* L. can be suggested as a potential plant candidate for ecological remediation and for simultaneously improving the activity and diversity of microorganisms in contaminated soils.

Accès au document

Impacts of antimony and arsenic co-contamination on the river sedimentary microbial community in an antimony-contaminated river

Authors: Xu R, Sun XX, Han F, Li BQ... more

Source: SCIENCE OF THE TOTAL ENVIRONMENT 713, 2020, DOI: 10.1016/j.scitotenv.2019.136451

Abstract: Antimony (Sb) and arsenic (As) are toxic elements that occur widely in trace soil concentrations. Expansion of mining activities has increased Sb and As pollution, thus posing a severe threat to human welfare and ecological systems worldwide. Know ledge regarding the composition and adaptation of the microbial communities in these metal(loid) contaminated sites is still limited. In the current study, samples along a river flowing through the world's largest Sb mining area (Xikuangshan) were selected to investigate the microbial response to different Sb or As species. A comprehensive analysis of geochemical parameters, high-throughput sequencing, and statistical methods were applied to reveal the different effects of Sb and As on sedimentary microorganisms. Results suggested that the majority of the Sb and As fractions were not bioavailable. The Sb extractable fraction had a stronger effect on the microbial community compared with its As counterpart. Random forest analyses indicated that the easily exchangeable Sb fraction and specifically sorbed surface-bound fraction were the two most selective variables shaping microbial community diversity. A total of 11 potential keystone phyla, such as bacteria associated with the Bacteroidetes, Proteobacteria, and Firmicutes, were identified according to a molecular ecological network analysis. Strong correlations (vertical bar $R > 0.7$, $P < 0.05$) were identified among the indigenous microbial community and pH (negative), sulfate (negative), and exchangeable Sb fraction (positive). Bacteria associated with the genera Geobacter, Phormidium, Ignavibacterium, Desulfobulbus, Ferruginibacter, Fluviicola, Methylotenera, and Scytonema, were predicted to tolerate or metabolize the Sb extractable fraction.

Accès au document

Sub-Arctic Field Degradation of Metsulfuron-Methyl in Two Alaskan Soils and Microbial Community Composition Effects

Authors: Tomco PL, Seefeldt SS, Rodriguez-Baisi K, Hatton JJ, Duddleston KN

Source: WATER AIR AND SOIL POLLUTION 231:4, 2020, DOI: 10.1007/s11270-020-04528-8

Abstract: Metsulfuron-methyl is a sulfonylurea herbicide, primarily with postemergence activity but also with occasional pre-emergent activity, used for control of weeds and woody plants on agricultural lands and natural areas. The active ingredient is popular in Alaska as Ally XP formulation; little is known about its high-latitude environmental behavior and potential adverse impacts on soil health in cold regions. Our study determined field degradation rates at two experimental farms in Alaska and assessed whether laboratory-incubated soil amended at 1x or 100x label rates would adversely impact microbial community diversity. DT50 was observed at 4.12-5.13 days, with the compound below 1 µg/kg detection limit at 90 days. Interestingly, this is faster than the reported range of field half-lives in the literature (7-42 days). Microbial community composition was not affected by MSM at both 1x and 100x rates. High-latitude regions exhibit extreme summer photoperiods that may exacerbate the MSM degradation/dissipation rate; we postulate that timing of application may have large impacts on MSM attenuation.

Accès au document

Influence of multi-walled carbon nanotubes on the microbial biomass, enzyme activity, and bacterial community structure in 2,4-dichlorophenol-contaminated sediment

Authors: Song B, Gong JL, Tang WW... more

Source: SCIENCE OF THE TOTAL ENVIRONMENT 713, 2020, DOI: 10.1016/j.scitotenv.2020.136645

Abstract: The rise in manufacture and use of carbon nanotubes has aroused the concern about their potential risks associated with coexisting pollutants in the aquatic environment. 2,4-dichlorophenol (2,4-DCP), with a high toxicity to many aquatic organisms, is a widespread pollutant resulting from the extensive use of pesticides and preservatives. In this article, the adsorption of 2,4-DCP by riverine sediment and the responses of sediment microbial community to 2,4-DCP were studied in the presence of multi-walled carbon nanotubes (MWCNTs). Adding MWCNTs significantly increased the adsorption amount of sediment for 2,4-DCP from 0.541 to 1.44 mg/g as the MWCNT concentration increased from 0 to 15 mg/g. The responses of sediment microbial community were determined after one-month exposure to MWCNTs at different concentrations (0.05,0.5, 5, and 50 mg/g). The microbial biomass carbon in the sediment contaminated with 2,4-DCP increased in the presence of 5 mg/g of MWCNTs (from 0.06 to 0.11 mg/g), but not significantly changed at other MWCNT concentrations. For the sediments contaminated with 2,4-DCP, the presence of MWCNTs made no difference to urease activity, while the dehydrogenase activity slightly increased with the addition of 5 mg/g of MWCNTs and decreased in the presence of 50 mg/g of MWCNTs. The changes of sediment bacterial communities were further determined by 16S rRNA gene sequencing. Based on the weighted UniFrac distance between communities, the clustering analysis suggested that the contamination of 2,4-DCP affected the bacterial community structure in a greater degree than that caused by MWCNTs at relatively low concentrations (<= 5 mg/g). Bacteroidetes, Planctomycetes, and Nitrospirae were feature bacterial phyla to reflect the effects of MWCNTs and 2,4-DCP on sediment bacterial community. These results may contribute to the understanding of microbial community response to co-exposure of MWCNTs and 2,4-DCP and the assessment of associated ecological risks.

Accès au document

Effects of electron donors on the degradation of hexachlorocyclohexane and microbial community in submerged soils

Authors: Zhao Y, Zhang Y, Wang J, Hou JY... more

Source: JOURNAL OF SOILS AND SEDIMENTS 20(4):2155-2165, 2020, DOI: 10.1007/s11368-020-02593-4

Abstract: Purpose Hexachlorocyclohexane (HCH) is a pesticide that is persistent in aerobic but not in anaerobic conditions. The aim of this investigation was to elucidate the impacts of different electron donors on the degradation of hexachlorocyclohexane and their relationships with the microbial community in submerged soils. Materials and methods Soil samples were collected from a pesticides-polluted site which was previously used for long-term storage of pesticides since the 1960s. Residual amounts of HCHs in submerged soils were assessed to evaluate the efficiency of the added electron donors after incubation. Changes in microbial community were monitored during incubation. Results and discussion The efficiencies of removal of HCHs by Fe-0, Fe-0 + straw and glucose treatments were 63.8%, 40.3%, and 22.0%, compared with 5.4% by the control. Soil redox potential decreased rapidly following addition of Fe-0 and became anaerobic, but there was no significant decrease in redox potential following the addition of glucose. Principal coordinates analysis (PCoA) confirms that the electron donors greatly affected the soil bacterial community. Furthermore, community composition analysis shows that Firmicutes was the dominant phylum after addition of carbon sources (straw and glucose) but Proteobacteria were dominant in the control and the Fe-0 treatment. Prauserella, Actinobacteria, and Streptomyces showed highly significant increases in the Fe-0 treatment and were positively correlated with total HCH residues. Conclusions These findings indicate that the addition of organic materials (straw and

glucose) had a gradual effect on the degradation of HCH while Fe-0 acted rapidly. Elucidation of the relationships between electron donors and soil microbial communities will help in the bioremediation of HCH-contaminated sites.

Accès au document

Pesticide application inhibit the microbial carbonic anhydrase-mediated carbon sequestration in a soil microcosm

Authors: Nathan VK, Jasna V, Parvathi A

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):4468-4477, 2020, DOI: 10.1007/s11356-019-06503-1

Abstract: Heterotrophic system for carbon sequestration is gaining importance in the recent decades. Carbonic anhydrase (CA) is a major enzyme involved in carbon sequestration and biomineralization process. In this paper, we evaluate the effect of pesticide on CA activity using inhibitory assay. 2,4-D, being one of the most extensively used pesticide, being deleterious to soil health, its usage should be minimized to regain the soil health. Maximum inhibitory constant (K-i) was observed for 5% 2,4-D (49.53 mM) followed by 5% glyphosate (43.92 mM). The maximum Km increase with increase in pesticide concentration by 3.05-fold was in case of glyphosate which was higher than that of 2,4-D (2.08-fold) and dichlorvos (2.38-fold). Moreover, we evaluated the carbon sequestration using CA enzyme in the soil microcosm. In the present study, we identified the negative impact of 2,4-D on carbonic anhydrase produced by *Bacillus halodurans* PO15. The inhibition was a mixed type and had significantly lowered the carbon reduction to about 2.38 +/- 0.17% in a soil microcosm study. Based on the molecular docking, the inhibition was contributed due to weak H-bonding interaction with amino acid residues (Gly65, Gly95, Val147, Ser150 and Gly65, Ser146, and Ser150).

Accès au document

Challenges with Verifying Microbial Degradation of Polyethylene

Authors: Montazer Z, Najafi MBH, Levin DB

Source: POLYMERS 12(1), 2020, DOI: 10.3390/polym12010123

Abstract: Polyethylene (PE) is the most abundant synthetic, petroleum-based plastic materials produced globally, and one of the most resistant to biodegradation, resulting in massive accumulation in the environment. Although the microbial degradation of polyethylene has been reported, complete biodegradation of polyethylene has not been achieved, and rapid degradation of polyethylene under ambient conditions in the environment is still not feasible. Experiments reported in the literature suffer from a number of limitations, and conclusive evidence for the complete biodegradation of polyethylene by microorganisms has been elusive. These limitations include the lack of a working definition for the biodegradation of polyethylene that can lead to testable hypotheses, a non-uniform description of experimental conditions used, and variations in the type(s) of polyethylene used, leading to a profound limitation in our understanding of the processes and mechanisms involved in the microbial degradation of polyethylene. The objective of this review is to outline the challenges in polyethylene degradation experiments and clarify the parameters required to achieve polyethylene biodegradation. This review emphasizes the necessity of developing a biochemically-based definition for the biodegradation of polyethylene (and other synthetic plastics) to simplify the comparison of results of experiments focused for the microbial degradation of polyethylene.

Accès au document

Phytostabilization of Polluted Military Soil Supported by Bioaugmentation with PGP-Trace Element Tolerant Bacteria Isolated from *Helianthus petiolaris*

Authors: Saran A, Imperato V, Fernandez L, Gkorezis, P… more

Source: AGRONOMY-BASEL 10(2), 2020, DOI: 10.3390/agronomy10020204

Abstract: Lead (Pb) and cadmium (Cd) are major environmental pollutants, and the accumulation of these elements in soils and plants is of great concern in agricultural production due to their toxic effects on crop growth. Also, these elements can enter into the food chain and severely affect human and animal health. Bioaugmentation with plant growth-promoting bacteria (PGPB) can contribute to an environmentally friendly and effective remediation approach by improving plant survival and promoting element phytostabilization or extraction under such harsh conditions. We isolated and characterised Pb and Cd-tolerant root-associated bacteria from *Helianthus petiolaris* growing on a Pb/Cd polluted soil in order to compose inoculants that can promote plant growth and also ameliorate the phytostabilization or phytoextraction efficiency. One hundred and five trace element-tolerant rhizospheric and endophytic bacterial strains belonging to eight different genera were isolated from the aromatic plant species Helianthus petiolaris. Most of the strains showed multiple PGP-capabilities, ability to immobilise trace elements on their cell wall, and promotion of seed germination. *Bacillus paramycoides* ST9, *Bacillus wiedmannii* ST29, *Bacillus proteolyticus* ST89, *Brevibacterium frigoritolerans* ST30, *Cellulosimicrobium cellulans* ST54 and *Methylobacterium* sp. ST85 were selected to perform bioaugmentation assays in greenhouse microcosms. After 2 months, seedlings of sunflower (*H. annuus*) grown on polluted soil and inoculated with *B. proteolyticus* ST89 produced 40% more biomass compared to the non-inoculated control plants and accumulated 20 % less Pb and 40% less Cd in the aboveground plant parts. In contrast, B. paramycoides ST9 increased the bioaccumulation factor (BAF) of Pb three times and of Cd six times without inhibiting plant growth. Our results indicate that, depending on the strain, bioaugmentation with specific beneficial bacteria can improve plant growth and either reduce trace element mobility or enhance plant trace element uptake.

Accès au document

Sulfate-reducing bacteria (SRB) can enhance the uptake of silver-containing nanoparticles by a wetland plant

Authors: Niu ZS, Yang Y, Tou FY, Guo XP... more

Source: ENVIRONMENTAL SCIENCE-NANO 7(3):912-92), 2020, DOI: 10.1039/c9en01162e

Abstract: The presence of sulfate-reducing bacteria (SRB) can reduce the bioavailability of toxic metal ions (e.g., Ag+) to plants via mediating the formation of metal sulfide precipitates; however, it remains largely elusive if SRB can also affect the phyto-uptake of metal nanoparticles (e.g., Ag-0-NPs). In the current study, the bioavailability of Ag-0-NPs to a model wetland plant, *Scirpus triqueter*, was investigated in the presence/absence of SRB. Comparative experiments were conducted using 0.01-10 mg L-1 Ag-0-NPs and silver ions. In addition to quantifying the total dissolved Ag concentrations, we analyzed the average sizes and particle concentrations of Ag-containing NPs (Ag-NPs) in plant tissues, including both roots and stems, after the designated treatments. The results show that although the presence of SRB can reduce the uptake of total Ag by 37% during the exposure of the plant to Ag ions, it can significantly enhance the uptake of total Ag during exposure of the plant to Ag-0-NPs, likely by transforming Ag-0-NPs into Ag-sulfide NPs with smaller particle sizes. Transmission electron microscopy data revealed that biogenic secondary Ag-sulfide particles smaller than 10 nm in size form in the vicinity of pristine Ag-0-NPs. These NPs are likely generated from the parent Ag-0-NPs via a dissolution-diffusion-sulfidation process. Moreover, the phyto-uptake of Ag-0-NPs of various sizes (i.e., 20, 40 and 80 nm) in the presence/absence of SRB also confirmed a size dependent pattern, with more silver identified in the plant exposed to smaller Ag-NPs. The combined results suggest that the enhanced bioavailability of Ag-NPs to Scirpus triqueter in the presence of SRB is mainly

attributed to the formation of secondary biogenic NPs with minute size. This result points to the importance of complex, coupled interactions between aqueous solutions, bacteria, plants, and labile NPs.

Accès au document

Comparative Genomics of a Paddy Field Bacterial Isolate Ochrobactrum sp. CPD-03: Analysis of Chlorpyrifos Degradation Potential

Authors: Nayak T, Panda AN, Kumari K, Adhya TK, Raina

Source: INDIAN JOURNAL OF MICROBIOLOGY 2020, DOI: 10.1007/s12088-020-00864-9

Abstract: Ochrobactrum genus is known to catabolize aromatic compounds. This study reports a complete genome sequence of Ochrobactrum sp. CPD-03 (similar to 4.6 Mb of chromosomal features) responsible for chlorpyrifos (CP) isolated form a paddy field (20.3588 degrees N, 85.8333 degrees E) in Bhubaneswar, India. A comparative genomics approach was performed between CPD-03 and eight closely related genomes of other Ochrobactrum strains in order to deepen our knowledge, to establish its phylogenetic and functional relationships. The involvement of CP degrading genes indicated a versatile role of CPD-03 in additional field trails. This research would provide the genetic information for its use in natural environment for the depletion of organophosphorus (OP) compounds.

Accès au document

Influence of the herbicide haloxyfop-R-methyl on bacterial diversity in rhizosphere soil of *Spartina alterniflora*

Authors: Liang QY, Yan ZZ, Li XZ

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 194, 2020, DOI: 10.1016/j.ecoenv.2020.110366

Abstract: Haloxyfop-R-methyl (haloxyfop) can efficiently control Spartina alterniflora in coastal ecosystems, but its effect on soil microbial communities is not known. In the present study, the impact of the haloxyfop on rhizosphere soil bacterial communities of S. alterniflora over the dissipation process of the herbicide has been studied in a coastal wetland. The response of the bacterial community in the rhizoplane (iron plaque) of S. alterniflora subjected to haloxyfop treatment was also investigated. Results showed that the persistence of haloxyfop in the rhizosphere soil followed an exponential decay with a half-life of 2.6-4.9 days, and almost all of the haloxyfop dissipated on Day 30. The diversity of rhizosphere soil bacteria was decreased at the early stages (Days 1, 3 & 7) and recovered at late stages (Days 15 & 30) of the haloxyfop treatment. Application of haloxyfop treatment increased the relative abundance of the genera Pseudomonas, Acinetobacter, Pontibacter, Shewanella and Aeromonas. Strains isolated from these genera can degrade herbicides efficiently, which possibly played a role in the degradation of haloxyfop. The rhizoplane bacterial diversity was reduced on Day 15 while being vastly enhanced on Day 30. Soil variables, including the electric conductivity, redox potential, and soil moisture, along with the soil haloxyfop residue, jointly shape the bacterial community in rhizosphere soil.

Accès au document

Optimized bioleaching of copper by indigenous cyanogenic bacteria isolated from the landfill of e-waste

Authors: Arab B, Hassanpour F, Arshadi M, Yaghmaei S, Hamedi J

Source: JOURNAL OF ENVIRONMENTAL MANAGEMENT 261, 2020, DOI: 10.1016/j.jenvman.2020.110124

Abstract: In this study, indigenous cyanogenic bacterial strains were isolated on nutrient, minimal salt, and soil extract media at various culture conditions from two distinct landfills of e-waste, Iran. Based on their cyanide formation profiles, five most potent isolates were selected

for optimization and to this end, the influence of the most effective factors on cyanide production including pH, glycine concentration and temperature were assessed using one-factor at a time method (OFAT). Initial pH of 7, glycine concentration of 2 g/L and temperature of 30 degrees C were obtained as optimal conditions for most of the isolates. Additionally, two bioleaching processes were applied for each bacteria to detect the effect of optimal conditions on bioleaching and to assay their potential in the mobilization of copper. Under optimal conditions and pulp density of 1 g/L, copper recoveries were recorded as 96.73%, 82.49%, 81.17%, 41.72%, and 31.52% by S22, N13, N37, N23, and N41 respectively during 10 days which is approximately 1.5-5 times higher than the recovery obtained without optimization. During the optimization and the bioleaching process, the pH fluctuation of the flasks was monitored which validated the activity of the microorganisms.

Accès au document

Construction of a Tetracycline Degrading Bacterial Consortium and Its Application Evaluation in Laboratory-Scale Soil Remediation

Authors: Wu XL, Gu YC, Wu XY, Zhou XY... more

Source: MICROORGANISMS 8(2), 2020, DOI: 10.3390/microorganisms8020292

Abstract: As an environmental pollutant, tetracycline (TC) can persist in the soil for years and damage the ecosystem. So far, many methods have been developed to handle the TC contamination. Microbial remediation, which involves the use of microbes to biodegrade the pollutant, is considered cost-efficient and more suitable for practical application in soil. This study isolated several strains from TC-contaminated soil and constructed a TC-degrading bacterial consortium containing Raoultella sp. XY-1 and Pandoraea sp. XY-2, which exhibited better growth and improved TC degradation efficiency compared with single strain (81.72% TC was biodegraded within 12 days in Lysogeny broth (LB) medium). Subsequently, lab-scale soil remediation was conducted to evaluate its effectiveness in different soils and the environmental effects it brought. Results indicated that the most efficient TC degradation was recorded at 30 degrees C and in soil sample Y which had relatively low initial TC concentration (around 35 mg/kg): TC concentration decreased by 43.72% within 65 days. Soil properties were affected, for instance, at 30 degrees C, the pH value of soil sample Y increased to near neutral, and soil moisture content (SMC) of both soils declined. Analysis of bacterial communities at the phylum level showed that Proteobacteria, Bacteroidetes, Acidobacteria, and Chloroflexi were the four dominant phyla, and the relative abundance of Proteobacteria significantly increased in both soils after bioremediation. Further analysis of bacterial communities at the genus level revealed that *Raoultella* sp. XY-1 successfully proliferated in soil, while Pandoraea sp. XY-2 was undetectable. Moreover, bacteria associated with nitrogen cycling, biodegradation of organic pollutants, soil biochemical reactions, and plant growth were affected, causing the decline in soil bacterial diversity. Variations in the relative abundance of tetracycline resistance genes (TRGs) and mobile gene elements (MGEs) were investigated, the results obtained indicated that tetD, tetG, tetX, intI1, tnpA-04, and tnpA-05 had higher relative abundance in original soils, and the relative abundance of most TRGs and MGEs declined after the microbial remediation. Network analysis indicated that tnpA may dominate the transfer of TRGs, and Massilia, Alkanibacter, Rhizomicrobium, Xanthomonadales, Acidobacteriaceae, and Xanthomonadaceae were possible hosts of TRGs or MGEs. This study comprehensively evaluated the effectiveness and the ecological effects of the TC-degrading bacterial consortium in soil environment.

Accès au document

Effects of soil heavy metal pollution on microbial activities and community diversity in different land use types in mining areas

Authors: Zhao XQ, Sun Y, Huang J, Wang H, Tang D

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI: 10.1007/s11356-020-08538-1

Abstract: Microbial activities and community structures play crucial roles in the soil environment and can be served as effective indicators to assess the ecological influence of heavy metal pollution in soil. This article selected soil samples from five land use types (mining area, mineral processing area, heap mining area, tailing area, and vegetable area) in the Shizishan mining area in Tongling, Anhui Province, China. The physicochemical properties, pollution characteristics, enzyme activities (catalase, urease, alkaline phosphatase, neutral phosphatase, cellulase, and sucrase), microbial biomass carbon (MBC), basal respiration (SBR), and metabolic entropy (qCO2) in soil were determined and compared, and the relationship between environmental factors and the microbial activities and community diversity was analyzed. The results showed that, according to the Nemerow's Pollution Index (P-N), the values were the heap mining area (24.47) > mineral processing area (12.55) > mining area (9.81) > tailings area (6.02) > vegetable area (4.51). With the increase of heavy metal contamination in the sampling area, the six enzyme activities, MBC and SBR decreased, but the qCO2 increased. Principal coordinate analysis (PCoA) and canonical correlation analysis (CCA) showed that the land use types, soil moisture content (MC), heavy metal content, pH, MBC, SBR, and qCO(2) were significantly affected by the microbial community. The most dominant phyla were Proteobacteria (34.73%), Bacteroidetes (9.25%), Acidobacteria (8.99%), and Chloroflexi (8.68%) at the phylum (0.01) level by a total of 18 phyla. It was also found that Firmicutes and Phormidium were more tolerant to heavy metals. These results contributed to an insight into key environmental variables shaping the microbial activities, community structure, and diversity under various land use types in mining area.

Accès au document

Tetracyclines Mode of Action and their Bacterial Mechanisms of Resistance

Authors: Roberts MC

Source: BACTERIAL RESISTANCE TO ANTIBIOTICS - FROM MOLECULES TO MAN, JOHN WILEY,

Ed. Bonev BB, Brown NM 101-124, 2020

Accès au document

Urban and agricultural soils in Southern California are a reservoir of carbapenem-resistant bacteria

Authors: Lopez NV, Farsar CJ, Harmon DE, Ruiz C

Source: MICROBIOLOGYOPEN 2020, DOI: 10.1002/mbo3.1034

Abstract: Carbapenems are last-resort beta-lactam antibiotics used in healthcare facilities to treat multidrug-resistant infections. Thus, most studies on identifying and characterizing carbapenem-resistant bacteria (CRB) have focused on clinical settings. (…) Here, we have surveyed 11 soil samples from 9 different urban or agricultural locations in the Los Angeles-Southern California area to determine the prevalence and characteristics of CRB in these soils. All samples tested contained CRB with a frequency of <10 to 1.3 x 10(4) cfu per gram of soil, with most agricultural soil samples having a much higher relative frequency of CRB than urban soil samples. Identification and characterization of 40 CRB from these soil samples revealed that most of them were members of the genera Cupriavidus, Pseudomonas, and Stenotrophomonas. Other less prevalent genera identified among our isolated CRB, especially from agricultural soils, included the genera Enterococcus, Bradyrhizobium, Achromobacter, and Planomicrobium. Interestingly, all of these carbapenem-resistant isolates were also intermediate or resistant to at least 1 noncarbapenem antibiotic. Further characterization of our isolated CRB revealed that 11 Stenotrophomonas, 3 Pseudomonas, 1 Enterococcus, and 1 Bradyrhizobium isolates were carbapenemase producers. Our findings show for the first time that both urban and agricultural soils in Southern California are an underappreciated reservoir of bacteria resistant to carbapenems and other antibiotics, including carbapenemase-producing CRB.

Accès au document

On the contribution of reclaimed wastewater irrigation to the potential exposure of humans to antibiotics, antibiotic resistant bacteria and antibiotic resistance genes - NEREUS COST Action ES1403 position paper

Authors: Pina B, Bayona JM, Christou A... more

Source: JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING 8(1), 2020, DOI: 10.1016/j.jece.2018.01.011

Abstract: Antibiotic resistance (AR) is becoming a worldwide threat due to the increasing occurrence of antibiotic-resistant pathogenic bacterial strains. There is a general consensus about the potential implications of the use of antibiotics in livestock on the onset of antibiotic resistant bacteria (ARB), mainly through meat consumption. However, the ever-increasing use of reclaimed wastewater (RWW) in agriculture may also contribute significantly to the non-accounted exposure to antibiotics, ARB, and antibiotic resistance genes (ARGs). This position paper aims at evaluating the current knowledge concerning the occurrence of antibiotics, ARBs, and ARGs in edible parts of different common crops irrigated with RWW. We will discuss which regulations on the use of RWW may contribute to the minimization of the prevalence of these contaminants in crops, and provide recommendations on how to minimize the impact of these practices.

Accès au document

Co-effect of minerals and Cd(II) promoted the formation of bacterial biofilm and consequently enhanced the sorption of Cd(II)

Authors: Xu SZ, Xing YH, Liu S... more

Source: ENVIRONMENTAL POLLUTION 258, 2020, DOI: 10.1016/j.envpol.2019.113774

Abstract: Heavy metal pollution is very common in soils. Soils are complex systems including minerals, bacteria, and various other substances. In Cd(II) contaminated soil, the combined effects of clay minerals and heavy metals on bacterial biofilm and Cd(II) adsorption are unappreciated. Our study showed that the combination of clay minerals (goethite, kaolinite, and montmorillonite) and heavy metals promoted Serratia marcescens S14 biofilm development significantly more than clay minerals or Cd(II) alone. The amount of biofilm after binary treatment with clay minerals and Cd(II) was 2.3-73 times than that in control. Mineral-induced cell death and the expression of the firnA, bsmA, and eps were key players in biofilm formation. Binary treatment with montmorillonite and Cd(II) significantly enhanced biofilm development and consequently increased the adsorption of Cd(II). Cd(II) removal is the result of co-adsorption of bacteria and minerals. Bacterial biofilm played an important role in Cd(II) adsorption. MR spectroscopy showed the components of biofilm were not affected by minerals and revealed the functional groups -OH, -NH, -CH2, -SH, -COO participated in Cd(II) immobilization. Our findings are of fundamental significance for understanding how minerals and Cd(II) affect biofilms and thereby enhance Cd(ll) adsorption and predicting the mobility and fate of heavy metals in heavy metal-contaminated soil.

Accès au document

Removal of Heavy Metals Zinc, Lead, and Cadmium by Biomineralization of Urease-Producing Bacteria Isolated from Iranian Mine Calcareous Soils

Authors: Jalilvand N, Akhgar A, Alikhani HA... more

Source: JOURNAL OF SOIL SCIENCE AND PLANT NUTRITION 20(1):206-219, 2020, DOI: 10.1007/s42729-019-00121-z

Abstract: One appropriate strategy for refining heavy metals could be based on bioprecipitation by ureolytic bacteria. The study was conducted to

isolate urease-producing bacteria from the contaminated soils and evaluate the potential of selected isolates in biomineralization of heavy metals.To this end, four isolates which had the greatest urease production, calcite precipitation, and endurance to the heavy metals were obtained from contaminated areas during the screening steps. These isolates along with Sporosarcina pasteurii were used to bioprecipitate zinc (Zn), lead (Pb), and cadmium (Cd) from solutions with concentrations of 100, 300, and 500 mM of these metals' ions. Amount of heavy metal precipitates formed by these bacteria were compared.Among these isolates, *Stenotrophomonas rhizophila* (A323) and *Variovorax boronicumulans* (C113) produced the highest carbonate minerals of heavy metals. *S. rhizophila* removed 96.25%, 71.3 %, and 63.91% of Pb, Cd, and Zn, respectively, after 72 h of incubation. Also, *V. boronicumulans* removed 95.93% of Pb, 73.45% of Cd, and 73.81% of Zn after having the same amount of time for incubation. *S. pasteurii* eliminated 98.71% of Pb, 97.15% of Cd, and 94.83% of Zn. The presence of lead, zinc, cadmium, and carbon as well as oxygen in precipitates formed from biomineralization of heavy metals was confirmed by energy dispersive spectroscopy (EDS). The S. pasteurii produced higher amounts of metal carbonates. Nevertheless, the use of selected bacteria in bioremediation of contaminated sites may be more effective due to the stability of these bacteria in high concentrations of Pb, Zn, and Cd.

Accès au document

Isotope Fractionation (delta C-13, delta N-15) in the Microbial Degradation of Bromoxynil by Aerobic and Anaerobic Soil Enrichment Cultures

Authors: Knossow N, Siebner H, Bernstein A

Source: JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY 68(6):1546-1554, 2020, DOI: 10.1021/acs.jafc.9b07653

Abstract: Bromoxynil is an increasingly applied nitrile herbicide. Under aerobic conditions, hydration, nitrilation, or hydroxylation of the nitrile group commonly occurs, whereas under anaerobic conditions reductive dehalogenation is common. This work studied the isotope effects associated with these processes by soil cultures. The aerobic soil enrichment culture presented a significant increase in Stenotrophomonas, Pseudomonas, Chryseobacterium, Achromobacter, Azospirillum, and Arcticibacter, and degradation products indicated that nitrile hydratase was the dominant degradation route. The anaerobic culture was dominated by Proteobacteria and Firmicutes phyla with a significant increase in Dethiosulfatibacter, and degradation products indicated reductive debromination as a major degradation route. Distinct dual-isotope trends (delta C-13, delta N-15) were determined for the two routes: a strong inverse nitrogen isotope effect (epsilon(N) = 10.56 +/- 0.36 parts per thousand) and an insignificant carbon isotope effect (epsilon(C) = 0.37 +/- 0.36 parts per thousand) for the aerobic process versus a negligible effect for both elements in the anaerobic process. These trends differ from formerly reported trends for the photodegradation of bromoxynil and enable one to distinguish between the processes in the field.

Accès au document

Effects of modified nanoscale carbon black on plant growth, root cellular morphogenesis, and microbial community in cadmium-contaminated soil

Authors: Cheng JM, Sun ZH, Li XR, Yu YQ

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI: 10.1007/s11356-020-08081-z

Abstract: Previous researches have confirmed that modified nanoscale carbon black (MCB) can decrease the bioavailability of heavy metals in soil and accumulation in plant tissues, resulting in the increase of biomass of plant. However, as a nanoparticle, the effects of MCB on plant cell morphology and microbial communities in Cd-contaminated soil are poorly understood. This study, through greenhouse experiments, investigated the effects of MCB as an amendment for 5 mg center dot kg(-1) Cd-contaminated soil on plant growth, plant cellular morphogenesis, and microbial communities. Two types of plants, metal-tolerant plant ryegrass (*Lolium multiflorum*), and hyperaccumulator plant chard (*Beta vulgaris* L. var. cicla) were selected. The results indicated that adding MCB to Cd-

contaminated soil, the dry biomass of shoot ryegrass and chard increased by 1.07 and 1.05 times, respectively, comparing with control group (the treatment without MCB). Meanwhile, the physiological characteristics of plant root denoted that adding MCB reduced the damage caused by Cd to plants. The acid phosphatase activity of soils treated with MBC was higher and the dehydrogenase activity was lower than control group during whole 50 days of incubation, while the urease and catalase activity of soils treated with MBC were higher than control group after 25 days of incubation. When compared with the treatment without MCB, the abundances of nitrogen-functional bacteria (Rhodospirillum and Nitrospira) and phosphorus-functional bacteria (Bradyrhizobium and Flavobacterium) increased but that of nitrogen-functional bacteria, Nitrososphaera, declined. The presence of MCB resulted in increased microbial community abundance by reducing the bioavailability of heavy metals in soil, while increasing the abundance of plants by increasing the amount of available nitrogen in soil. The result of this study suggests that MCB could be applied to the in-situ immobilization of heavy metal in contaminated soils because of its beneficial effects on plants growth, root cellular morphogenesis, and microbial community.

Accès au document

Significance of soil microbe in microbial-assisted phytoremediation: an effective way to enhance phytoremediation of contaminated soil

Authors: Yang Y, Liu Y, Li Z, Wang Z, Li C, Wei H

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY 2020, DOI: 10.1007/s13762-020-02668-2

Abstract: Soil contamination is an increasing global problem. Efforts are underway to minimize the release of contaminants and develop effective bioremediation strategies. Contaminated soil can be treated by phytoremediation that is dependent on the contaminant and soil properties and plant growth rate. In recent decades, soil microbes have been used successfully to enhance the capacity of plants to tolerate, remove and/or degrade contaminants. This paper reviews the principles and applications of microbe-assisted phytoremediation, including the factors that influence phytoremediation, and the mechanisms of microbial remediation. Inoculation with specific contaminant-degrading bacteria and plant growth-promoting rhizobacteria is effective in enhancing phytoremediation. However, in the context of serious and complicated cases of environmental pollution exacerbated by climate change, it is critical to increase the knowledge about the mechanisms of microbe-assisted phytoremediation to underpin the selection of most appropriate phytoremediation approaches.

Accès au document

Long-term effects of chlorothalonil on microbial denitrification and N2O emission in a tea field soil

Authors: Su XX, Wang YY, Peng GL, He Q

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI: 10.1007/s11356-020-07679-7

Abstract: Pesticide chlorothalonil is widely applied in tea agroecosystem, potentially disturbing soil microbial-mediated nitrogen cycle. The underlying toxicity mechanism, however, is not well explored. Here, we investigated the long-term effects of chlorothalonil on soil microbial denitrification and N2O emission pattern in a tea field after 40 days of exposure. Results showed that chlorothalonil inhibited denitrification process but remarkably promoted N2O emission by 380-830%. Chlorothalonil significantly inhibited N2O reductase activity but did not affected nosZ abundance. Our results further revealed that chlorothalonil influenced soil denitrification by directly suppressing microbial electron transport system activity, and decreasing electron donor nicotinamide adenine dinucleotide (NADH) and energy source adenosine triphosphate (ATP) levels. Additionally, chlorothalonil also downregulated denitrifying functional genes (narG, nirS, and norB) and declined the relative abundances of potential denitrifiers (i.e., Pseudomonas and Streptomyces). Stepwise regression and path modeling suggested that nitrate reductase was the most significant factor

in explaining denitrification rate under chlorothalonil applications. This study provides important information for revealing the chronic impacts of pesticide on tea soil denitrification and N2O emission on the basis of electron transport mechanism. Most significantly, N2O emission is underestimated in chlorothalonil-treated soils, which suggests that future estimations of N2O emission from agricultural lands should take account of pesticide dependency conditions.

Accès au document

Soil exposed to silver nanoparticles reveals significant changes in community structure and altered microbial transcriptional profiles

Authors: Meier MJ, Dodge AE, Samarajeewa AD, Beaudette LA

Source: ENVIRONMENTAL POLLUTION 258, 2020, DOI: 10.1016/j.envpol.2019.113816

Abstract: Anthropogenic activities can disrupt soil ecosystems, normally resulting in reduced soil microbial health. Regulatory agencies need to determine the effects of uncharacterized substances on soil microbial health to establish the safety of these chemicals if they end up in the environment. Previous work has focused on measuring traditional ecotoxicologial endpoints within the categories of microbial biomass, activity, and community structure/diversity. Because these tests can be labor intensive, lengthy to conduct, and cannot measure changes in individual gene functions, we wanted to establish whether metatranscriptomics could be used as a more sensitive endpoint and provide a perspective on community function that is more informative than taxonomic identification of microbes alone. We spiked a freshly collected sandy loam soil (Vulcan, Alberta, Canada) with 0, 60, 145, 347, 833, and 2000 mg kg(-1) of silver nanoparticles (AgNPs), a known antagonist of microorganisms due to its propensity for dissolution of toxic silver ions. Assessments performed in our previous work using traditional tests demonstrated the toxicity of AgNPs on soil microbial processes. We expanded this analysis with genomics-based tests by measuring changes in community taxonomic structure and function using 16S rDNA profiling and metatranscriptomics. In addition to identifying bacterial taxa affected by AgNPs, we found that genes involved in heavy metal resistance (e.g., the CzcA efflux pump) and other toxicity response pathways were highly upregulated in the presence of silver. Dose-response analysis using BMDExpress2 software successfully modeled many physiologically relevant genes responding to low concentrations of AgNPs. We found that the transcriptomic point of departure (BMD50) was lower than the IC50s calculated using the traditional tests in our previous work. These results suggest that dose-response modeling of metatranscriptomic gene expression is a useful tool in soil microbial health assessment.

Accès au document

Arbuscular Mycorrhizal Fungi (AMF) from Heavy Metal-Contaminated Soils: Molecular Approach and Application in Phytoremediation

Authors: Kumar S, Saxena S

Source: BIOFERTILIZERS FOR SUSTAINABLE AGRICULTURE AND ENVIRONMENT, Edited by: Giri B, Prasad R, Wu QS, Varma A, Book Series: Soil Biology 55:489-500, 2019, DOI: 10.1007/978-3-030-18933-4_22

Abstract: Discharge of effluents from textile industry into river and agricultural land is one of the major global problems. The discharge of dye-containing effluents directly into the water makes it toxic for environment and living organisms. Currently available physical and chemical processes do not remove toxic chemicals, dyes, and detergents completely from the environment. It is now known that biological organisms like Arbuscular mycorrhizal fungi (AMF), in association with different plant species grown under contaminated soils, enhance uptake of heavy metals. However, very limited knowledge is available with community composition of tolerant mycorrhizal species/strains associated with heavy metal accumulator plants. Therefore, the present chapter deals with identification of novel approaches for diagnosis of mycorrhizal species

from complex environmental soil. Furthermore, this chapter suggests more sustainable approaches for reclamation of heavy metals by AMF associated with the heavy metal accumulator plants.

Accès au document

Tolerance of dark septate endophytic fungi (DSE) to agrochemicals in vitro

Authors: Spagnoletti FN, Chiocchio VM

Source: REVISTA ARGENTINA DE MICROBIOLOGIA 52(1):43-49, 2020, DOI: 10.1016/j.ram.2019.02.003

Abstract: Dark septate endophytes (DSE) are a heterogeneous group of fungi, mostly belonging to the Phylum Ascomycota, that are involved in a mutualistic symbiosis with plant roots. The aim of this study is to evaluate the behavior of two strains of DSE isolated from wheat roots of two cropping areas in the province of Buenos Aires, Argentina, against some agrochemicals. Of all the isolates obtained, two strains were identified as *Alternaria alternata* and *Cochliobolus* sp. These DSE were found to be tolerant to glyphosate, carbendazim and cypermethrin when evaluated at the recommended agronomic dose (AD), 2 AD and, in some cases, 10 AD. This work contributes to the study of the biology of this group of fungi and their tolerance in the presence of xenobiotics widely used in agriculture.

Accès au document

Temporal effects of repeated application of biogas slurry on soil antibiotic resistance genes and their potential bacterial hosts

Authors: Liu C, Chen YX, Li XH, Zhang YR... more

Source: ENVIRONMENTAL POLLUTION, 258, 2020, DOI: 10.1016/j.envpol.2019.113652

Abstract: Biogas slurry, a liquid end product of animal manure fermentation, is widely used as fertilizer in crop fields. Land application may introduce antibiotics and related resistance genes from livestock production into agricultural soil. Nevertheless, changes in antimicrobial resistance in soil where biogas slurry has been repeatedly applied are not fully understood. In the present study, 13 veterinary antibiotics were analyzed in soils that were repeatedly sprayed with biogas slurry, and simultaneously, temporal changes in antibiotic resistance genes (ARGs) and bacterial community composition were investigated using a real-time quantitative PCR assay and MiSeq sequencing. Long-term repeated application of biogas slurry did not result in excessive accumulation of antibiotic residuals in the soil but increased the abundance of ARGs and facilitated ARG transfer among potential hosts. Although the quantitative PCR assay showed a decreasing trend for the relative abundance of ARGs over time, a relevance network analysis revealed highly complex bacteria-ARG co-occurrence after long-term application, which implied that repeated application might intensify horizontal gene transfer (HGT) of ARGs among different bacterial hosts in soil. The increased relative abundance of the intl1 gene supported the shift in ARG-bacteria co-occurrence. Furthermore, ordination analysis showed that the distributions of antibiotic resistance bacteria (ARB) and ARGs were closely related to application duration than to the influence of antibiotic residuals in the biogas slurry-treated soil environment. Additionally, natural level of ARG abundance in untreated soils indirectly suggested the presence/absence of antibiotics was not a key determinant causing the spread of antimicrobial resistance. This study provides improved insight into the effects of long-term repeated application of biogas slurry on the shift in ARG abundances and bacteria-ARG co-occurrence in soils, highlighting the need to focus on the influence of changed soil environment on the ARG transfer.

Accès au document

Evaluation of degradation of a novel sulfone bactericide in soils: identification of degradation product and kinetics study

Authors: Meng XG, Long XF, Wang N, Pan SZ... more

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY 17(2):891-902, 2020, DOI: 10.1007/s13762-019-02523-z

Abstract: Fubianezuofeng is a novel bactericide that shows good inhibitory activity on rice bacterial leaf streak and leaf blight. In this study, the probable influencing factors such as light, soil moisture, soil types, temperature, soil sterilization, and soil organic matter on this bactericide degradation were investigated. The results showed that the degradation experiments of Fubianezuofeng follow the first-order kinetics equation. The rate of degradation was remarkably affected by the types of soil with the degradation half-life t(1/2) 3.89, 5.21, 4.56, 7.22, 213.05, and 137.29 h for Tianjin, Hefei, Guiyang, Nanning, Harbin, and Changsha soils, respectively. The high moisture and increased temperature can accelerate its degradation rate in soil. Moreover, the degradation rate was faster under non-sterilized condition (t(1/2) 9.24 days) than under sterilized condition (t(1/2) 31.51 days) and removed organic matter from soil (t(1/2) 57.76 days). And the degradation under ultraviolet light (t(1/2) 0.47 days) was the fastest followed by xenon light (t(1/2) 5.42 days) and dark condition (t(1/2) 9.24 days). Finally, the major degradation product, named 2-(4-fluorobenzyl)-5-methoxy-1,3,4-oxadiazole, was identified by ultra-high-performance liquid chromatography equipped with high-resolution mass spectrometry, and the probable mechanism and degradation pathway of FBEZF under the present experimental conditions were proposed in soil. This research can be helpful for the security evaluation of FBEZF and provide some useful data for further investigations and developments on sulfone pesticides in the agricultural and environmental field. Graphic abstract

Accès au document

Inoculation with abscisic acid (ABA)-catabolizing bacteria can improve phytoextraction of heavy metal in contaminated soil

Authors: Lu Q, Weng YN, You Y, Xu QR, Li HY... more

Source: ENVIRONMENTAL POLLUTION 257, 2020, DOI: 10.1016/j.envpol.2019.113497

Abstract: Promotion of plant capacity for accumulation of heavy metals (HMs) is one of the key strategies in enhancing phytoremediation in contaminated soils. Here we report that, *Rhodococcus qingshengii*, an abscisic acid (ABA)-catabolizing bacteria, clearly boosts levels of Cd, Zn, and Ni in wild-type Arabidopsis by 47, 24, and 30%, respectively, but no increase in Cu was noted, when compared with non-inoculated Arabidopsis plants in contaminated growth substrate. Furthermore, when compared with wild-type plants, *R.qingshengii*-induced increases in Cd, Zn, and Ni concentrations were more pronounced in abi1/hab1/abi2 (ABA-sensitive mutant) strains of Arabidopsis, whereas little effect was observed in snrk2.2/2.3 (ABA insensitive mutant). This demonstrates that metabolizing ABA might be indispensable for R. qingshengii to improve metal accumulation in plants. Bacterial inoculation significantly elevated the expression of Cd, Zn, and Ni-related transporters; whereas the transcript levels of Cu transporters remained unchanged. This result may be a reasonable explanation for why the uptake of Cd, Zn, and Ni in plants was stimulated by bacterial inoculation, while no effect was observed on Cu levels. From our results, we clearly demonstrate that *It qingshengii* can increase the accumulation of Cd, Zn, and Ni in plants via an ABA-mediated HM transporters-associated mechanism. Metabolizing ABA in the plants by ABA-catabolizing bacterial inoculation might be an alternative strategy to improve phytoremediation efficiency in HMs contaminated soil.

Accès au document

Bioremediation of Oxamyl Compounds by Algae: Description and Traits of Root-Knot Nematode Control

Authors: El-Ansary MSM, Hamouda RAF, Ahmed-Farid OA

Source: WASTE AND BIOMASS VALORIZATION, 2020, DOI: 10.1007/s12649-020-00950-5

Abstract: Safety of environment and human health has newly become crucial factors when selecting crops production programs. With regard

to nematicides, oxamyl is a systematic nematicide widely used for the control of soil nematodes. Accelerated biodegradation of the oxamyl, utilized at the recommended dose in soil cultured by banana plants and coupled with root-knot nematode (RKN, Meloidogyne incognita), was observed using algal bioassay studies. However, algae play an important role in maintaining micro and macro elements availability, plant biochemical process, nitrogen fixation, photosynthesis and rebate the harmful effect of pesticides through degradation. For this reason, algae such as: *Chlorella vulgaris*, *Scenedesmus obliquus*, *Anabaena oryza* and *Nostoc muscorum* have been used to determine the degradability enhancement of oxamyl by an accelerated biodegradation process. All oxamyl-degrading species showed a highly effective to enhance biodegradation of oxamyl compound. Memorable, the alga S. *obliquus* was the most successful one for oxamyl degradation that denoted by the least residue in plant was 25% and oxamyl degradation in untreated soil by algae was 100% and had an active promoting effect on plant health. Unlike, the incorporated application of alga, *C. vulgaris* was the most successful action in diminishing the nematode, juveniles2 count in soil (57.55%) and galls count on roots (52.87%).

Accès au document

The toxic factor of copper should be adjusted during the ecological risk assessment for soil bacterial community

Authors: Chen JW, Zhang H, Li JJ, Liu Y... more

Source: ECOLOGICAL INDICATORS, 111, 2020, DOI: 10.1016/j.ecolind.2020.106072

Abstract: The toxic factor (TF) is a key parameter commonly used to evaluate the potential ecological risk index (RI) of heavy metals. However, it remains largely unknown whether this traditional TF is applicable to the ecological risk assessment of heavy metal to soil microorganisms, which are essential to ecological functions and ecosystem sustainability. Here, based on the TF values of 5 and 30 for copper (Cu) and cadmium (Cd), respectively, we constructed soil microcosms to establish a gradient of ecological risk levels, and different combinations of Cu and Cd concentrations were used at each ecological risk level. We found that bacterial abundance and functional diversity significantly decreased and the metal resistance gene (MRG) abundances increased with the increasing RI level. At the same RI level, the bacterial abundance and functional diversity decreased while MRG abundances increased with increasing Cu concentrations, suggesting that the ecological risk to soil bacterial community was more relevant to Cu, rather than Cd. The traditional TF of Cu used to calculate the RI might be underestimated if it is used for evaluation of the risk to soil bacteria. Our calibration analysis revealed that the TF of Cu should be adjusted to 6 during the assessment of the RI for soil bacterial community in heavy-metal contaminated area.

Accès au document

Amelioration of chromium and heat stresses in *Sorghum bicolor* by Cr6+ reducing-thermotolerant plant growth promoting bacteria

Authors: Bruno LB, Karthik C, Ma Y, Kadirvelu K... more

Source: CHEMOSPHERE 244, 2020, DOI: 10.1016/j.chemosphere.2019.125521

Abstract: Climatic factors particularly increased atmospheric temperature (IAT) greatly alters plant microbe and heavy metal interactions and subsequently reduces plant growth and phytoremediation efficiency. The aim of the study was to assess the effects of inoculation of chromium reducing-thermotolerant plant growth promoting bacteria (CRT-PGPB) on plant growth, physiological responses and chromium (Cr) uptake by Sorghum bicolor under IAT condition. Three potential CRT-PGPB strains were isolated from Cr contaminated sites and identified as Bacillus cereus TCR17, Providencia rettgeri TCR21 and Myroides odoratimimus TCR22 through molecular characterization. These strains displayed the potential to reduce Cr6+ to Cr3+, produce siderophores, indole-3-acetic acid and solubilize phosphate. Inoculation of S. bicolor with CRT-PGPB increased plant growth, antioxidant status (superoxide dismutase, catalase and ascorbate peroxidase) and decreased proline and malondialdehyde contents in plants under Cr, IAT and Cr + IAT stress indicate that PGPB helped

plants to reduce stress induced oxidative damage. Irrespective of IAT stress, inoculation of CRT-PGPB decreased the accumulation of Cr in plants compared with uninoculated control suggest that CRT-PGPB might have the potential to improve phytostabilization process in Cr contaminated soils. Furthermore, gene expression studies confirmed that inoculation of TCR21 down-regulated the expression of proline synthesis gene (p5cs1) and up-regulated the expression of antioxidant related genes (sod, apx1 and cat) and stress tolerance genes (sHsp). Our results showed that CRT-PGPB exhibiting potential to tolerate Cr, temperature, produce plant beneficial metabolites and reduce Cr6+ to Cr3+, can be exploited as potential inoculants for improving plant growth and phytoremediation process in Cr contaminated soil under IAT condition.

Accès au document

Microbial diversity in soils from antimony mining sites: geochemical control promotes species enrichment

Authors: Deng RJ, Tang ZE, Hou BL, Ren BZ... more

Source: ENVIRONMENTAL CHEMISTRY LETTERS 2020, DOI: 10.1007/s10311-020-00975-1

Abstract: Elevated soil concentrations of antimony (Sb) and co-contaminants are frequently encountered where antimony has been mined on a large scale. For instance, the Xikuangshan antimony mine in central South China has sustained, over many centuries, dispersed and spatially variable input of toxic elements into the soil ecosystem. We utilized this unique environment to assess the impact of geochemical conditions on soil microbiology. Geochemical conditions were assessed by monitoring absolute and available fractions of toxic elements and disrupted soil properties. Soil microbiology was studied by high-throughput sequencing and statistical analysis, including principle component analysis and canonical correspondence analysis. Results show that Sb concentrations were ranged from 970 to more than 24,000 mg/kg. As concentrations were three times higher than the regional background values and ten times higher for Pb, 590 times higher for Cd and 30 times higher for Hg. About 5-10% of the total soil Sb was environmentally mobile. Microbial diversity was high, and soil properties such as pH, organic matter, iron and sulfate controlled the absolute microbial activity. We identified strong positive and negative correlations with specific bacterial taxonomic groups which show: (1) an intolerance of available fractions for all elements, e.g., Gemmatimonas, Pirellula, Spartobacteria; (2) a good tolerance of available fractions for all elements, e.g., Povalibacter, Spartobacteria; and (3) a mixed response, tolerating available Sb, Hg and Cd and inhibition by As, Pb, e.g., Escherichia/Shigella and Arthrobacter, and in reverse, e.g., Gemmatimonas and Sphingomonas. The site hosts great diversity dominated by Gram-negative organisms, many with rod (bacillus) morphologies but also some filamentous forms, and a wide range of metabolic capabilities: anaerobes, e.g., Saccharibacteria, metal oxidizing, e.g., Geobacter, chemoautotrophs, e.g., Gemmata, and sulfur reducing, e.g., Desulfuromonas. The bioremediation potential of Arthrobacter and Escherichia/Shigella for Sb control is highlighted.

Accès au document

Effective bioremediation of heavy metal-contaminated landfill soil through bioaugmentation using consortia of fungi

Authors: Hassan A, Periathamby A, Ahmed A... more

Source: JOURNAL OF SOILS AND SEDIMENTS 20(1):66-80, 2020, DOI: 10.1007/s11368-019-02394-4

Abstract: Purpose Heavy metals' contamination of soil is a serious concern as far as public health and environmental protection are concerned. As a result of their persistent and toxic properties, heavy metals need to be removed from contaminated environments using an efficient technology. This study is aimed to determine the heavy metals' (Ni, Pb, and Zn) bioremoval capacity of consortia of filamentous fungi from landfill leachate-contaminated soil.

Materials and methods Three different groups of consortia of fungi, namely all isolated fungi, Ascomycota, and Basidiomycota, were employed

for the bioremediation of the contaminated soil. A total of thirteen fungal species were used to make up the three consortia. The setup was kept for 100 days during which regular watering was carried out. Soil subsamples were collected at day 20, day 60, and 100 for monitoring of heavy metal concentration, fungal growth, and other physicochemical parameters.

Results and discussion Highest tolerance index of 1.0 was recorded towards Ni and Zn concentrations. The maximum metal bioremoval efficiency was observed for soil bioaugmented with the all isolated fungi for Ni and Pb with the removal efficiencies as 52% and 44% respectively. However, 36% was realized as the maximum removal for Zn, and was for Ascomycota consortium-treated soil. The order for the heavymetal removal for Ni and Pb is all isolated fungi > Basidiomycota > Ascomycota, while for Zn is Basidiomycota > all isolated fungi > Ascomycota. Spectra analysis revealed the presence of peaks (1485-1445 cm(-1)) only in the consortia-treated soil which corresponded to the bending of the C-H bond which signifies the presence of methylene group.

Conclusions Soil treated using bioaugmentation had the best heavy metal removal as compared to that of the control. This suggests the contribution of fungal bioaugmentation in the decontamination of heavy metal-contaminated soil.

Accès au document

Azoxystrobin dissipation and its effect on soil microbial community structure and function in the presence of chlorothalonil, chlortetracycline and ciprofloxacin

Authors: Han LX, Liu YL, Fang K, Zhang XL, Liu T... more

Source: ENVIRONMENTAL POLLUTION 257, 2020, DOI: 10.1016/j.envpol.2019.113578

Abstract: The residual characteristics and the adsorption-desorption behaviors of azoxystrobin (AZO) as well as the soil ecological effects in the individual repeated treatments of AZO and its combination with chlorothalonil (CTL), chlortetracycline (CTC) and ciprofloxacin (CIP) were systematically studied in organic manure (OM)-amended soil under laboratory conditions. The presence of CTL, CTC, and CIP, both individually and combined, decreased the sorption affinity of AZO with the Freundlich adsorption and desorption coefficient decreasing by 0.3-24.2%, and CTC and CIP exhibited greater adverse effects than CTL. AZO dissipated slowly and the residues significantly accumulated during ten repeated treatments. The dissipation of AZO was inhibited to different degrees in the combined treatments. Biolog analysis revealed that the soil microbial functional diversity in the OM-soil + AZO and OM-soil + AZO + CTL treatments was higher than that in the OM-soil treatment during the former three repeated treatments, but which was inhibited during the latter seven repeated treatments. The soil microbial functional diversity in the OM-soil + AZO + CTC, OM-soil + AZO + CIP and OM-soil + AZO + CTL + CTC + CIP treatments was inhibited during the ten repeated treatments compared with OM-soil treatment. Metagenomic results showed that all repeated treatments significantly increased the relative abundance of Actinobacteria, but significantly decreased that of Proteobacteria and Firmicutes during the ten repeated treatments. Furthermore, the relative abundance of soil dominant bacterial genera Rhodococcus, Mycobacterium and Arthrobacter in all the repeated treatments significantly increased by 1.5-1283.9% compared with the OM-soil treatment. It is concluded that coexistence of CTL, CTC and CIP, both individually and combined, with AZO can inhibit the dissipation of AZO, reduce the adsorption affinity of AZO on soil, and alter the soil microbial community structure and functional diversity.

Accès au document

Metal-Tolerant Fungal Communities Are Delineated by High Zinc, Lead, and Copper Concentrations in Metalliferous Gobi Desert Soils

Authors: Kerfahi D, Ogwu MC, Ariunzaya D... more

Source: MICROBIAL ECOLOGY 79(2):420-431, 2020, DOI: 10.1007/s00248-019-01405-8

Abstract: The soil fungal ecology of the southern Gobi region of Mongolia has been little studied. We utilized the ITS1 region from soil DNA to study possible influences soil metal concentrations on soil fungal community variation. In the sample network, a distinctive fungal community was closely associated with high zinc (Zn), lead (Pb), and copper (Cu) concentrations. The pattern of occurrence suggests that high metal concentrations are natural and not a product of mining activities. The metal-associated fungal community differs little from the "normal" community in its major OTUs, and in terms of major fungal guilds and taxa, and its distinctiveness depends on a combination of many less common OTUs. The fungal community in the sites with high metal concentrations is no less diverse than that in areas with normal background levels. Overall, these findings raise interesting questions of the evolutionary origin and functional characteristics of this apparently "metal-tolerant" community, and of the associated soil biota in general. It is possible that rehabilitation of metal-contaminated mined soils from spoil heaps could benefit from the incorporation of fungi derived from these areas.

Accès au document

Short-term application of mulch, roundup and organic herbicides did not affect soil microbial biomass or bacterial and fungal diversity

Authors: Bottrill D, Ogbourne SM, Citerne N, Smith T... more

Source: CHEMOSPHERE 244, 2020, DOI: 10.1016/j.chemosphere.2019.125436

Abstract: Application of synthetic herbicides is currently the most widely used and cost-effective methods to assist with revegetation programs. However, the effects of short-term application of herbicides such as Roundup, acetic acid, BioWeed (TM) and Slasher (R) as compared with mulch, on soil microbial biomass and microbial diversity remain unknown. This study examined the effects of short-term herbicide application on soil microbial biomass, C:N ratio, and fungal and bacterial communities at months 2 and 8 following initiation of treatment application. No effects of treatments on soil pH, C:N and microbial biomass were found. No segregation among treatments in the community structure of bacteria and fungi was observed. However, the fungal phylum Basiodiomycota had one unidentified class, which was only found in the mulch treatment, suggesting the C quality in the mulch treatment may differ compared with the other treatments. The dry and hot conditions experienced throughout the study period may have resulted in fast degradation of the herbicides and may have minimised the impacts of the herbicides on microbial diversity and community structure. Given that the research was undertaken at a single site and over only a short time frame, the results should be extrapolated with caution. Herbicides may have greater impact with long-term use. Future research will need to assess the revegetation success of each treatment and determine if the observed change in Basidiomycota profile and C quality identified in this study becomes significant over the long-term. We hypothesise that mulching may be a preferred treatment to facilitate weed control in riparian zone revegetation.

Accès au document

Design of a degenerate primer pair to target a bacterial functional community: The hppd bacterial gene coding for the enzyme targeted by herbicides, a study case

Authors: Thiour-Mauprivez C, Devers-Lamrani M, Mounier A, Beguet J, Spor A, Calvayrac C, Barthelmebs L, Martin-Laurent

Source: JOURNAL OF MICROBIOLOGICAL METHODS 170, 2020, DOI: 10.1016/j.mimet.2020.105839

Abstract: The present work aimed to design a degenerate primer pair to target a large part of the hppd soil bacterial community, possibly affected by herbicides. We validated these primers by qPCR and high-throughput sequencing analysis of soil samples.

Accès au document

Study on degradation of chlorpyrifos-methyl and utilization od chlorpyrifos-methyl drading vacterium, *Bacillus vallismortis* CM-11

Authors: Zhu JW, Meng ZL, Zhao Y

Source: FRESENIUS ENVIRONMENTAL BULLETIN 29(3):1316-1321, 2020

Abstract: A strain CM-11 capable of highly degrading chlorpyrifos-methyl was isolated from soil. The strain CM-11 was identified as *Bacillus vallismortis* based on 16S rRNA and analysis of morphology, physiological and biochemical characters. The optimal pH value and temperature were 6.8-7.2 and 30-35 square. The 6d degradation rate of 100 mg/L chlorpyrifos-methyl by strain CM-11 was at about 99.6% in inorganic salt medium. The strain CM-11 could hydrolyze chlorpyrifos-methyl to 3,5,6-trichloro-2-pyridinol (TCP), but it could only slowly degrade TCP. The combined applications of the strain CM-11 and the strain TBE-6 was considered an effective means for degrading chlorpyrifos-methyl, because the strain TBE-6 could rapidly degrade TCP. The degradation rate of chlorpyrifos-methyl (100mg/L) by the strain CM-11 and the strain TBE-6 could reach about 100% in 5d. This study may provide theoretic basis and reference for prevention and control of pesticides pollution.

Accès au document

Temporal dynamics of earthworm (*Eisenia fetida*) microbial communities after cadmium stress based on a compound mathematical model

Authors: Ning YC, Zhou HR, Wang SB... more

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI: 10.1007/s11356-020-08122-7

Abstract: Soil cadmium (Cd) pollution has received increasing attention from scholars. In the field of Cd pollution remediation, there is an urgent need to study the combined bioremediation technology of earthworms and microbes. (…) After different Cd stress times, the regulation process between the microbial communities in the earthworms and in the soil was studied. Canonical correlation analysis and the TOPSIS method were combined to establish a mathematical model for data analysis, and the changes in the carbon source utilization intensity by microbes were analysed. The results showed that in the short-term stress tests, the regulation process could be divided into five stages. Specifically, after 1-3 days of stress, the microbial community in the earthworms regulated the soil microbial community, but on the 3rd day, the regulation was weakened. On the 4th day, the soil microbial community was affected not only by the microbes in the earthworms but also by the increasing intensity of Cd stress. After 5 days of stress, the microbial communities in the earthworms and the soil were both greatly affected by Cd poisoning, and the microbes transitioned from stable to declining. At 6-7 days, the microbes in the earthworms gained control over those in the soil once again, and the Cd-tolerant microbes began to appear and proliferate. At 8-10 days, the regulation of the soil microbes by the earthworm microbes weakened, while the Cd-tolerant population in the soil microbial communities gradually evolved at this stage to adapt to the increasing Cd stress. The long-term stress tests showed that the difference between the microbial communities in the soil and in the earthworms increased, and there was almost no regulation between them.

Accès au document

Mercury alters the rhizobacterial community in Brazilian wetlands and it can be bioremediated by the plant-bacteria association

Authors: Mariano C, Mello IS, Barros BM... more

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI:10.1007/s11356-020-07913-2

Abstract: This study examined how soil mercury contamination affected the structure and functionality of rhizobacteria communities from *Aeschynomene fluminensis* and *Polygonum acuminatum* and how rhizobacteria mediate metal bioremediation. The strains were isolated using culture-dependent methods, identified through 16S rDNA gene sequencing, and characterized with respect to their functional traits related to plant growth promotion and resistance to metals and antibiotics. The bioremediation capacity of the rhizobacteria was determined in greenhouse using corn plants. The isolated bacteria belonged to the phyla Actinobacteria, Deinococcus-Thermus, Firmicutes, and Proteobacteria, with great abundance of the species Microbacterium trichothecenolyticum. The rhizobacteria abundance, richness, and diversity were greater in mercury-contaminated soils. Bacteria isolated from contaminated environments had higher minimum inhibitory concentration values, presented plasmids and the merA gene, and were multi-resistant to metals and antibiotics. *Enterobacter* sp. C35 and M. trichothecenolyticum_C34 significantly improved (Dunnett's test, $p < 0.05$) corn plant growth in mercury-contaminated soil. These bacteria helped to reduce up to 87% of the mercury content in the soil, and increased the mercury bioaccumulation factor by up to 94%. Mercury bioremediation mitigated toxicity of the contaminated substrate. Enterobacter sp. C35, *Bacillus megaterium*_C28, and *Bacillus mycoides*_C1 stimulated corn plant growth and could be added to biofertilizers produced in research and related industries.

Accès au document

Heavy metals, antibiotics and nutrients affect the bacterial community and resistance genes in chicken manure composting and fertilized soil

Authors: Deng WW, Zhang AY, Chen SJ... more

Source: JOURNAL OF ENVIRONMENTAL MANAGEMENT Volume: 257, 2020, DOI: 10.1016/j.jenvman.2019.109980

Abstract: Succession of bacterial communities involved in the composting process of chicken manure, including first composting (FC), second composting (SC) and fertilizer product (Pd) and fertilized soil (FS), and their associations with nutrients, heavy metals, antibiotics and antibiotic resistance genes (ARGs) were investigated. Firmicutes, Proteobacteria, Bacteroidetes, and Actinobacteria were the dominant phyla observed during composting. Overall, potential pathogenic bacteria decreased from 37.18% (FC) to 3.43% (Pd) and potential probiotic taxa increased from 5.77% (FC) to 7.12% (Pd). Concentrations of heavy metals increased after second composting (SC), however, no significant differences were observed between FS and CS groups. Alpha diversities of bacterial communities showed significant correlation with heavy metals and nutrients. All investigated antibiotics decreased significantly after the composting process. The certain antibiotics, heavy metals, or nutrients was significantly positive correlated with the abundance of ARGs, highlighting that they can directly or indirectly influence persistence of ARGs. Overall, results indicated that the composting process is effective for reducing potential pathogenic bacteria, antibiotics and ARGs. The application of compost lead to a decrease in pathogens and ARGs, as well as an increase in potentially beneficial taxa and nutrients in soil.

Accès au document

The combined effects of treated wastewater irrigation and plastic mulch cover on soil and crop microbial communities

Authors: Obayomi O, Edelstein M, Safi J, Mihiret M... more

Source: BIOLOGY AND FERTILITY OF SOILS 2020, DOI: 10.1007/s00374-020-01442-3

Abstract: Global water scarcity necessitates the use of treated wastewater (TWW) for various purposes, including agricultural irrigation, yet this water may introduce various contaminants to the soil and crops. Therefore, application of TWW irrigation was sanctioned by barriers (drip irrigation and plastic mulch) to reduce risks to consumers; however, barriers' effect on soil health is controversial. We hypothesized that the combination of TWW irrigation with plastic mulch barrier would alter the soil microbial community (bacteria and protists), while TWW irrigation alone would have a negligible effect. To test our hypothesis, we compared the response of soil and crop (cucumbers and melons) microbiomes to water qualities (TWW and potable water (PW) applied by drip irrigation in combination with plastic mulch during two growing seasons. The abundance, diversity, composition, and predicted functions of the water, soil, and crop microbial communities were analyzed in 230 samples, concomitant to monitoring the physicochemical parameters. TWW had significantly higher nutrients and salinity than PW but did not differ in pH. TWW-irrigated soils were significantly more saline than PW-irrigated soils, particularly under plastic cover, but all other physiochemical parameters were similar. The microbial communities significantly differed between water qualities, yet these differences did not carry to the irrigated soils or crops, regardless of the use of plastic mulch. Moreover, limited migration was detected between communities in the different matrices. Our results imply that short-term irrigation with TWW and the use of plastic mulch has negligible impact on soil and crop microbiomes.

Accès au document

Do combined nanoscale polystyrene and tetracycline impact on the incidence of resistance genes and microbial community disturbance in *Enchytraeus crypticus*?

Authors: Ma J, Sheng GD, Chen QL, O'Connor P

Source: JOURNAL OF HAZARDOUS MATERIALS Volume: 387, 2020, DOI: 10.1016/j.jhazmat.2019.122012

Abstract: It has been proved that nanoplastics can effectively adsorb pollutants and thus influence their behavior and availability. The combined toxic effects of nanoplastic and its adsorbed pollutant on the soil fauna are still not well known. We used high-throughput quantitative PCR to explore the effects of oral nanoscale polystyrene and tetracycline exposure on antibiotic resistance genes in the soil invertebrate *Enchytraeus crypticus*, and used bacterial 16S rRNA gene amplification sequencing to examine the response of the microbiome of E. crypticus. After 14 days of tetracycline and nanoscale polystyrene exposure, we terminated exposure and monitored the restoration of ARGs and microbiome in the *E. crypticus*. Results showed that the number of ARGs, especially macrolide-lincosamide-streptogramin B (MLSB), tetracycline ARGs, as well as multidrug ARGs, increased with exposure to nanoscale polystyrene and tetracycline. The abundance of Aminoglycoside and Beta_Lactamase ARGs in *E. crypticus* also significantly increased. The exposure significantly perturbed the abundance of families Microbacteriaceae, Streptococcaceae, Enterobacteriaceae, Rhodocyclaceae and Sphinomonadaceae. After terminating exposure for 14 days, the diversity and abundance of ARGs were not completely restored, while the microbiome was not permanently changed but reversibly impacted.

Microbial and Viral Communities and Their Antibiotic Resistance Genes Throughout a Hospital Wastewater Treatment System

Authors: Petrovich ML, Zilberman, Kaplan A, Eliraz GR, Wang YB, Langenfeld K, Duhaime M, Wigginton K, Poretsky R, Avisar D… more

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.00153

Abstract: Antibiotic resistance poses a serious threat to global public health, and antibiotic resistance determinants can enter natural aquatic systems through discharge of wastewater effluents. Hospital wastewater in particular is expected to contain high abundances of antibiotic resistance genes (ARGs) compared to municipal wastewater because it contains human enteric bacteria that may include antibiotic-resistant organisms originating from hospital patients, and can also have high concentrations of antibiotics and antimicrobials relative to municipal wastewater. Viruses also play an important role in wastewater treatment systems since they can influence the bacterial community composition through killing bacteria, facilitating transduction of genetic material between organisms, and modifying the chromosomal content of bacteria as prophages. However, little is known about the fate and connections between ARGs, viruses, and their associated bacteria in hospital wastewater systems. To address this knowledge gap, we characterized the composition and persistence of ARGs, dsDNA viruses, and bacteria from influent to effluent in a pilot-scale hospital wastewater treatment system in Israel using shotgun metagenomics. Results showed that ARGs, including genes conferring resistance to antibiotics of high clinical relevance, were detected in all sampling locations throughout the pilot-scale system, with only 16% overall depletion of ARGs per genome equivalent between influent and effluent. The most common classes of ARGs detected throughout the system conferred resistance to aminoglycoside, cephalosporin, macrolide, penam, and tetracycline antibiotics. A greater proportion of total ARGs were associated with plasmid-associated genes in effluent compared to in influent. No strong associations between viral sequences and ARGs were identified in viral metagenomes from the system, suggesting that phage may not be a significant vector for ARG transfer in this system. The majority of viruses in the pilot-scale system belonged to the families Myoviridae, Podoviridae, and Siphoviridae. Gammaproteobacteria was the dominant class of bacteria harboring ARGs and the most common putative viral host in all samples, followed by Bacilli and Betaproteobacteria. In the total bacterial community, the dominant class was Betaproteobacteria for each sample. Overall, we found that a variety of different types of ARGs and viruses were persistent throughout this hospital wastewater treatment system, which can be released to the environment through effluent discharge.

Accès au document

Rhizoremediation of Cu(II) ions from contaminated soil using plant growth promoting bacteria: an outlook on pyrolysis conditions on plant residues for methylene orange dye biosorption

Authors: Yaashikaa PR, Kumar PS, Varjani S, Saravanan A

Source: BIOENGINEERED 11(1):175-187, 2020, DOI: 10.1080/21655979.2020.1728034

Abstract: Rhizoremediation is one of the most accepted, cost-effective bioremediation techniques focusing on the application of rhizospheric microorganisms in combination with plants for the remediation of organic and inorganic pollutants from the contaminated sites. This work focuses on isolation and identification of metal resistant bacteria to grow on medium with the copper ion concentration of 1500 mg/L. The resistant isolate was identified as *Pantoea dispersa* by a 16S rRNA sequencing. The bioaccumulation of Cu(II) ions in plant is high at the concentration of Cu(II) ion is 125 mg/L in soil. In *Sphaeranthus indicus* the Cu(II) ion translocation factor has expanded with an expansion of grouping of Cu(II) ion in the soil and the most extreme TF factor was acquired at the centralization of Cu(II) ion is 150 mg/L in soil.

Surface morphology of biochar was characterized by Scanning Electron Microscopy (SEM) analysis. The adsorption performance of biochar (Sphaeranthus indicus biomass) and mechanism for the removal of Cu(II) ion were investigated. This study resolves that pyrolysis is promising technology for the conversion of metal ion contaminated plant residues from phytoremediation into valuable products.

Accès au document

Isolation of urease-producing bacteria and their effects on reducing Cd and Pb accumulation in lettuce (*Lactuca sativa* L.)

Authors: Wang TJ, Wang SL, Tang XC, Fan XP, Yang S, Yao LG, Li YD, Han H

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(8):8707-8718, 2020, DOI: 10.1007/s11356-019-06957-3

Abstract: Excess Cd and Pb in agricultural soils enter the food chain and adversely affect all organisms. Therefore, it is important to find an eco-friendly way to reduce heavy metal accumulation in vegetables. We used urea agar plates to isolate urease-producing bacteria from the rhizosphere soil of lettuce in Cd- and Pb-contaminated farmland and investigated their ability to produce urease and immobilize heavy metals. The effects of these strains on the biomass, quality, and Cd and Pb accumulation of lettuce were also studied. The results showed that two urease-producing bacteria, *Enterobacter bugandensis* TJ6 and *Bacillus megaterium* HD8, were screened from the rhizosphere soil of lettuce. They had a high ability to produce urease (44.5 mS cm(-1) min(-1) OD600-1 and 54.2 mS cm(-1) min(-1) OD600-1, respectively) and IAA (303 mg L-1 and 387 mg L-1, respectively). Compared with the control, inoculation with strains TJ6 and HD8 reduced the Cd (75.3-85.8%) and Pb (74.8-87.2%) concentrations and increased the pH (from 6.92 to 8.13-8.53) in solution. A hydroponic experiment showed that the two strains increased the biomass (31.3-55.2%), improved the quality (28.6-52.6% for the soluble protein content and 34.8-88.4% for the vitamin C (Vc) content), and reduced the Cd (25.6-68.9%) and Pb (48.7-78.8%) contents of lettuce shoots (edible tissue). In addition, strain HD8 had a greater ability than strain TJ6 to reduce lettuce Cd and Pb uptake and water-soluble Cd and Pb levels in solution. These data show that the urease-producing bacteria protect lettuce against Cd and Pb toxicity by extracellular adsorption, Cd and Pb immobilization, and increased pH. The effects of heavy metal immobilization by the two strains can guarantee vegetable safety in situ for the bioremediation of heavy metal-polluted farmland.

Accès au document

Uranium tolerant phosphate solubilizing bacteria isolated from Gogi, a proposed uranium mining site in South India

Authors: Sowmya S, Rekha PD, Yashodhara I, Karunakara N, Arun AB

Source: APPLIED GEOCHEMISTRY 114, 2020, DOI: 10.1016/j.apgeochem.2020.104523

Abstract: Remediation of uranium contamination presents a significant environmental problem worldwide. Bioremediation has gained increasing importance as a feasible and eco-friendly strategy. Uranium tolerant phosphate solubilizing bacteria are considered as important candidates in the development of bioremediation technology. In this context, we have isolated bacteria from a proposed uranium mining site, Gogi in the Bhima river belt of Karnataka (South India) with special reference to phosphate solubilizers. Out of 270 bacteria isolated, 14 isolates solubilized 148.5-1226.6 mgL(-1) phosphate from 5 g L-1 tri-calcium phosphate accompanied by drop in media pH from an initial 6.9 to pH values between 3.9 and 6.3. Phylogenetic analysis of 14 phosphate solubilizing bacteria by 16S rRNA gene sequencing grouped them into three phyla, namely Firmicutes, Proteobacteria and Actinobacteria. When tested for uranium sensitivity, 12 of the 14 phosphate solubilizing isolates showed significant (p < 0.01) tolerance to uranium (4.1%-26.1%) compared to the reference strain *Escherichia coli* ATCC 25922(T). This demands further in-depth studies on microbial inhabitants from such complex environmental conditions that could provide better agents and insights for remediation technology.

Accès au document

Characteristics and in situ remediation effects of heavy metal immobilizing bacteria on cadmium and nickel co-contaminated soil

Authors: Wang Y, Luo Y, Zeng GQ, Wu XD, Wu B, Li X, Xu H

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 192, 2020, DOI: 10.1016/j.ecoenv.2020.110294

Abstract: Cadmium (Cd) and nickel (Ni) in soil have caused serious environmental problems and increased healthy risks to humans and biota, it is vital important and necessary to develop effective methods to resolve the combined contaminated problems. In this study, strains L5 and L6 with good heavy metal resistant and immobilizing capacities were isolated from Cd and Ni contaminated soil. Bacterial characteristic experiment illustrated that many functional groups (-OH, -NH2 and -COO et al.) were distributed on the surface of 1.5 and L6. Under the stress of heavy metals, bacterial appearances were distorted. The pot experiment indicated that the concentrations of HOAc-extractable Cd and Ni in soil reduced 6.26-15.33% and 13.31-19.53% with the inoculation of L5 and L6. In addition, the immobilization rates on Cd and Ni improved 61.27-128.50% and 23.69-39.66% with re-inoculation of strains L5 and L6 at 30 days, respectively. After inoculation of strains L5 and L6 for 60 days, the activities of FDA hydrolysis, acid phosphatase, urease, invertase and dehydrogenase in soil increased obviously. Furthermore, bacterial diversity indexes and community structure of soil were also improved. Thus, given the beneficial remediation effects of the isolated strains, L5 and L6 have great potentials for heavy metals contaminated soil remediation.

Accès au document

Quantifying the Mineralization of C-13-Labeled Cations and Anions Reveals Differences in Microbial Biodegradation of Herbicidal Ionic Liquids between Water and Soil

Authors: Wilms W, Wozniak-Karczewska M, Niemczak M, Lisiecki P, Zgola-Grzeskowiak A, Lawniczak L, Framski G, Pernak J, Owsianiak M, Vogt C... more

Source: ACS SUSTAINABLE CHEMISTRY & ENGINEERING 8(8):3412-3426, 2020, DOI: 10.1021/acssuschemeng.9b07598

Abstract: Characterization of the biodegradability of herbicidal ionic liquids (HILs) using the industry standard activated sludge methodology is thought to be insufficient to fully understand the biodegradation of HILs in the environment because cations and anions of the HILs may have different potential for biodegradation in aquatic and terrestrial systems. To test this hypothesis, we conducted laboratory microcosm experiments using C-13-labeled cations and anions forming benzyldodecyldimethylammonium 4-chloro-2-methylphenoxyacetate ([C-12-BA][MCPA]) and evaluated their biodegradation potential in soil with a known history of herbicide exposure, and in water (mineral medium) augmented with microorganisms present in activated sludge. The biodegradability of the cation and anion was found to depend on the test system (water or soil). The cation was mineralized in water, whereas the anion was fully utilized in soil. These results suggest that performing biodegradation tests using differently C-13-labeled species of the target HIL and mimicking various environmental compartments (e.g., soil, activated sludge) is needed to provide a better understanding of the fate of HILs in the environment. They also indicate that biodegradation kinetic parameters of HILs derived from experiments performed in aqueous systems should not be used to estimate biodegradation rates in terrestrial environments.

Microbial inoculant and garbage enzyme reduced cadmium (Cd) uptake in *Salvia miltiorrhiza* (Bge.) under Cd stress

Authors: Wei XM, Cao P, Wang G, Han JP

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 192, 2020, DOI: 10.1016/j.ecoenv.2020.110311

Abstract: The uptake and accumulation of cadmium (Cd) in *Salvia miltiorrhiza* (Bge.) negatively affects the quality of its harvested roots, and seriously threatens human health. This study investigates the effect of a microbial inoculant (MI) and garbage enzyme (GE) on Cd uptake, the accumulation of bioactive compounds, and the community composition of microbes in the rhizosphere soil of *S. miltiorrhiza* under Cd stress. *S. miltiorrhiza* seedlings were transplanted to Cd-contaminated pots and irrigated with an MI, GE, a combination of an MI and GE (MIGE) or water (control). The results indicated that treatments with an Ml, GE or MIGE can reduce Cd uptake in S. miltiorrhiza. The MIGE treatment had greater efficiency in reducing Cd uptake than the control (reduction by 37.90%), followed by the GE (25.31%) and MI (5.84%) treatments. Treatments with an MI, GE and MIGE had no significant impact on fresh and dry root biomass. Relative to the control, the MI treatment had the highest efficiency in increasing the accumulation of total tanshinones (an increase of 40.45%), followed by the GE treatment (40.08%), with the MIGE treatment (9.90%) treatment not having a more favorable effect than the separate application of an MI or GE. The salvianolic acid content for all groups was higher than the standard prescribed by Chinese pharmacopoeia, notwithstanding a slightly lower level in the treated groups relative to the control. In addition, metagenomic analysis indicated changes in the relative abundance of soil microbes associated with the bioremediation of heavy metals. The relative abundances of Brevundimonas, Microbacterium, Cupriavidus and Aspergillus were significantly greater in the treated groups than in the Control. These results suggest that using MI and GE, either separately or together, may not only improve the quality of *S. miltiorrhiza* but may also facilitate the microbial remediation of soil contaminated with Cd.

Impact of pesticide monocrotophos on microbial populations and histology of intestine in the Indian earthworm Lampito mauritii (Kinberg)

Authors: Kavitha V, Anandhan R, Alharbi N, Kadaikunnan S, Khaled JM, Almanaa TN, Govindarajan M

Source: MICROBIAL PATHOGENESIS, 139, 2020, DOI: 10.1016/j.micpath.2019.103893

Abstract: Soil contamination has enlarged over the decades due to intensive use of pesticides and chemical fertilizers in agronomy. Earthworms are significant organisms in the soil community. Earthworms are the major role in soil fertility in most ecological system and the production of biogenic structures. Moreover, earthworm gut mucus enhances the beneficial soil microorganism potential biological activities. They are used as model organisms for assessing the ecological risks of chemicals. Enrichment of essential nutrients in soil through earthworm is a cost-effective and eco-friendly approach. In India, the organophosphorus pesticide monocrotophos is commonly used to control agricultural pests. Hence, it is important to study the effect of monocrotophos on the gut microbiota in *Lampito mauritii*. A 15-day exposure to a low (1/10th of the LC50 after 96 h i.e., 0.093 ppm kg(-1)) and high sublethal concentration (1/3rd of the LC50 after 96 h i.e., 0.311 ppm kg(-1)) of monocrotophos led to reduced proliferation of the gut microbiota in *L. mauritii*. However, exposure for 30 days led to a recuperation of the microbial populations to near control values. Among the eight bacterial and five fungal species that inhabit the gut of *L. mauritii*, only six bacterial and three fungal species were able to survive after exposure to monocrotophos. In addition to the study, histopathological changes were observed in the intestine of *L. mauritii* after application of lower sublethal concentration of monocrotophos. Severe pathological changes such as vacuolization, degenerated nuclei, damaged villi and congestion of the blood sinuses were noticed in the intestine on 1st and, 5th day of the experiment. But in 30th day the damages were slowly recovered due to degradation of monocrotophos by the presence of some pesticides degrading bacterial and fungal species

and regenerative capability of chloragogen cells in the intestine. The results suggested that reduced microbial populations and pathological damages in intestine were observed during the application of monocrotophos. So, the monocrotophos have several harmful impacts on earthworms.

Soil Microbial Communities in Diverse Agroecosystems Exposed to the Herbicide Glyphosate

Authors: Kepler RM, Schmidt DJE, Yarwood SA, Cavigelli MA, Reddy KN, Duke SO, Bradley CA, Williams MM, Buyer JS, Maul JE

Source: APPLIED AND ENVIRONMENTAL MICROBIOLOGY 86(5), 2020, DOI: 10.1128/AEM.01744-19

Abstract: Despite glyphosate's wide use for weed control in agriculture, questions remain about the herbicide's effect on soil microbial communities. The existing scientific literature contains conflicting results, from no observable effect of glyphosate to the enrichment of agricultural pathogens such as *Fusarium* spp. We conducted a comprehensive field-based study to compare the microbial communities on the roots of plants that received a foliar application of glyphosate to adjacent plants that did not. The 2-year study was conducted in Beltsville, MD, and Stoneville, MS, with corn and soybean crops grown in a variety of organic and conventional farming systems. By sequencing environmental metabarcode amplicons, the prokaryotic and fungal communities were described, along with chemical and physical properties of the soil. Sections of corn and soybean roots were plated to screen for the presence of plant pathogens. Geography, farming system, and season were significant factors determining the composition of fungal and prokaryotic communities. Plots treated with glyphosate did not differ from untreated plots in overall microbial community composition after controlling for other factors. We did not detect an effect of glyphosate treatment on the relative abundance of organisms such as *Fusarium* spp.

IMPORTANCE Increasing the efficiency of food production systems while reducing negative environmental effects remains a key societal challenge to successfully meet the needs of a growing global population. The herbicide glyphosate has become a nearly ubiquitous component of agricultural production across the globe, enabling an increasing adoption of no-till agriculture. Despite this widespread use, there remains considerable debate on the consequences of glyphosate exposure. In this paper, we examine the effect of glyphosate on soil microbial communities associated with the roots of glyphosate-resistant crops. Using metabarcoding techniques, we evaluated prokaryotic and fungal communities from agricultural soil samples (n = 768). No effects of glyphosate were found on soil microbial communities associated with glyphosate-resistant corn and soybean varieties across diverse farming systems.

Zinc resistance of six dark septate endophytic fungi and the growth response of tomato

Authors: Lin LC

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH 18(1):389-400, 2020, DOI: 10.15666/aeer/1801_389400

Abstract: Dark septate endophytic fungi (DSEF) can promote the growth response of host plants and can increase their resistance to heavy metals. In this study, six isolated DSEFs were proven to be able to form microsclerotia with plants. The objective of this study was to investigate the promoting and inoculation effects of these six DSEFs. Molecular analysis showed that the DSEFs may be new additions to the fungal flora of Taiwan and may be new species in the world. Screening and selection of Zn-resistant DSEFs showed that only two strains, CkDB5 and RrtHH10, were Zn-resistant. Evaluation of the Zn resistance range of CkDB5 and RrtHH10 revealed that the former presented lower EM50 values than the latter, and that both strains showed the same minimum inhibitory concentration values. As the Zn concentration increased, twisting and looping of the mycelial morphology of the strains was observed. Resynthesis experiments proved that CkDB5 and RrtHH10 could promote the growth response of tomato. The biomasses of CkDB5-inoculated plants was up to four times higher than that of the controls. This study showed that, of the six DSEFs, only CkDB5 and RrtHH10 showed Zn-resistance. CkDB5 is a fungus with particularly

high Zn resistance, and it could facilitate tomato growth.

Effects of soil chemical properties and fractions of Pb, Cd, and Zn on bacterial and fungal communities

Authors: Pan XM, Zhang SR, Zhong QM, Gong, GS, Wang GY, Guo X, Xu XX

Source: SCIENCE OF THE TOTAL ENVIRONMENT 715, 2020, DOI: 10.1016/j.scitotenv.2020.136904

Abstract: Heavy metal contamination in soils poses a serious threat to microorganisms, which play important roles in soil biogeochemical process. However, the key fractions of heavy metals affecting soil microorganisms are still unclear. In this study, DNA sequencing, redundancy and variance partition analysis were performed to investigate the combined effects of heavy metal fractions and soil chemical properties on microbial communities in Pb, Cd, and Zn co-contaminated soils. The results showed that long-term exposure of microorganisms to these metals changed the richness, diversity, and structure of their communities. The bacterial and fungal Chao richness indexes decreased, but only the bacterial Shannon index improved with increasing metal concentrations. Moreover, soil available potassium and add-extractable Pb made the greatest contributions to variations in the bacterial community structure, while soil pH, water-extractable Pb and Zn were the dominant factors influencing the fungal community structure. In addition, Marmoricola, Nocardioides, and Gibberella were sensitive to these metals. Overall, the effects of different heavy metal fractions on microorganisms varied significantly, and these metal fractions together with soil chemical properties determined the soil microbial communities. (C) 2020 Elsevier B.V. All rights reserved.

Optimization of Paraquat degradation with microbial consortium from contaminated soil using statistic mehod

Authors: Teerakun M, Reungsang A, Chaowarat, M, Saraphirom P

Source: INTERNATIONAL JOURNAL OF GEOMATE 18(68):73-79, 2020, DOI: 10.21660/2020.68.5676

Abstract: Paraquat is one of non-selective herbicides, widely used in Thailand and other countries that can be used to prevent and mitigate problems with weeds that have become resistant. It has a broad spectrum of weed knockdown herbicide which can be easily distributed in an aquatic environment due to its high solubility in water. The aim of the research is to study the optimization condition for biodegradation of paraquat by microbial consortium using an orthogonal array design in culture media. The microbial consortium which can degrade paraquat were isolated from cassava rhizosphere soil with a historic area of using paraquat in Kalasin, Thailand Analysis of the 16S rDNA gene sequences compared with the database in Gen Bank demonstrated that microbial consortium showed the similarity with *Sphingomicrobium marinum* (97%), *Ferrovibrio xuzhouensis* (93%), *Azospirillum lipoferum* (93%), *Altererythrobacter xinjiangensis* (94%), *Xanthobacter autofrophicus* (92%) and *Azospirillum amazonense* (99%). To achieve the biodegradation experiments, orthogonal arrays design was investigated, with the three independent variables: glucose concentration (1-20 g/L), paraquat concentration (10-100 mg/L) and inoculum concentration (110%). The biodegradation consortium was done triplicate in 250 mL Erlenmeyer flask at 30 degrees C 150 rpm for 35 days. Paraquat biodegradation was reported as biodegradation percentage. The results demonstrated that the optimum concentrations of glucose, paraquat, and inoculum for paraquat biodegradation were 1 g/L, 10 mg/L, and 5%, respectively. The paraquat removal efficiency of 95.69% was achieved under the optimal condition.

A slurry microcosm study on the interaction between antibiotics and soil bacterial community

Authors: Dong XH, Rao DW, Tian LJ, Wang QZ, Yang K

Source: HELIYON 6(2), 2020, DOI: 10.1016/j.heliyon.2020.e03348

Abstract: Antibiotics released in the environment have attracted great attention. The environmental emission control of antibiotics should be based on the degree of their negative impacts on the environment and ecology. Here, we conducted a series of soil slurry microcosm experiments to investigate the interactions between antibiotics and the soil bacterial community. In the soil slurry, distinctive behaviors were observed for different antibiotics. Betalactams (ampicillin and ceftriaxone) experienced fast biodegradation. Kanamycin was adsorbed on soil particles soon after its addition. Nalidixic acid was stable throughout the experimental period (164 h). The main inactivation mechanism of tetracycline was deduced to be hydrolysis. Bacterial communities in slurries with or without antibiotic-treatment were profiled via high-throughput Illumina sequencing of the 16S rRNA gene. Unstable (ceftriaxone) and adsorbed (kanamycin) antibiotics show minor or negligible influences on the soil bacterial community. Stable antibiotics (nalidixic acid and tetracycline) have significantly affected the structure of the bacterial community. Most of enriched bacterial genera by various antibiotics belong to the same phylum, Proteobacteria. Inhibited bacterial phyla by nalidixic acid are Firmicutes and Bacteroidetes, while those inhibited by tetracycline are Firmicutes, Bacteroidetes and Cyanobacteria. According to the PICRUSt prediction of metagenome, influence of antibiotics on overall metabolic function of the bacterial community is rather limited. This study has provided valuable information, from a phylogenetic viewpoint, about the influence of high concentration of antibiotics on soil bacterial community.

Role of extracellular polymeric substance (EPS) in toxicity response of soil *bacteria Bacillus* sp. S3 to multiple heavy metals

Authors: Zeng Weimin, Li Fang, Wu Chenchen... more

Source: BIOPROCESS AND BIOSYSTEMS ENGINEERING 43(1):153-167, 2020, DOI: 10.1007/s00449-019-02213-7

Abstract: Heavy metal resistant bacteria are of great interest because of their potential use in bioremediation. Understanding the survival and adaptive strategies of these bacteria under heavy metal stress is important for better utilization of these bacteria in remediation. The objective of this study was to investigate the role of bacterial extracellular polymeric substance (EPS) in detoxifying against different heavy metals in Bacillus sp. S3, a new hyper antimony-oxidizing bacterium previously isolated from contaminated mine soils. The results showed that Bacillus sp. S3 is a multi-metal resistant bacterial strain, especially to Sb(III), Cu(II) and Cr(VI). Toxic Cd(II), Cr(VI) and Cu(II) could stimulate the secretion of EPS in *Bacillus* sp. S3, significantly enhancing the adsorption and detoxification capacity of heavy metals. Both Fourier transform infrared spectroscopy (FTIR) and three-dimensional excitation-emission matrix (3D-EEM) analysis further confirmed that proteins were the main compounds of EPS for metal binding. In contrast, the EPS production was not induced under Sb(III) stress. Furthermore, the TEM-EDX micrograph showed that Bacillus sp. S3 strain preferentially transported the Sb(III) to the inside of the cell rather than adsorbed it on the extracellular surface, indicating intracellular detoxification rather than extracellular EPS precipitation played an important role in microbial resistance towards Sb(III). Together, our study suggests that the toxicity response of EPS to heavy metals is associated with difference in EPS properties, metal types and corresponding environmental conditions, which is likely to contribute to microbial-mediated remediation.

Microsegmented flow-assisted miniaturized culturing for isolation and characterization of heavy metal-tolerant bacteria

Authors: Cao J, Kalensee F, Guenther PM, Koehler JM

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY 17(1):1-16, 2020, DOI: 10.1007/s13762-019-02424-1

Abstract: Soils are complex ecosystem, and their function in the environment is mainly determined by the microbial communities. Metal-tolerant micro-organisms have an important function in the formation of soil and the development of microbial communities in all areas where heavy metals are released by natural erosion processes or by human activities. The investigation of dose-dependent growth and behaviour is an essential part of the search for heavy metal-tolerant microorganism communities and their characterization. In this study, next-generation sequencing was used for the analysis of soil sample and reduced communities and droplet-based microfluidics was used to assess the growth behaviour of unknown bacterial communities and single strains in response to different heavy metal ions. Highly resolved dose-response functions of the bacterial communities reflect the specific character in their concentration-dependent response to different culture media and heavy metals of copper, nickel and cobalt. Besides the characterization of community responses, they allowed to characterize newly isolated strains. Concentration-dependent growth patterns of the micro-organisms in the droplets could be observed. The investigation demonstrates the potential of droplet-based microfluidics for miniaturized eco-toxicological studies and their suitability for the discovery of novel strains with special tolerance features.

Incorporation of cyclodiene pesticides and their polar metabolites to model membranes of soil bacteria

Authors: Wojcik Aneta, Perczyk Paulina, Wydro Pawel, Broniatowski Marcin

Source: JOURNAL OF MOLECULAR LIQUIDS 298:112019, 2020, DOI: 10.1016/j.molliq.2019.112019

Abstract: The world-wide application of cyclodiene pesticides (CP) lead to severe pollution of arable land and because of the long half-lives they will be for many decades present in the soil. The only reasonable way of the elimination of these chemicals from the soil is bioremediation - the introduction to the soil of decomposer microorganisms strains capable of CP degradation. CP are highly hydrophobic and exhibit large membrane activity; thus, they can be incorporated to the cellular membrane and retained therein. The presence of CP and their metabolites in the cellular membrane of the decomposer organism can lead to severe alterations of its function and in consequence to the death of the decomposer cell. Microorganisms protect themselves changing the phospholipid composition of their membranes. To shed light on the correlation between the membrane composition and its interactions with CP and their metabolites we applied Langmuir monolayers as versatile models of decomposers' membranes. By the proper selection of phospholipids we prepared different models of cellular membranes of Gram-negative and Gram-positive bacteria. The model membranes were doped by four most frequently applied CP and their common metabolite. The combined application of microscopic, diffractometric and spectroscopic methods proved that CP can be incorporated into the model membranes and that the membrane activity of endosulfan is comparable with endrin - one of the most toxic pesticides. The penetration tests and spectroscopic studies proved also the possibility of the uptake of the polar CP metabolites by the model membranes from the aqueous subphase.

Fire Phoenix facilitates phytoremediation of PAH-Cd co-contaminated soil through promotion of beneficial rhizosphere bacterial communities

Authors: Dai Yuanyuan, Liu Rui, Zhou Yuemei, Li Na, Hou Liqun... more

Source: ENVIRONMENT INTERNATIONAL 136:UNSP 105421, 2020, DOI: 10.1016/j.envint.2019.105421

Abstract: Pot experiments were conducted in a growth chamber to evaluate the phytoremediation efficiency and rhizosphere regulation mechanism of Fire Phoenix (a mixture of Festuca L.) in polycyclic aromatic hydrocarbon-cadmium (PAH-Cd) co-contaminated soils. Plant biomass, removal rates of PAHs and Cd, soil enzyme activity, and soil bacterial community were determined. After 150 days of planting, the removal rates of the total 4 PAHs and Cd reached 64.57% and 40.93% in co-contaminated soils with low-PAH (104.79-144.87 mg.kg(-1)), and 68.29% and 25.40% in co-contaminated soils with high-PAH (169.17-197.44 mg.kg(-1)), respectively. The polyphenol oxidase (PPO) activity decreased in soils having Fire Phoenix, while the dehydrogenase (DHO) activity increased as the changes of DHO activity had a strong positive correlation with the removal rates of PAHs and Cd in the low-PAH soils ($r = 0.862$ ($P < 0.006$) and 0.913 ($P < 0.002$), respectively). Meanwhile, successional changes in the bacterial communities were detected using high-throughput 454 Gs-FLX pyrosequencing of the 16S rRNA, and these changes were especially apparent for the co-contaminated soils with the low PAH concentration. The Fire Phoenix could promote the growth of Mycobacterium, Dokdonella, Gordonia and Kaistobacter, which played important roles in PAHs degradation or Cd dissipation. These results indicated that Fire Phoenix could effectively motivate the soil enzyme and bacterial community and enhance the potential for phytoremediation of PAH-Cd co-contaminated soils.

Effects of pesticide residues on bacterial community diversity and structure in typical greenhouse soils with increasing cultivation years in Northern China

Authors: Wang Chao-Nan, Wu Rui-Lin, Li Yu-Yan, Qin Yi-Fan, Li Yi-Long... more

Source: SCIENCE OF THE TOTAL ENVIRONMENT 710:136321, 2020, DOI: 10.1016/j.scitotenv.2019.136321

Abstract: The understanding of soil microbiome is important for sustainable cultivation, especially under greenhouse conditions. Here, we investigated the changes in soil pesticide residues and microbial diversity and community structure at different cultivation years under a greenhouse system. The 9-to-14 years sites were found to have the least diversity/rich microbial population as compared to sites under 8 years and over 16 years, as analyzed with alpha diversity index. In total, 42 bacterial phyla were identified across soils with different pesticide residues and cultivation ages. Proteobacteria, Acidobacteria, and Bacteroidetes represented the dominant phyla, that accounted for 34.2-43.4%, 9.7-19.3% and 92-16.5% of the total population, respectively. Our data prove that certain pesticides contribute to variation in soil microbial community and that soil bacteria respond differently to cultivation years under greenhouse conditions. Thus, this study provides an insight into microbial community structure changes by pesticides under greenhouse systems and natural biodegradation may have an important part in pesticides soil decontamination.

Exploring bacterial community composition in Mediterranean deep-sea sediments and their role in heavy metal accumulation

Authors: Jroundi Fadwa, Martinez-Ruiz Francisca, Merroun Mohamed L, Teresa Gonzalez-Munoz Maria

Source: SCIENCE OF THE TOTAL ENVIRONMENT 712:135600, 2020, DOI: 10.1016/j.scitotenv.2019.135660

Abstract: The role of microbial processes in bioaccumulation of major and trace elements has been broadly demonstrated. However, microbial communities from marine sediments have been poorly investigated to this regard. In marine environments, particularly under high anthropogenic pressure, heavy metal accumulation increases constantly, which may lead to significant environmental issues. A better knowledge of bacterial diversity and its capability to bioaccumulate metals is essential to face environmental quality assessment. The oligotrophic westernmost Mediterranean, which is highly sensitive to environmental changes and subjected to increasing anthropogenic pressure, was selected for this study. A sediment core spanning the last two millennia was sampled at two intervals, with ages corresponding to 140 (S1) and 1400 (S2) yr BP. High-throughput sequencing showed an abundance of Bacillus, Micrococcus, unclassified members of Planococcaceae, Anaerolineaceae, Planctomycetaceae, Microlunatus, and Microbacterium in both intervals, with slight differences in their abundance, along with newly detected ones in S2, i.e., Propionibacterium, Fictibacillus, Thalassobacillus, and Bacteroides. Canonical correspondence analysis (CCA) and co-occurrence patterns confirmed strong correlations among the taxa and the environmental parameters, suggesting either shared and preferred environmental conditions, or the performance of functions similar to or complementary to each other. These results were further confirmed using culture-dependent methods. The diversity of the culturable bacterial community revealed a predominance of Bacillus, and Micrococcus or Kocuria. The interaction of these bacterial communities with selected heavy metals (Cu, Cr, Zn and Pb) was also investigated, and their capacity of bioaccumulating metals within the cells and/or in the extracellular polymeric substances (EPS) is demonstrated. Interestingly, biomineralization of Pb resulted in the precipitation of Pb phosphates (pyromorphite). Our study supports that remnants of marine bacterial communities can survive in deep-sea sediments over thousands of years. This is extremely important in terms of bioremediation, in particular when considering possible environmentally friendly strategies to bioremediate inorganic contaminants.

Responses of bacterial communities in wheat rhizospheres in different soils to di-n-butyl and di(2-ethylhexyl)phthalate contamination

Authors: Gao Minling, Zhang Ze, Dong Youming... more

Source: GEODERMA 362:114126, 2020, DOI: 10.1016/j.geoderma.2019.114126

Abstract: Di-n-butyl phthalate (DBP) and di(2-ethylhexyl)phthalate (DEHP) are commonly used as plasticizers to enhance the flexibility of plastic products. They are universal pollutants and well-known endocrine disruptors, and their effects on rhizosphere organisms have aroused great concern. In the present study, the effects of DBP and DEHP contamination on bacterial community structure and functions in wheat rhizospheres in fluvo-aquic, cinnamon, and brown soils were investigated using Illumina HiSeq 2500 sequencing. Operational taxonomic unit richness and bacterial diversity were decreased in DEHP-contaminated fluvo-aquic and brown soils, but not in DEHP-contaminated cinnamon and DBP-polluted soils. The relative abundance of some families was positively associated with soil pH, total nitrogen content (TN), and soil organic matter (SOM), and negatively correlated with DBP/DEHP concentration. The relative abundances of families that can extremely effectively degrade DBP/DEHP were enhanced by DBP/DEHP pollution, whereas the relative abundances of some genera that are beneficial to soil health were reduced in the DBP/DEHP-polluted soils. Soil pH, TN, and SOM were crucial in determining the fate and effect of PAEs in the soil ecosystems. In conclusion, DBP/DEHP pollution alters the rhizosphere bacterial community structure and affects microbial metabolic behavior and functional diversity during wheat growth.

The utilization of biomineralization technique based on microbial induced phosphate precipitation in remediation of potentially toxic ions contaminated soil: A mini review

Authors: Jiang Luhua, Liu Xueduan, Yin Huaqun... more

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 191:110009, 2020, DOI: 10.1016/j.ecoenv.2019.110009

Abstract: In recent years, many studies have been devoted to investigate the application of microbial induced phosphate precipitation (MIPP) process for potentially toxic element polluted soil remediation. MIPP biomineralization technique exhibits a great potential to efficiently remediate polluted soil considering its low cost, green and ecofriendly process, and simple in operation. This paper represented a review on the state of the art of polluted soil remediation based on MIPP technique. Briefly, certain defined criteria on targeted microbe selection was discussed; an overall review on the utilization of MIPP process for toxic ions biomineralization in soil was provided; influencing factors reported in the literature, such as pH, temperature, humic substances, coexisting ions, effective microbial population, and enzyme activity, were then comprehensively reviewed; finally; a special emphasis was given to enhance MIPP remediation performance in soil in future research.

Effect of the veterinary ionophore monensin on the structure and activity of a tropical soil bacterial community

Authors: Granados-Chinchilla Fabio, Arias-Andre, Maria de Jesus, Fernandez Montes de Oca Maria Laura, Rodriguez Cesar

Source: JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH PART B-PESTICIDES FOOD CONTAMINANTS AND AGRICULTURAL WASTES 55(2):127-134, 2020, DOI: 10.1080/03601234.2019.1673612

Abstract: Monensin (MON) is a coccidiostat used as a growth promoter that can reach the environment through fertilization with manure from farm animals. To verify whether field-relevant concentrations of this drug negatively influence the structure and activity of tropical soil bacteria, plate counts, CO2 efflux measurements, phospholipid fatty acids (PLFA) and community-level physiological profiling (CLPP) profiles were obtained for soil microcosms exposed to 1 or 10 mg kg(-1) of MON across 11 days. Although 53% (1 mg kg(-1)) to 40% (10 mg kg(-1)) of the MON concentrations added to the microcosms dissipated within 5days, a subtle concentration-dependent decrease in the number of culturable bacteria (<1 log CFU g(-1)), reduced (-20 to -30%) or exacerbated (+25%) soil CO2 effluxes, a marked shift of non-bacterial fatty acids, and altered respiration of amines (1.22-fold decrease) and polymers (1.70-fold increase) were noted in some of the treatments. These results suggest that MON quickly killed some microorganisms and that the surviving populations were selected and metabolically stimulated. Consequently, MON should be monitored in agronomic and environmental systems as part of One Health efforts.

Associative effects of lignin-derived biochar and arbuscular mycorrhizal fungi applied to soil polluted from Pb-acid batteries effluents on barley grain safety

Authors: Khan Muhammad Asaf, Mahmood-ur-Rahman, Ramzani Pia Muhammad Adnan, Zubair Muhammad, Rasool Bilal, Khan Muhammad Kamran, Ahmed Ammar, Khan Shahbaz Ali, Turan Veysel, Iqbal Muhammad

Source: SCIENCE OF THE TOTAL ENVIRONMENT 710:136294, 2020, DOI: 10.1016/j.scitotenv.2019.136294

Abstract: While disobeying environmental regulations of Pakistan, several Pb-acid batteries recycling and repairing units discharge their effluents into water canals that irrigate arable fields. Resultantly, serious ecological risks, as

well as human health hazards through consumption of edible crops grown on such Pb-polluted soils have been reported. In this experiment, we observed associative effects of amending a soil polluted from Pb-add batteries effluents (SPB) with arbuscular mycorrhizal fungi (AMF) and lignin-derived biochar (LBC) on barley grain safety to human health. The SPB was treated with AMF inoculum (a consortium of four AMF species), lignin (IN), and 113C, as sole treatments and AMF inoculum with LN and LBC. Barley parameters involving Pb distribution in grain and other parts, grain biochemistry, and nutrition were assessed. Likewise. Pb bioavailability in SPB, AMF root colonization, soil enzymes, microbial biomass carbon (MBC), and AMP produced total glomalin related soil protein (TGSP) were also scoped. Additionally, human renal cells (HEK 293) cytotoxicity test was performed by opting barley grain-related Pb concentrations. Results show that LBC + AMF significantly reduced grain Pb concentrations below the critical limit [4.67 mg kg(-1) (WHO/FAO standard)], AMF colonization, MBC, soil enzymology, and TGSP, compared to control. Likewise, rest barley parameters were also improved in this treatment Contrary to other treatments, grain produced on LBC + AMF did not result in (a) cell apoptosis, (b) cell distortion and (c) cohesion loss. Immobilization of Pb in SPB was due to the dilution effect of Pb adsorption on LBC, AMF mycelium and TGSP which resulted in a significant drop of grain Pb concentrations below the critical limit and ultimately no harm to HEK 293 cells. Our findings endorse that grain produced at LBC + AMF treatment are safer for human consumption and will not pose health risks. The LBC + AMF application can remediate SPB for safer cereal production.

Effects of Soil Amendments on Microbial Activities in a Typical Cd-Contaminated Purple Field Soil, Southwestern China

Authors: Wang Wenqiang, Zhou Fengwu, Chang Yajun, Cui Jian, He Dongyi, Du Jinmeng, Chan Andy, Yao Dongrui, Li Yong, Chen Zhiyuan... more

Source: BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY 104(3):380-385, 2020, DOI: 10.1007/s00128-020-02786-0

Abstract: In this study, three soil amendments (inorganic, liming, or organic-inorganic materials) were used in a Cd-contaminated purple field soil to investigate their impacts on soil Cd availability, enzyme (urease, catalase, sucrase, and acid phosphatase) activities, microbial biomass (carbon/nitrogen) and type (bacteria, fungi, and actinomycetes) in mustard and corn trials. Results showed that soil amendments generally decreased soil exchangeable Cd, fungi and bacterial populations while increasing the activities of all the four soil enzymes tested, microbial biomass carbon and populations of actinomycetes ($p < 0.05$). Soil pH and microbial biomass nitrogen did not exhibit any significant response ($p > 0.05$) whereas stronger effects appeared in soil organic matter and available nutrients (nitrogen, phosphorous and potassium; $p < 0.05$). However, only soil available phosphorous significantly correlated with soil microbial activity in both mustard and corn trails ($p < 0.05$). Thus, application of phosphorous-containing amendments should be considered for promoting soil health in the remediation of the Cd-contaminated purple soils.

Biodegradation of Organophosphorus Compounds Predicted by Enzymatic Process Using Molecular Modelling and Observed in Soil Samples Through Analytical Techniques and Microbiological Analysis: A Comparison

Authors: Cardozo Monique, de Almeida Joyce S, F D, Cavalcante Samir F de A, Salgado Jacqueline RS, Goncalves Arlan S, Franca, Tanos CC, Kuca Kamil, Bizzo Humberto R

Source: MOLECULES 25(1):58, 2020, DOI: 10.3390/molecules25010058

Abstract: Organophosphorus compounds (OP) are chemicals widely used as pesticides in different applications such as agriculture and public health (vector control), and some of the highly toxic forms have been used as chemical weapons. After

application of OPs in an environment, they persist for a period, suffering a degradation process where the biotic factors are considered the most relevant forms. However, to date, the biodegradation of OP compounds is not well understood. There are a plenty of structure-based biodegradation estimation methods, but none of them consider enzymatic interaction in predicting and better comprehending the differences in the fate of OPs in the environment. It is well known that enzymatic processes are the most relevant processes in biodegradation, and that hydrolysis is the main pathway in the natural elimination of OPs in soil samples. Due to this, we carried out theoretical studies in order to investigate the interactions of these OPs with a chosen enzyme-the phosphotriesterase. This one is characteristic of some soils' microorganisms, and has been identified as a key player in many biodegradation processes, thanks to its capability for fast hydrolyzing of different OPs. In parallel, we conducted an experiment using native soil in two conditions, sterilized and not sterilized, spiked with specific amounts of two OPs with similar structure-paraoxon-ethyl (PXN) and O-(4-nitrophenyl) O-ethyl methylphosphonate (NEMP). The amount of OP present in the samples and the appearance of characteristic hydrolysis products were periodically monitored for 40 days using analytical techniques. Moreover, the number of microorganisms present was obtained with plate cell count. Our theoretical results were similar to what was achieved in experimental analysis. Parameters calculated by enzymatic hydrolysis were better for PXN than for NEMP. In soil, PXN suffered a faster hydrolysis than NEMP, and the cell count for PXN was higher than for NEMP, highlighting the higher microbiological toxicity of the latter. All these results pointed out that theoretical study can offer a better comprehension of the possible mechanisms involved in real biodegradation processes, showing potential in exploring how biodegradation of OPs relates with enzymatic interactions.

Enhanced bioremediation of lindane-contaminated soils through microbial bioaugmentation assisted by biostimulation with sugarcane filter cake

Authors: Raimondo Enzo E, Aparicio Juan D, Bigliardo Ana L, Fuentes Maria S, Benimeli Claudia S

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 190:110143, 2020, DOI: 10.1016/j.ecoenv.2019.110143

Abstract: Lindane is a toxic and persistent organochlorine pesticide, whose extensive use generated its accumulation in different environmental matrices. Bioremediation is a promising technology that can be used combining bioaugmentation and biostimulation processes to soil restoration. The aim of the present work was to determine the conditions of maximum lindane removal by bioaugmentation with an actinobacteria consortium and biostimulation with sugarcane filter cake (SCFC). The assays were carried out on lindane-contaminated silty loam (SLS), clayey (CS), and sandy (SS) soils. Through complete factorial designs, the effects of three abiotic factors (moisture content, proportion and size of SCFC particles) were evaluated on lindane removal. In addition, a response optimizer determined the optimal conditions for pesticide removal in bioaugmented and biostimulated soils, in the range of levels studied for each factor. In these conditions, bioaugmentation of biostimulated soils increased the pesticide removal (SLS: 61.4%, CS: 70.8%, SS: 86.3%), heterotrophic microbial counts, and soil enzymatic activities, and decreased lindane T-1/2, regarding the non-bioaugmented biostimulated controls, after 14 days of assay. The values of these parameters confirmed the efficiency of the bioremediation process. Finally, the viability of the four strains was demonstrated at the end of the assay. The results indicate that the simultaneous application of bioaugmentation with the actinobacteria consortium and biostimulation with SCFC constitutes a promising tool for restoring soils contaminated with lindane, by using the optimal conditions obtained through the factorial designs.

Variation in soil microbial population and enzyme activities under faba bean as affected by pentachlorophenol

Authors: Siczek Anna, Frac Magdalena, Gryta Agata, Kalembasa Stanislaw, Kalembasa Dorota

Source: APPLIED SOIL ECOLOGY 150:UNSP 103466, 2020, DOI: 10.1016/j.apsoil.2019.103466

Abstract: Pentachlorophenol (PCP) is a widely detectable toxic chemical with a detrimental effect on the functioning of ecosystems. A field trial was undertaken to study its effects on the activities, metabolic and genetic diversifies, as well as soil bacterial and fungal community composition. The seeds of faba bean (*Vicia faba* L.) were either treated (PCP) or left untreated (Control) with pentachlorophenol before sowing. During the vegetative period, soil samples were taken three times from the rhizosphere in order to assess the influence of PCP on soil enzymatic activity, metabolic diversity (Biolog EcoPlate), community of ammonia-oxidizing archaea (DGGE and t-RFLP) and the fungal and bacterial microbiome (NGS). PCP treatment led to a considerable reduction in the activities of enzymes connected with the N cycle (protease and urease) and showed a significant negative correlation with them (r = -0.934 and - 0.716, respectively). Dehydrogenase and respiration activities were also reduced by PCP. In contrast to other enzymes analysed, PCP significantly increased acid phosphomonoesterase activity compared to the Control (r = 0.850). PCP also decreased the carbon utilization efficiency of indigenous microbes and caused the lower utilization of amines, amides and carboxylic acids. The amount of isolated DNA was lower in PCP-treated soil than in the Control. The technique of t-RFLP fingerprinting revealed the changes caused by contamination and new specific fragments were observed in PCP-contaminated soil. Additionally, pentachlorophenol changed more fungal than bacterial structures in the faba bean rhizosphere. For most of the analysis parameters, the effect of PCP was notable during the entire analysis period of faba bean growth (from 5-6 leaves to pod formation). The results demonstrated the harmful effect of PCP on soil activity and changes in soil microorganism genetic diversity, which could result in the deterioration of the environment for soil function and processes as well as for plant growth.

Development of microbial communities in organochlorine pesticide contaminated soil: A post-reclamation perspective

Authors: Balazs Helga E, Schmid Christoph AO, Podar Dorina, Hufnagel Gudrun, Radl Viviane, Schroeder Peter

Source: APPLIED SOIL ECOLOGY 150:UNSP 103467, 2020, DOI: 10.1016/j.apsoil.2019.103467

Abstract: In order to meet constantly increasing demands for land without damaging pristine environments like forests or grasslands, reclamation and re-purposing of historically contaminated areas should become a priority. Successful reclamation goes hand in hand with the soil functional recovery potential and with resilient microbial communities capable of performing the necessary ecosystem services. In this context, we designed a greenhouse pot experiment as a mock reclamation situation, where traces of lindane at hazard threshold and twice the concentration accepted for waste deposits are left in the soil after conventional clean-up by excavation and land filling. We assessed the effects of lindane at 50 and 100 mg kg(-1) regarding crop growth and nutrient turnover (with focus on the nitrogen cycle) as two key parameters for soil functions. The bulk and rhizosphere soil bacterial community composition were chosen as parameters for soil resilience in lindane contamination conditions. Lindane severely affected plant growth and development. The potential nitrogen fixation, quantified as nifH gene copy number, suffered direct negative effects of lindane contamination in bulk soil, which could represent an additional obstacle for phytoremediation. Changes in rhizosphere bacterial community composition were related to lindane toxic effects towards the plants, which might have supported the growth of opportunists and saprophytes. In bulk soil, the bacterial community shifted towards lindane tolerant taxa like Sphingomonas and Porphyrobacter that are interesting with regard to their applications in bioremediation. We concluded that lindane at

hazard threshold concentration left in soil after clean-up has negative effects both soil functionality, and the recovery of the bacterial communities to their original composition when lindane resistant plant crops are not involved.

Biodegradation and biotransformation of pentachlorophenol by wood-decaying white rot fungus *Phlebia acanthocystis* TMIC34875

Authors: Xiao Pengfei, Kondo Ryuichiro

Source: JOURNAL OF WOOD SCIENCE 66(1):2, 2020, DOI: 10.1186/s10086-020-1849-6

Abstract: Pentachlorophenol (PCP) has been introduced into the environment mainly as a wood preservative and biocide. The degradation and transformation of PCP in liquid culture by wood-decaying fungus capable of degrading organochlorine pesticides was investigated in this study. The results of tolerance test showed that the tolerance level of *Phlebia acanthocystis* to PCP in potato dextrose agar medium was higher than that of other Phlebia species. At the end of 10 days of incubation, P. acanthocystis was able to remove 100% and 76% of PCP (25 μM) in low-nitrogen and potato dextrose broth media, respectively. The decrease of PCP in *P. acanthocystis* culture is accompanied by the formation of pentachloroanisole and p-tetrachlorohydroquinone via methylation and oxidation reactions. Moreover, the p-tetrachlorohydroquinone formed is rapidly converted to methylated products including tetrachloro-4-methoxyphenol and tetrachloro-1,4-dimethoxybenzene. The activities of lignin peroxidase and manganese peroxidase were found to increase in extracellular fluid from fungal culture treated with high-concentration PCP, with maximum values of 169.6 U/L and 73.4 U/L, respectively. The in vitro degradation of PCP and p-tetrachlorohydroquinone was confirmed using extracellular fluid of *P. acanthocystis*, suggested that the methylation of both compounds is related to extracellular enzymes. Degradation of PCP was efficiently inhibited by piperonyl butoxide or 1-aminobenzotriazole, demonstrating that cytochrome P450 monooxygenase is involved in fungal transformation of PCP, particularly in the oxidation of PCP to p-tetrachlorohydroquinone. Additionally, *P. acanthocystis* mineralized 9.3% of the PCP to (CO2)-C-14 in low-nitrogen culture during 42 days. Results obtained in the present study are in favor of the use of *P. acanthocystis* as a microbial tool of remediation of PCP-contaminated sites.

Impacts of Cu and sulfadiazine on soil potential nitrification and diversity of ammonia-oxidizing archaea and bacteria

Authors: Liao Qiang, Li Mingzhu, Dong Yuanpeng, Wu Mi, Meng Zilin, Zhang Qian, Liu Aiju

Source: ENVIRONMENTAL POLLUTANTS AND BIOAVAILABILITY 31(1):60-69, 2019, DOI: 10.1080/26395940.2018.1564629

Abstract: Soil potential nitrification rate (PNR) and diversity of ammonia-oxidizing microbes were investigated in spiked soils with Cu and Sulfadiazine (SDZ). An obvious decrease of PNR was observed with the increase of Cu and SDZ concentrations in the soil. Real-time fluorescence quota PCR result showed that AOA and AOB were slightly stimulated at the gene level in both contaminated soils. Sequential analysis indicated that 200 mg kg(-1) Cu could improve AOA diversity but reduce AOB diversity, but 5 mg kg(-1) SDZ caused a decrease of both AOA and AOB diversity. Microbial community's analysis also found that 200 mg kg(-1) Cu and 5 mg kg(-1) SDZ had different influence on the populations of AOA and AOB. It could be concluded that Cu and SDZ might have a different ecological effect mechanism on soil potential nitrification and ammonia-oxidizing microbial communities.

Hydrogeochemical and microbiological effects of simulated recharge and drying within a 2D meso-scale aquifer

Authors: Regnery Julia, Li Dong, Lee Jonghyun, Smits Kathleen M, Sharp Jonathan O

Source: CHEMOSPHERE 241:UNSP 125116, 2020, DOI: 10.1016/j.chemosphere.2019.125116

Abstrac: tOscillating cycles of dewatering (termed drying) and rewetting during managed aquifer recharge (MAR) are used to maintain infiltration rates and could also exert an influence on subsurface microbial structure and respiratory processes. Despite this practice, little knowledge is available about changes to microbial community structure and trace organic chemical biodegradation potential in MAR systems under these conditions. A biologically active two-dimensional (2D) synthetic MAR system equipped with automated sensors (temperature, water pressure, conductivity, soil moisture, oxidation-reduction potential) and embedded water and soil sampling ports was used to test and model these important subsurface processes at the meso-scale. The fate and transport of the antiepileptic drug carbamazepine, the antibiotics sulfamethoxazole and trimethoprim, and the flame retardant tris (2-chloroethyl) phosphate were simulated using the finite element analysis model, FEFLOW. All of these compounds exhibit moderate to poor biodegradability in MAR systems. Within the operational MAR scenario tested, three episodic drying cycles spanning between 18 and 24 days were conducted over a period of 184 days. Notably, cessation of flow and partial dewatering of the 2D synthetic aquifer during dry cycles caused no measurable decrease in soil moisture content beyond the near-surface layer. The episodic flow introduction and dewatering cycles in turn had little impact on overall trace organic chemical biotransformation behavior and soil microbial community structure. However, spatial differences in oxidation-reduction potential and soil moisture were both identified as significant environmental predictors for microbial community structure in the 2D synthetic aquifer.

Association between antibiotic residues, antibiotic resistant bacteria and antibiotic resistance genes in anthropogenic wastewater - An evaluation of clinical influences

Authors: Voigt AM, Zacharias N, Timm C, Wasser F, Sib E, Skutlarek D, Parcina M, Schmithausen RM, Schwartz T, Hembach N ... more

Source: CHEMOSPHERE 241:UNSP 125032, 2020, DOI: 10.1016/j.chemosphere.2019.125032

Abstract: The high use of antibiotics in human and veterinary medicine has led to a wide spread of antibiotics and antimicrobial resistance into the environment. In recent years, various studies have shown that antibiotic residues, resistant bacteria and resistance genes, occur in aquatic environments and that clinical wastewater seems to be a hot spot for the environmental spread of antibiotic resistance. Here a representative statistical analysis of various sampling points is presented, containing different proportions of clinically influenced wastewater. The statistical analysis contains the calculation of the odds ratios for any combination of antibiotics with resistant bacteria or resistance genes, respectively. The results were screened for an increased probability of detecting resistant bacteria, or resistance genes, with the simultaneous presence of antibiotic residues. Positive associated sets were then compared, with regards to the detected median concentration, at the investigated sampling points. All results show that the sampling points with the highest proportion of clinical wastewater always form a distinct cluster concerning resistance. The results shown in this study lead to the assumption that ciprofloxacin is a good indicator of the presence of multidrug resistant *P. aeruginosa* and extended spectrum beta-lactamase (ESBL)-producing *Klebsiella* spec., E*nterobacter* spec. and *Citrobacter* spec., as it positively relates with both parameters. Furthermore, a precise relationship between carbapenemase genes and meropenem, regarding the respective sampling sites, could be obtained. These results highlight the role of clinical wastewater for the dissemination and development of multidrug resistance.

Antibiotic Residues and Antibiotic-Resistant Bacteria in Pig Slurry Used to Fertilize Agricultural Fields

Authors: Rasschaert Geertrui, Van Elst Daan, Colson Lander, Herman Lieve, De Carvalho Ferreira Helena Cardoso, Dewulf Jeroen, Decrop

Johan, Meirlaen Jurgen, Heyndrickx Marc, Daeseleire Els

Source: ANTIBIOTICS-BASEL 9(1):34, 2020, DOI: 10.3390/antibiotics9010034

Abstract: Pig manure may contain antibiotic residues, antibiotic-resistant bacteria or pathogens, which may reach the environment upon fertilization. During this study, 69 antibiotic residues belonging to 12 classes were quantified in 89 pig slurry samples. These samples were also studied for the presence of Salmonella and for *E. coli* resistant to meropenem, colistin, ciprofloxacin, or cefotaxim. The obtained isolates were further tested for antibacterial susceptibility. No antibiotic residues were detected in four samples, whereas in the other samples, up to 12 antibiotics were found. The most frequently detected antibiotic residues were doxycycline, sulfadiazine, and lincomycin. Doxycycline was found in the highest concentration with a mean of 1476 µg/kg manure (range: 18-13632 µg/kg). Tylosin and oxytetracycline were found with mean concentrations of 784 µg/kg (range: 17-5599 µg/kg) and 482 µg/kg (range: 11-3865 µg/kg), respectively. Lincomycin, had a mean concentration of 177 µg/kg manure (range: 9-3154 µg/kg). All other 18 antibiotic residues were found with mean concentrations of less than 100 µg/kg manure. Fifty-one slurry samples harbored Salmonella; 35% of the Salmonella isolates were sensitive to a panel of 14 antibiotics, whereas the other 65% were resistant up to five antibiotics. For *E. coli*, 52 manure samples contained *E. coli* isolates which were resistant to ciprofloxacin and 22 resistant to cefotaxime. All ciprofloxacin and cefotaxime-resistant isolates were multi-resistant, with resistance up to nine and eight antibiotics, respectively. This research indicates that pig slurry used for fertilization often contains antibiotic residues and antibiotic-resistant bacteria, including pathogens.

Characterization of tetracycline effects on microbial community, antibiotic resistance genes and antibiotic resistance of *Aeromonas* spp. in gut of goldfish *Carassius auratus* Linnaeus

Authors: Jia Jia, Cheng Mengqian, Xue Xue, Guan Yongjing Wang Zaizhao

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 191:110182, 2020, DOI: 10.1016/j.ecoenv.2020.110182

Abstract: The gut of aquatic animals was a significant niche for dissemination of antibiotic resistance genes (ARGs) and direct response of living conditions. In this study, the gut microbiota of goldfish *Carassius auratus* Linnaeus was sampled at 7 days and 21 days after treatment with tetracycline at 0.285 and 2.85 µg L-1 to investigate the influences on the microbial structure and antibiotic resistance. The proportion of tetracycline resistance bacteria was 1.02% in the control group, while increased to 23.00%, 38.43%, 62.05% in groups of high concentration for 7 days (H7), low concentration for 21 days (L21) and high concentration for 21 days (H21), respectively. Compared to the control group, the diversity of isolated *Aeromonas* spp. was decreased in the treatment groups and the minimal inhibitory concentration (MIC) of resistant isolates was enhanced from 32 to 256 mu g mL(-1) with the treatment of tetracycline in time- and dose-dependent manners. Furthermore, the abundance of most genes was increased in treatment groups and efflux genes mainly responded to the stress of tetracycline with an average level of 1.0 x 10(-2). After treatment with tetracycline, the predominant species were changed both at phylum and genus levels. The present study explored the impact of tetracycline on gut microbiota of goldfish at environmentally realistic concentrations for the first time and our findings will provide a reference for characterizing the microbiome of fish in the natural environment.

Rapid elimination of foodborne and environmental fungal contaminants by benzo analogs

Authors: Kim et al

Source: J Sci Food Agric, 2020, DOI: 10.1002/jsfa.10288

Abstract: Contamination of food or the environment by fungi, especially those resistant to conventional fungicides or drugs, represents a hazard to human health. The objective of this study is to identify safe, natural antifungal agents that can remove fungal pathogens or contaminants rapidly from food and / or environmental sources. Fifteen antifungal compounds (nine benzo derivatives as candidates; six conventional fungicides as references) were investigated. (...) when OG, CA, and 2H5M were examined in commercial food matrices, organic apple, or grape juices, only CA maintained a similar level of antifungal activity, compared with a PBS bioassay. trans-Cinnamaldehyde showed higher antifungal activity (...). trans-Cinnamaldehyde could be developed as a potent antifungal agent in food processing or soil sanitation by reducing the time / cost necessary for fungal removal. Published 2020. This article is a U.S. Government work and is in the public domain in the USA.

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / PESTICIDES ET FAUNE SAUVAGE

Oxidative stress risk assessment through heavy metal and arsenic exposure in terrestrial and aquatic bird species of Pakistan

Authors: Kanwal et al

Source: Environ Sci Pollut Res Int 27(11):12293-12307, 2020, doi: 10.1007/s11356-020-07649-z

Abstract: In this study, we investigated metal- and metalloid-induced oxidative stress response in two aquatic (cattle egret (*Bubulcus ibis*) (n = 10), pond heron (*Ardeola grayii*) (n = 10)), as well as two terrestrial (spotted owlet (*Athene brama*) (n = 6) and bank myna (*Acridotheres ginginianus*) (n = 16)) bird species collected from the outskirts of Lahore city, Pakistan. For this purpose, glutathione (tGSH) and lipid peroxidation (thiobarbituric acid-reactive substances (TBARS)) levels and activities of antioxidant enzymes (superoxide dismutase (SOD); catalase (CAT)) were analyzed as biomarkers of oxidative stress against metal (Pb, Cd, Cu, Zn) and metalloid (As) concentrations in kidney liver and blood of birds. Our results depicted significant correlation for Pb, Cd, and As with oxidative stress biomarkers in birds. The levels of heavy metals and As and their corresponding effects on oxidative stress biomarkers were comparably higher in aquatic species ($p \leq 0.01$) except for Pb and Zn. The overall order of metal accumulation and subsequent oxidative damage among families followed the pattern as Strigidae ≥Ardieda ≥ Sturnidae with their respective trophic levels. (...)

Accès au document

Content of essential and non-essential elements in wild animals from western Ukraine and the health risks associated with meat and liver consumption

Source: Pilarczyk et al.

Source: Chemosphere 244, 2020, DOI: 10.1016/j.chemosphere.2019.125506.

Abstract: (...) The purpose of the work was to determine the levels of selected toxic and non-toxic elements in the tissues of free-living animals (...) to assess the health risks associated with meat and liver consumption. The test material comprised muscle, liver and kidney samples taken from 12 wild boar (*Sus scrofa*), 10 roe deer (*Capreolus capreolus*), 8 hares (*Lepus europaeus* L.). The permissible concentration of Pb was exceeded in all meat and offal samples. The permissible concentration of Cd was exceeded in muscle of wild boar. (...) However, in neither case was the HQ or HI found to be greater than 1, which indicates a low probability of the development of adverse health effects associated with the consumption of game.

Accès au document

Ingestion of unusual items by wetland birds in urban landscapes Microsoft Word

Authors: Francis et al

Source: CURRENT SCIENCE 118(6):25, 2020, doi: 10.18520/cs/v118/i6/977-983

Abstract: In view of the variety of waste items casually disposed off by humans, a survey was conducted in two cities, Indore and Coimbatore, in roosting sites of colonial birds looking for unusual items in their food. Of the 891 regurgitated pellets of birds examined, about 53% in Coimbatore and 14% in Indore contained rubber bands, rubber balloons and small plastic debris. Rub-ber bands (95.3%), balloon (2.35%), plastic bits (1.41%) and plastic cap (0.94%) were found in the pellets. (...). These findings show that the birds mis-judge an artefact as natural prey. (...) The potential hazard from such leachable contaminants needs to be further stu-died. (...)

Accès au document

Organic farming benefits birds most in regions with more intensive agriculture

Authors: Kirk, DA, Martin, AE, Freemark Lindsay, KE

Source: J Appl Ecol. 00: 1–13, 2020, doi: 10.1111/1365-2664.13589

Abstract: Organic farming is considered beneficial for biodiversity conservation in agricultural landscapes but the role of agricultural land use intensity ('agricultural intensity'), particularly at regional scales, has often been neglected. (...). The effect of organic farming on the cross-species abundance of birds was only statistically supported in Ontario when not accounting for agricultural intensity. However, the estimated effect of organic farming was the same whether or not we controlled for agricultural intensity in Saskatchewan (supported positive effect) and Québec (unsupported effect). (...) Our results showed, for the first time in North America, an effect of regional-scale agricultural intensity on the potential benefit of organic farms.

Additionally, we showed that benefits of organic farming can be overestimated if the effects of local- and landscape-scale agricultural intensity are not considered. However, positive effects of organic farming on cross-species abundance and the abundance of individual species were still detectable when we controlled for agricultural intensity at local- and landscape-scales.

Accès au document

Juvenile Toxicity Rodent Model to Study Toxicological Effects of Bisphenol A (BPA) at Dose Levels Derived from Italian Children

Authors: Tassinari et al

Source: Biomonitoring Study. Toxicological Sciences, 173:387–401, 2020, doi: 10.1093/toxsci/kfz226

Abstract: Bisphenol A (BPA) is a plasticizer with endocrine disrupting properties (...). This study aimed to evaluate BPA modes of action and hazards during animal juvenile life-stage, corresponding to childhood. Immature Sprague-Dawley rats of both sexes were orally treated with 0, 2, 6, and 18 mg/kg bw per day of BPA for 28 days, from weaning to sexual maturity. Dose levels were obtained from the PERSUADED biomonitoring study in Italian children. (...) General toxicity, parameters of sexual development, endocrine/reproductive/functional liver and kidney biomarkers, histopathology of target tissues, and gene expression in hypothalamic-pituitary area and liver were studied. No mortality or general toxicity occurred. (...) Thyroid homeostasis and liver were the most sensitive targets of BPA exposure in the peripubertal phase. (...). The BMD lower bounds were 0.05 and 1.33 mg/kg bw in males and females, considering liver and thyroid biomarkers, respectively. (...) identify sex-specific, targeted toxicological effects that may have significant impact on risk assessment for children.

Accès au document

Uptake, Metabolism, and Elimination of Fungicides from Coated Wheat Seeds in Japanese Quail (*Coturnix japonica*)

Authors: Gross et al.

Source: J. Agric. Food Chem. 68:1514-1524, 2020, doi: 10.1021/acs.jafc.9b05668

Abstract: Pesticides coated to the seed surface potentially pose an ecological risk to granivorous birds (...). To assess the toxicokinetics of seeds treated (...) Coturnix japonica were orally dosed with commercially coated wheat seeds. Quail were exposed to metalaxyl, tebuconazole, and fludioxonil at either a low dose (0.0655, 0.0308, and 0.0328 mg/kg of body weight, respectively) or a high dose (0.196, 0.0925, and 0.0985 mg/kg of body weight, respectively). Fungicides were rapidly absorbed and distributed to tissues. (...) All compounds were eliminated to below detection limits within 24 h. The high detection frequencies observed in fecal samples potentially offer a non-invasive matrix to monitor pesticide exposure. With the summation of total body burden across plasma, tissue, and fecal samples, less than 9% of the administered dose was identified as the parent fungicide (...).

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / PESTICIDES/CLIMAT et VdT/Enchytreides

Enchytraeus crypticus Avoid Soil Spiked with Microplastic

Author: Pflugmacher S, Huttunen JH, von Wolff A, Penttinen OP, Kim YJ, Kim S, Mitrovic SM, Esterhuizen-Londt M

Source: TOXICS 10:MDPI 2020, DOI: 10.3390/toxics8010010

Abstract: Microplstics (MPs) of varying sizes are widespread pollutants in our environment. The general opinion is that the smaller the size, the more dangerous the MPs are due to enhanced uptake possibilities. It would be of considerably ecological significance to understand the response of biota to microplastic contamination both physically and physiologically. Here, we report on an area choice experiment (avoidance test) using Enchytraeus crypticus, in which we mixed different amounts of high-density polyethylene microplastic particles into the soil. In all experimental scenarios, more Enchytraeids moved to the unspiked sections or chose a lower MP-concentration. Worms in contact with MP exhibited an enhanced oxidative stress status, measured as the induced activity of the antioxidative enzymes catalase and glutathione S-transferase. As plastic polymers per se are nontoxic, the exposure time employed was too short for chemicals to leach from the microplastic, and as the microplastic particles used in these experiments were too large (4 mm) to be consumed by the Enchytraeids, the likely cause for the avoidance and oxidative stress could be linked to altered soil properties.

Accès au document

Opening a can of worms: Can the availability of soil invertebrates be indicated by birds?

Recently detected invertebrate population declines are likely to have far-reaching impacts for ecosystem function. However, very little large-scale monitoring of invertebrates, especially soil invertebrates, has taken place. To address t...

DOI: 10.1016/j.ecolind.2020.106222

Accès au document

Effects of elevated temperatures and cadmium exposure on stress biomarkers at different biological complexity levels in *Eisenia fetida* earthworms

Several ecotoxicological studies assessed metal toxicity upon soil biota and other communities but were mainly focused on the study of a single chemical and usually under optimal conditions of temperature. Meanwhile an increasing global...

DOI: 10.1016/j.cbpc.2020.108735

Accès au document

Evaluating the effects of the tebuconazole on the earthworm, *Eisenia fetida* by H-1 NMR-Based untargeted metabolomics and mRNA assay

Tebuconazole, a widely used fungicide, can severely disrupt the reproductive process of various organisms. In this study, we investigated the subacute effects of tebuconazole on the earthworm to fully understand its toxic implications...

DOI: 10.1016/j.ecoenv.2020.110370

Accès au document

Impact of temperature on the toxicity of Kraft 36 EC (R) (a.s. abamectin) and Score 250 EC (R) (a.s. difenoconazole) to soil organisms under realistic environmental exposure scenarios

Pesticides can affect all receiving compartments, especially soils, and their fate and effects may be enhanced by temperature, increasing their risk to ecological functions of soils. In Brazil, the most widely used pesticides are the ins...

DOI: 10.1016/j.ecoenv.2020.110446

Accès au document

Combined effects of goethite nanoparticles with metallic contaminants and an organophosphorus pesticide on *Eisenia andrei*

The effects of mixtures of nanoparticles (NPs) and other chemicals have been poorly studied in terrestrial invertebrates. In this study, we investigated the effects of binary mixtures of goethite (alpha-FeOOH) NPs and metallic (Cd and Pb...

DOI: 10.1007/s11356-020-08547-0

Accès au document

Effect of phenanthrene on the biological characteristics of earthworm casts and their relationships with digestive and anti-oxidative systems

Earthworms as ecosystem engineers partially improve soil properties by egesting casts. Our previous study confirmed that soil pollution affects the physico-chemical properties of earthworm casts. It is still unclear whether the biologica...

DOI: 10.1016/j.ecoenv.2020.110359

Accès au document

Exposure of earthworm (*Eisenia fetida*) to bauxite residue: Implications for future rehabilitation programmes

Bauxite residue is typically alkaline, has high sodium content and elevated concentrations of trace elements. Effective rehabilitation strategies are needed to mitigate potential environmental risks from its disposal and storage. Increas...

DOI: 10.1016/j.scitotenv.2020.137126

Accès au document

Toxicity of imidacloprid to the earthworm *Eisenia andrei* and collembolan *Folsomia candida* in three contrasting tropical soils

Purpose Imidacloprid is a widely used seed dressing insecticide in Brazil. However, the effects of this pesticide on non-target organisms such as soil fauna still present some knowledge gaps in tropical soils. This study aimed to assess...

DOI: 10.1007/s11368-019-02538-6

Accès au document

Applying fungicide on earthworms: Biochemical effects of *Eisenia fetida* exposed to fluoxastrobin in three natural soils

Fluoxastrobin is one of the most widely used strobilurin fungicides, however, application of the fungicides may result in soil residues leading to environmental damage including oxidative stress and damage to sentinel organisms (i.e. ear...

DOI: 10.1016/j.envpol.2019.113666

Accès au document

A reconsideration of the safety of fenoxycarb (IGR) in soil environment: The toxicity of fenoxycarb to *Yuukianura szeptyckii* (Collembola)

Fenoxycarb, a juvenile hormone agonist has been widely used to control various insect pests in agriculture. Fenoxycarb has been considered environmentally safe because it degrades quickly and has lower mammalian toxicity compared with ma...

DOI: 10.1016/j.aspen.2019.12.006

Accès au document

Impact of pesticide monocrotophos on microbial populations and histology of intestine in the Indian earthworm *Lampito mauritii* (Kinberg)

Soil contamination has enlarged over the decades due to intensive use of pesticides and chemical fertilizers in agronomy. Earthworms are significant organisms in the soil community. Earthworms are the major role in soil fertility in most...

DOI: 10.1016/j.micpath.2019.103893

Accès au document

A sensitive optical-based test method for the locomotor activity of earthworms

The outdated test methodologies for terrestrial animals have limited the progress of soil ecotoxicology to some extent. To improve the behavioral testing of earthworms, a terrestrial model animal, a sensitive optical-based method for det...

DOI: 10.1016/j.scitotenv.2020.136966

Accès au document

Toxicity in Neonicotinoids to *Folsomia candida* and *Eisenia andrei*

We compared the toxicity of the neonicotinoids imidacloprid, thiacloprid, thiamethoxam, acetamiprid, and clothianidin in terms of the survival and reproduction of 2 species of soil invertebrates, *Folsomia candida* and *Eisenia andrei*. Test...

DOI: 10.1002/etc.4634

Accès au document

Biochemical responses and DNA damage induced by herbicide QYR301 in earthworm (*Eisenia fetida*)

QYR301, a novel herbicidal inhibitor of 4-hydroxyphenylpyruvate dioxygenase (HPPD), has great potential for resistant weed control in paddy fields, but massive use of pesticides may result in toxicity to soil non-target organisms. Thus, ...

DOI: 10.1016/j.chemosphere.2019.125512

Accès au document

An energy-based model to analyze growth data of earthworms exposed to two fungicides

The pesticide risk assessment for earthworms is currently performed using standardized tests, the model species Eisenia fetida, and the analyses of the data obtained are performed with ad hoc statistical tools. We assessed the impact of ...

DOI: 10.1007/s11356-019-06985-z

Accès au document

First report on a classification-based QSAR model for chemical toxicity to earthworm

As the use of the pesticides has increased extensively in the farming fields to have a better agricultural production, the negative impacts of such use have also increased exponentially. Hence, the toxic effects of pesticides along with ...

DOI: 10.1016/j.jhazmat.2019.121660

Accès au document

The sublethal lead (Pb) toxicity to the earthworm *Eisenia fetida* (Annelida, Oligochaeta) as affected by NaCl salinity and manure addition in a calcareous clay loam soil during an indoor mesocosm experiment

The combined effects of salinity and organic amendments on lead (Pb) toxicity to earthworms as important components of soil invertebrates are still largely unknown. A mesocosm experiment was conducted to examine how the combined use of N...

DOI: 10.1016/j.ecoenv.2019.110083

Accès au document

Glyphosate spraying and earthworm *Lumbricus terrestris* L. activity: Evaluating short-term impact in a glasshouse experiment simulating cereal post-harvest

A glasshouse experiment was conducted to study if glyphosate spraying has immediate short-term effects on the growth, reproduction and residue incorporation of the earthworm species *Lumbricus terrestris* L. The experiment simulated post-h...

DOI10.1016/j.ejsobi.2019.103148

Accès au document

Glyphosate but not Roundup harms earthworms (*Eisenia fetida*)

Glyphosate is the active ingredient in Roundup (R) formulations. While multiple studies have documented the toxicity, environmental persistence, and tendency to spread for glyphosate and Roundup (R), few studies have compared the toxicit...

DOI: 10.1016/j.chemosphere.2019.125017

Accès au document

Individual and cellular responses of earthworms (*Eisenia fetida*) to endosulfan at environmentally related concentrations

The presence of endosulfan at high levels in soils poses a potential risk for terrestrial ecosystems and human health via the food chain. Therefore, the effects of endosulfan at environmentally related doses on the terrestrial biota are...

DOI: 10.1016/j.etap.2019.103299

Accès au document

Leaching of insecticides used in blueberry production and their toxicity to red worm

Soil columns were collected from a blueberry field, and insecticide solutions were allowed to leach through these columns. Insecticides from four different chemical classes were applied at two different rates: the concentration at which...

DOI: 10.1016/j.chemosphere.2019.125091

Accès au document

Exploring QSAR modeling of toxicity of chemicals on earthworm

Earthworm provides sustainability towards the agroecosystem which can be degraded day by day by the extensive use of pesticides (e.g., fungicides, insecticides and herbicides). The present study attempts to develop a predictive quantitat...

DOI: 10.1016/j.ecoenv.2019.110067

accès au document

DROIT ET POLITIQUE DE L'ENVIRONNEMENT

Le réseau d'épidémiosurveillance financé par le plan Ecophyto - Réorientations à opérer

La mission conjointe CGEDD-CGAAER d'expertise relative aux réorientations à opérer du réseau d'épidémiosurveillance est intervenue dans un contexte où les moyens alloués à cette action du plan Ecophyto ont été réduits de 23 % pour l'année 2019. Mis en en place en 2009 dans le cadre du plan Ecophyto, le réseau d'épidémiosurveillance est une des composantes de la surveillance biologique du territoire et s'inscrit dans le cadre de la directive 2009/128/CE du Parlement

européen et du Conseil du 21 octobre 2009 instaurant un cadre d'action communautaire pour parvenir à une utilisation des pesticides compatible avec le développement durable. Ce réseau fonctionne de manière relativement autonome au sein du plan Ecophyto et par rapport aux plans officiels de surveillance des organismes nuisibles réglementés. […]

Auteurs : LAVARDE Patrick, MALEZIEUX Sylvie, BELLEMAIN Véronique

Rapport

Accès au document

DROIT ET REGLEMENTATION

Produits biocides «HYPRED's octanoic acid based products» : règlement d'autorisation de l'Union

REGLEMENT D'EXÉCUTION (UE) 2020/579 DE LA COMMISSION du 27 avril 2020 accordant une autorisation de l'Union pour la famille de produits biocides «HYPRED's octanoic acid based products»

Numéro officiel : UE/2020/579

Date de signature : 27/04/2020

Accès au document

Famille de produits biocides «SOPURCLEAN» : réglement d'autorisation de l'Union

REGLEMENT D'EXÉCUTION (UE) 2020/580 DE LA COMMISSION du 27 avril 2020 accordant une autorisation de l'Union pour la famille de produits biocides «SOPURCLEAN»

Numéro officiel : UE/2020/580

Date de signature : 27/04/2020

Accès au document

Suspension d'introduction, d'importation et de mise sur le marché en France de cerises fraîches destinées à l'alimentation produites dans un pays autorisant le traitement des cerisiers avec des produits phytopharmaceutiques contenant la substance active diméthoate

Arrêté du 8 avril 2020 portant suspension d'introduction, d'importation et de mise sur le marché en France de cerises fraîches destinées à l'alimentation produites dans un pays autorisant le traitement des cerisiers avec des produits phytopharmaceutiques contenant la substance active diméthoate

Numéro officiel : AGRG2009406A

Date de signature : 08/04/2020

Accès au document

Prolongation de la période d'approbation des substances actives «abamectine»

RÈGLEMENT D'EXÉCUTION (UE) 2020/421 DE LA COMMISSION du 18 mars 2020 modifiant le règlement d'exécution (UE) n° 540/2011 en ce qui concerne la prolongation de la période d'approbation des substances actives «abamectine», «Bacillus subtilis (Cohn 1872) - souche QST 713», «Bacillus thuringiensis subsp. aizawai - souches ABTS-1857 et GC-91», «Bacillus thuringiensis subsp. israeliensis (sérotype H-14) - souche AM65-52», «Bacillus thuringiensis subsp. kurstaki - souches ABTS 351, PB 54, SA 11, SA 12 et EG 2348», «Beauveria bassiana - souches ATCC 74040 et GHA», «clodinafop», «clopyralid», «Cydia pomonella Granulovirus (CpGV)», «cyprodinil», «dichlorprop-P», «fenpyroximate», «fosétyl», «Lecanicillium muscarium (anciennement «Verticillium lecanii») - souche Ve6», «mépanipyrim», «Metarhizium anisopliae (var. anisopliae) - souche BIPESCO 5/F52»,

«metconazole», «metrafenone», «Phlebiopsis gigantea - souches FOC PG 410.3, VRA 1835 et VRA 1984», «pirimicarbe», «Pseudomonas chlororaphis - souche MA342», «pyriméthanile», «Pythium oligandrum M1», «rimsulfuron», «spinosad», «Streptomyces K61 (anciennement «griseoviridis»)», «Trichoderma asperellum (anciennement «harzianum») - souches ICC012, T25 et TV1», «Trichoderma atroviride (anciennement «T. harzianum») - souches IMI 206040 et T11», «Trichoderma gamsii (anciennement «T. viride») - souche ICC080», «Trichoderma harzianum - souches T-22 et ITEM 908», «triclopyr», «trinexapac», «triticonazole» et «zirame»

numéro : UE/2020/421

signé(e) le : 18/03/2020

Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Produits phytopharmaceutiques : autorisations de mise sur le marché d'une durée maximale de 120 jours délivrées par le ministère dans des situations d'urgence phytosanitaire

Dans le cadre de la loi d'avenir pour l'agriculture, l'alimentation et la forêt (LAAAF) du 13 octobre 2014, le ministère chargé de l'Agriculture reste compétent pour délivrer, dans des situations d'urgence phytosanitaire, des autorisations de mise sur le marché d'une durée maximale de 120 jours. Ces décisions sont rendues publiques sur le site du ministère durant leur période de validité. [...]

Accès au document

Liste des produits de biocontrôle

Cette note établit la liste des produits phytopharmaceutiques de biocontrôle, au titre des articles L.253-5 et L.253-7 du code rural et de la pêche maritime. Elle définit également la méthodologie d'élaboration de la liste, et notamment les critères généraux de définition des produits concernés.

Accès au document

REGLEMENTATION / DEBAT

Parliament objects to lead in PVC to protect public health and the environment

MEPs have vetoed a Commission proposal that would have allowed some lead in recycled PVC.

The Commission has proposed to amend the rules concerning lead concentration in PVC. As a general rule, 0,1 % lead would have been tolerated in PVC, but higher thresholds would have been allowed for recycled PVC (2 % in rigid PVC and 1 % in flexible/soft PVC).

With 394 votes for, 241 votes against and 13 abstentions, MEPs on Wednesday rejected the Commission's proposal.

MEPs believe the proposal goes against the main principle of the REACH regulation, which is to protect human health and the environment. They recall that lead is a toxic substance that can seriously affect health, including irreversible neurological damage, even in low doses. They believe that the levels proposed by the Commission do not correspond to "safe levels" and underline that alternatives are available.

The Parliament's objection means that the draft measure shall not be adopted by the Commission. The Commission may either submit an amended draft or present a new one.

Parliament has long held the position that recycling PVC must not perpetuate the problem of heavy metals. European producers began to phase out lead in PVC in 2015, due to the EU PVC industry's voluntary commitment, some lead is still present in imported PVC.

Accès au document

AVIS / EXPERTISES / NORMES

Outcome of the consultation with Member States, the applicant and EFSA on the pesticide risk assessment for isopyrazam in light of confirmatory data

The European Food Safety Authority (EFSA) was asked by the European Commission to provide scientific assistance with respect to the risk assessment for an active substance in light of confirmatory data requested following approval in accordance with Article 6(1) of Directive 91/414/EEC and Article 6(f) of Regulation (EC)No 1107/2009. In this context EFSA's scientific views on the specific points raised during the commenting phase conducted with Member States, the applicant and EFSA on the confirmatory data and their use in the risk assessment for isopyrazam are presented. The current report summarises the outcome of the consultation process organised by the rapporteur Member State the United Kingdom and presents EFSA's scientific views and conclusions on the individual comments received.

https://doi.org/10.2903/sp.efsa.2020.EN-1811

Accès au document

PUBLICATIONS DU RESEAU ECOTOX

Potential Use of Earthworms to Enhance Decaying of Biodegradable Plastics

Authors: Sanchez-Hernandez JC, Capowiez Y, Ro KS

Source: ACS SUSTAINABLE CHEMISTRY & ENGINEERING 8(11):4292-4316, 2020, DOI: 10.1021/acssuschemeng.9b05450

Abstract: Biosolid application, wastewater irrigation, and plastic mulching technologies are major sources of plastic pollution in agroecosystems. Microplastics may interact with soil physicochemical properties and organisms and negatively affect plant growth. To alleviate environmental plastic pollution, synthetic and biobased biodegradable polymers are replacing nonbiodegradable polymers, but their biodegradation rate in the field is frequently lower than that estimated from standardized biodegradation testing. Plastic polymer biodegradation is a multistep process that involves plastic deterioration, microbial colonization, production of polymer-degrading exoenzymes, and mineralization. However, these physicochemical and biological processes are not always efficient because of unfavorable environmental conditions (e.g., temperature, soil moisture). We propose to use earthworms to increase the biodegradable polymer biodegradation rate by creating optimal habitats for microbial proliferation. Earthworm-induced processes that lead to soil alteration (bioturbation) and solid organic wastes decomposition (vermicomposting) are described to understand how earthworms may favor biodegradable plastic mineralization. Therefore, we suggest two practical sustainable bioengineering strategies: (1) enhancing bioturbation by inoculating agricultural soils with soil-dwelling earthworms, which is viable for horticulture where using biodegradable mulching films increases plastic debris in the soil and (2) vermicomposting with blended biodegradable plastic debris and solid organic wastes, which is complementary to industrial or home composting of single-use biodegradable plastics.

Genotoxicity in the rivers from the Brantas catchment (East Java, Indonesia): occurrence in sediments and effects in *Oreochromis niloticus* (Linn AE us 1758)

Authors: Risjani Y, Loppion G, Couteau JM, Yunianta Y, Widowati I, Hermawati A, Minier, C

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early access, 2020, DOI: 10.1007/s11356-020-08575-w

Abstract: This paper reports the first data from an integrated study investigating genotoxicity in the Brantas River, Java, Indonesia. Results showed that organic sediment extracts from the sites in the Brantas Delta retained genotoxic compounds identified using the SOS Chromotest and that the Aloo River and, to a lesser extent, the Surabaya River were the most contaminated studied sites. This genotoxicity was attributable to compounds that did not require any bioactivation under the test conditions. Occurrence of genotoxic effects was further investigated in erythrocytes from Nile tilapia, Oreochromis niloticus. High numbers of micronuclei were counted, especially in fish sampled in the rivers of the Brantas Delta. Moreover, cytoplasmic alterations which could be indicative of the presence of lipofuscin were found in the cytoplasm of the fish blood cells, especially in fish from the Aloo, Surabaya and Kalimas rivers. Altogether, our data showed that genotoxicity is occurring in fish living in rivers of the delta of the Brantas River and suggest that sediments from these sites may constitute a major source of pollution and hazard for species living or feeding in the area.

Determination of polycyclic aromatic hydrocarbon (PAH) contents in micro-volumes of the whole blood and liver of Red Kite by a simplified GC-MS/MS method

Authors: Morin-Crini N, Scheifler R, Amiot C, Riols R, Coeurdassier M

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY 2020 Early access, DOI: 10.1080/03067319.2020.1726899

Abstract: The aim of this work was to determine PAH concentrations in two matrices, fluid samples and biological tissue, from Red Kite. For this purpose, a simplified and sensitive method for the analysis of 16 PAHs at trace levels in small samples of whole blood and liver was developed and validated using dispersive extraction in n-hexane combined with gas chromatography-triple quadrupole mass spectrometry (GC-MS/MS). For blood and liver, the average limits of detection were 0.71 ng mL(-1) and 3.16 ng g(-1), the mean relative standard deviations (RSD (%)) were 16% and 15%, and the mean relative recoveries were 100% and 92% for all PAH compounds, respectively. This method was applied to PAH determination in the liver and blood of Red kites from wild populations. At least one PAH was detected in the blood and in the liver of 83% and 62% of the individual birds, respectively. Acenaphthene, anthracene and phenanthrene were the most frequently detected in the blood, while the blood concentrations of naphthalene, phenanthrene and pyrene were the highest. In the liver, fluoranthene was detected in 54% of the individual birds, followed by naphthalene, fluoranthene, phenanthrene and benzo[k]fluoranthene, with the highest concentrations being those of naphthalene and phenanthrene. This demonstrated that our method is suitable for assessing trace levels of PAHs in red kite blood and tissue and monitoring exposure in their natural environment. Moreover, our data show that raptors may be exposed to a mixture of PAHs, among which some belong to the IARC carcinogen classes for humans 1 and 2B, throughout their life cycle.

Health risk assessment to dioxins, furans and PCBs in young children: The first French evaluation

Authors: Hulin M, Sirot V, Vasseur P, Mahe A, Leblanc JC, Jean J, Marchand P, Venisseau A, Le Bizec B, Riviere G

Source: FOOD AND CHEMICAL TOXICOLOGY 139:111292, 2020, DOI: 10.1016/j.fct.2020.111292

Abstract: A total diet study (TDS) was conducted between 2010 and 2016 to characterize the health risk related to chemical residues in food of French not breastfed children under three years of age (infant TDS). Among the targeted substances, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) have been characterized as they accumulate through the food chain, especially in lipid-rich food items, and because they have been associated with a number of adverse effects in humans.

Food samples (n = 180) were collected to be representative of the dioxins and PCB exposure through the whole diet of non-breastfed children from 1 to 36 months old and prepared as consumed (including cooking) prior to analysis.

Dietary exposure was then assessed for 705 representative children under 3 years of age based on their food consumptions recorded through a 3-consecutive-days record. Levels of PCDD/Fs and PCBs in infant food were lower than those observed in common food, leading to significant differences in exposure according to age groups. Mean exposures to PCDD/Fs ranged from 0.22 to 0.44 pg TEQ(WHO05).kg bw(-1).d(-1) (0.40-0.65 at the 90th percentile), depending on the age group and the hypothesis considered to manage left-censored data. Mean exposure to non-dioxin-like PCBs ranged from 0.87 ng kg bw(-1).d(-1) (1.55 at the 90th percentile) in the 1-4 months old children to 3.53 ng kg bw(-1).d(-1) (5.44 at the 90th percentile) in the 13-36 months old children. For dioxins and NDL-PCBs, the tolerable daily intake (TDI) was exceeded for some age groups, in particular for older ones.

Therefore, appropriate management measures must continue for reducing exposure; it concerns mainly common milk in youngest children, ultra-fresh dairy products and fish. For PCBs, recommendations on fish consumption should be reminded. Moreover, toxicity studies focusing on mixtures of dioxin-like compounds should be encouraged in order to take into account effect of mixtures.

Improving Silver Birch (*Betula pendula*) Growth and Mn Accumulation in Residual Red Gypsum Using Organic Amendments

Authors: Zapata-Carbonell J, Ciadamidaro L, Parelle J, Chalot M, Tatin-Froux F

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8:24, 2020, DOI: 10.3389/fenvs.2020.00024

Abstract: The increasing production of wastes that are landfilled might contribute to sources of potentially toxic elements; this is the case of residual red gypsum tailings, a by-product of titanium dioxide extraction. Revegetation of such a site is essential, and Mn phytoextraction may render the operations economically profitable. This study aimed to apply phytomanagement techniques for increasing the plant development, tailings revegetation and an optimal Mn phytoextraction using silver birch, the most abundant plant species on this site. To enhance the nutrient availability from the tailings, amendments that reduce the pH, i.e., pine bark chips, Miscanthus straw, white peat, and ericaceous compost, were mixed with residual red gypsum and birches were allowed to grow for 3 months. The pine bark chips and ericaceous compost led to a maximum decrease in pH, allowing the accumulation of up to 1400 mg Mn kg(-1) dry matter in the leaves silver birch leaves. However, some nutrient competition was found in the pine bark treatment, which halved biomass production as compared to control. Further amendment addition may be needed to take advantage of the pine bark capabilities as a soil conditioner and Mn solubilizing treatment in residual red gypsum.

Inorganic Mercury and Methyl-Mercury Uptake and Effects in the Aquatic Plant *Elodea nuttallii*: A Review of Multi-Omic Data in the Field and in Controlled Conditions

Authors: Cosio C

Source: APPLIED SCIENCES-BASEL 10(5):1817, 2020, DOI: 10.3390/app10051817

Abstract: (1) Background: Mercury is a threat for the aquatic environment. Nonetheless, the entrance of Hg into food webs is not fully

understood. Macrophytes are both central for Hg entry in food webs and are seen as good candidates for biomonitoring and bioremediation; (2) Methods: We review the knowledge gained on the uptake and effects of inorganic Hg (IHg) and methyl-Hg (MMHg) in the macrophyte Elodea nuttallii found in temperate freshwaters; (3) Results: E. nuttallii bioaccumulates IHg and MMHg, but IHg shows a higher affinity to cell walls. At the individual level, IHg reduced chlorophyll, while MMHg increased anthocyanin. Transcriptomics and metabolomics in shoots revealed that MMHg regulated a higher number of genes than IHg. Proteomics and metabolomics in cytosol revealed that IHg had more effect than MMHg; (4) Conclusions: MMHg and IHg show different cellular toxicity pathways. MMHg's main impact appears on the non-soluble compartment, while IHg's main impact happens on the soluble compartment. This is congruent with the higher affinity of IHg with dissolved OM (DOM) or cell walls. E. nuttallii is promising for biomonitoring, as its uptake and molecular responses reflect exposure to IHg and MMHg. More generally, multi-omics approaches identify cellular toxicity pathways and the early impact of sublethal pollution.

Accumulation, speciation and localization of silver nanoparticles in the earthworm *Eisenia fetida*

Authors: Courtois P, Rorat A, Lemiere S, Levard C, Chaurand P, Grobelak A, Lors C, Vandenbulcke F

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early access, 2020, DOI: 10.1007/s11356-020-08548-z

Abstract: The use of silver nanoparticles (AgNPs) in agriculture and many consumer products has led to a significant release of Ag in the environment. Although Ag toxicity in terrestrial organisms has been studied extensively, very little is known about the accumulation capacity and coping mechanisms of organisms in Ag-contaminated soil. In this context, we exposed *Eisenia fetida* earthworms to artificial OECD soil spiked with a range of concentrations of Ag (AgNPs or AgNO3). The main aims were to (1) identify the location and form of accumulation of Ag in the exposed earthworms and (2) better understand the physiological mechanisms involved in Ag detoxification. The results showed that similar doses of AgNPs or AgNO3 did not have the same effect on *E. fetida* survival. The two forms of Ag added to soil exhibited substantial differences in speciation at the end of exposure, but the Ag speciation and content of Ag in earthworms were similar, suggesting that biotransformation of Ag occurred. Finally, 3D images of intact earthworms obtained by X-ray micro-computed tomography revealed that Ag accumulated preferentially in the chloragogen tissue, coelomocytes, and nephridial epithelium. Thus, *E. fetida* bioaccumulates Ag, but a regulation mechanism limits its impact in a very efficient manner. The location of Ag in the organism, the competition between Ag and Cu, and the speciation of internal Ag suggest a link between Ag and the thiol-rich proteins that are widely present in these tissues, most probably metallothioneins, which are key proteins in the sequestration and detoxification of metals.

Is metallothionein in *Mimachlamys varia* a suitable biomarker of trace elements in the waters of the French Atlantic coast?

Authors: Breitwieser M, Bruneau M, Barbarin M, Churlaud C, Mouneyrac C, Thomas H

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early access, 2020, DOI: 10.1007/s11356-020-08392-1

Abstract: The development of human activities along the Atlantic coast is responsible for the chronic pollution of the environment with organic and inorganic contaminants. In recent years, environmental regulations such as the MSFD (2008/56/EC) and the OSPAR commission have been developed to preserve coastal environments, giving rise to studies in aquatic biomonitoring. One of them is to use biomarkers to observe the pollutants impact on coastal species such as the bivalve Mimachlamys varia. A defence biomarker was considered in this research to study metal accumulation, with metallothioneins (Mts) involved in the uptake, storage and excretion of metals. To achieve this, bivalves were collected in March 2016 in seven sites along the French Atlantic coasts (open area)

and in harbours (semi-open area) with contrasting levels of pollution. Biomarker assays were performed to compare the responses in several tissues (digestive glands, gonads, gills) to inorganic pollutants. The results showed that the accumulation of trace element was different depending on the site and the organ. Mts concentrations were greater in digestive gland compared with gills. Usually, Mts levels were decreased in site showing elevated levels of trace element which explained by downregulation of Mts. Furthermore, results of correlation between Mts and inorganic contaminants and the influence of abiotic factors on Mts suggested that Mts in M. varia is not a relevant biomarker in environments exposed to cocktails of contaminants.

Changes in sediment microbial diversity following chronic copper-exposure induce community copper-tolerance without increasing sensitivity to arsenic

Authors: Ahmed AM, Tardy V, Bonnineau C, Billard P, Pesce S, Lyautey E

Source: JOURNAL OF HAZARDOUS MATERIALS 391:122197, 2020, DOI: 10.1016/j.jhazmat.2020.122197

Abstract: Sediment microbial communities were exposed for 21 days to an environmental concentration of copper to assess Cu-induced composition changes and resulting effects on microbial sensitivity to acute Cu and As toxicity. Chronic Cu exposure reduced the diversity of the bacterial and archaeal communities from Day 0 to Day 21. The pollution-induced community tolerance concept (PICT) predicts that loss of the most sensitive taxa and gain of more tolerant ones should increase the capacity of Cu-exposed communities to tolerate acute Cu toxicity. Although diversity loss and functional costs of adaptation could have increased their sensitivity to subsequent toxic stress, no increased sensitivity to As was observed. PICT responses varied according to heterotrophic activity, selected as the functional endpoint for toxicity testing, with different results for Cu and As. This suggests that induced tolerance to Cu and As was supported by different species with different metabolic capacities. Ecological risk assessment of contaminants would gain accuracy from further research on the relative contribution of tolerance acquisition and co-tolerance processes on the functional response of microbial communities.

Control of poultry contamination in chlordecone-contaminated areas of the French West Indies

Authors: Jurjanz S, Fournier A, Clostre F, Godard E, Feidt C

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, Early access, 2020, DOI: 10.1007/s11356-020-08172-x

Abstract: The consumption of private hold poultry foodstuffs, escaping of official maximum residue limit (MRL) controls in the commercial foodstuff, is an important exposure way for the local populations to chlordecone on the French West Indies. Therefore, chlordecone contamination of different tissues in 42 birds from 32 private holders was determined depending on the contamination of the soil of the outside plot but also surveying the rearing practices of these holders of both islands. Chlordecone contents in tissues increased rapidly with this of the topsoil of the site. The most sensitive tissues to chlordecone presence were egg yolk and liver, followed by abdominal fat and finally leg tissue. The rearing practices varied between the surveyed private holders of both islands. Nevertheless, practices for the distribution of feed and water as well as covering of soil were hardly protective, what would increase the exposure risk of these birds to this potentially present soil-bound contaminant. Although depuration of birds seems possible, the ongoing modelization of the necessary time to meet MRL thresholds indicates that such time lapse seems hardly compatible with acceptable delays for private holders. Therefore, very protective rearing practices are the main way to obtain poultry foodstuffs compliant to MRL, what seems possible if the topsoil is contaminated at less than 0.1 mg kg(-1) and perhaps up to 0.5 mg kg(-1) if protective practices vis-a-vis of soil exposure are very strict. Nevertheless, a higher contamination of the topsoil seems not compatible with compliant poultry foodstuffs.

A new protocol for the simultaneous flow cytometric analysis of cytotoxicity and immunotoxicity on zebra mussel (*Dreissena polymorpha*) hemocytes

Authors: Barjhoux I, Rioult D, Geffard A, Ladeiro MP

Source: FISH & SHELLFISH IMMUNOLOGY 98:224-235, 2020, DOI: 10.1016/j.fsi.2019.12.092

Abstract: Immunotoxicity analysis receives a strong interest in environmental a priori and a posteriori risk assessment procedures considering the direct involvement of the immune system in the health status of organisms, populations and thus ecosystems. The freshwater mussel *Dreissena polymorpha* is an invasive species widely used in ecotoxicology studies and biomonitoring surveys to evaluate the impacts of contaminants on aquatic fauna. Bivalve hemocytes are the immunocompetent cells circulating in the open circulatory system of the organism. However, there is nowadays no consensus on a protocol to evaluate the immunocompetent state of this particular cell type using flow cytometry. Wild species such as *D. polymorpha* present several technical barriers complicating their analyze including (i) the quality and the purity of the hemolymph sample, (ii) the controversial characterization of hemocyte subpopulations and their diversity, (iii) the quantity of biological material, and (iv) the high inter-individual variability of hemocyte responses. The present work proposes several technical and analytical improvements to control the above-mentioned issues. The inclusion of sedimentation and cell detachment steps in the pre-analytical phase of the protocol substantially ameliorate the quality of the hemolymph sample as well as the accuracy of the cytometric measurements, by selecting the analyzed cells on their adhesion ability and by increasing the concentration of the analyzed events. The development of an effective triple-labeling procedure including the cellular probe Hoechst (R) 33342, the membrane impermeant dye propidium iodide and yellow-green fluorescent microspheres allowed the simultaneous analysis of cytotoxicity and phagocytosis activity in hemocytes. It also significantly enhanced the accuracy of hemocyte endpoint measurements by eliminating non-target events from the analysis and allowing relevant gating strategies. Finally, the use of pooled samples of hemolymph noticeably reduced inter-sample variability while providing more plasticity in the experimental design and improving the discriminating potency between treatments. The developed protocol is suitable for ex vivo exposure of hemocyte in a chemical/environmental toxicity assessment as well as for in vivo exposure in the laboratory or in situ biomonitoring surveys with few adaptations.

How can interspecific interactions in freshwater benthic macroinvertebrates modify trace element availability from sediment?

Authors: Andrade VS, Wiegand C, Pannard A, Gagneten AM, Pedrot M, Bouhnik-Le Coz M, Piscart C

Source: CHEMOSPHERE 245:125594, 2020, DOI: 10.1016/j.chemosphere.2019.125594

Abstract: This study aimed to assess how bioturbation by freshwater benthic macroinvertebrates with different biological traits alone or in combination could modify trace elements (TE) fate between sediment and water, and if water TE concentration and animal TE content impair their body stores. Three macroinvertebrate species were exposed to TE contaminated sediment for 7 days: the omnivorous *Echinogammarus berilloni* (Amphipoda), the sediment feeding *Tubifex tubifex* (Oligochaeta) and the filter feeding *Pisidium* sp. (Bivalvia). Treatments were one without invertebrates (control), two with amphipods or mussels alone, and the combinations amphipod-mussel, and amphipod-mussel-worms. Water TE concentration increased significantly in 2 or 3 species mesocosms, concerning mainly Rare Earth Elements, Cr, U and Pb, known to be associated to the colloidal phase. By contrast, water soluble TE were not affected by animals. For both, amphipods and mussels, TE body content increased with the number of coexisting species. For amphipods, this increase concerned both, soluble and colloid-associated TE, possibly due to intense contact and feeding from sediment and predation on tubificids. TE bioaccumulation in mussel was less important and

characterized by soluble TE, with water filtration as most plausible uptake route. Protein, triglyceride and Whole Body Energy Budget increased in amphipods with the number of coexisting species (probably by feeding on mussels' feces and tubificids) whereas triglycerides declined in mussels (presumably filtration was disturbed by amphipods). This study highlights interspecific interactions as key drivers explaining both: TE bioturbation, depending on their water solubility or colloidal association, and the exposure/contamination of species through another species activity.

Modelling herbicides mobility in amended soils: Calibration and test of PRZM and MACRO

Authors: Marin-Benito JM, Mamy L, Carpio MJ, Sanchez-Martin MJ, Rodriguez-Cruz MS

Source: SCIENCE OF THE TOTAL ENVIRONMENT 717:137019, 2020, DOI: 10.1016/j.scitotenv.2020.137019

Abstract: Addition of organic residues to soil is a current farming practice but it is not considered in the modelling studies for pesticide risk assessment at regulatory level despite its potential impact on the pesticide dynamics in soil. Thus, the objective of this work was to examine and to compare the ability of PRZM and MACRO pesticide fate models to simulate soil water content, and bromide (Br- tracer), chlorotoluron and flufenacet concentrations in the soil profiles (0-100 cm) of one agricultural soil, unamended (control soil, S), amended with spent mush-room substrate (S SMS) or amended with green compost (S + GC). Based on a two-year field-scale dataset, the models were first calibrated against measurements of water and solutes contents in the soil profiles (first year) and then tested without any further model calibration by comparison with the field observations of the second year. In general, the performance of MACRO to simulate the whole dataset in the three soil treatments was higher than that of PRZM. MACRO simulated satisfactorily the water dynamics along the soil profiles whereas it was poorly described by the capacity model PRZM. Both models predicted very well the Br- mobility in control and amended soils after dispersion parameters were fitted to observations. No calibration was necessary to re-produce correctly herbicides vertical distribution in the control soil profile. In the amended soils, MACRO simulations were highly correlated to the observed vertical distribution of flufenacet and chlorotoluron, but calibration of the Kd of chlorotoluron was needed. On the contrary, modelling with PRZM required calibration of Kd and DT50 of both herbicides to obtain an acceptable agreement between observations and predictions in the amended soils. Kd and DT50 calibration was based on the initial dissolved organic carbon contents (DOC) of amended soils. It allowed to take into account the processes that decrease the herbicides sorption on the soil and enhance their bioavailability, but that are not described in PRZM and MACRO (such as the formation of herbicide-DOC mobile complexes). This work showed that models such as PRZM and MACRO are able to simulate the fate of pesticides in amended soils. However, before using these models as predictive tools in large amended soil conditions, and especially in the regulatory context, further modelling studies should focus on other pedoclimatic-pesticides-organic residues combinations, and on longer periods.

Accumulation and immunotoxicity of microplastics in the estuarine worm Hediste diversicolor in environmentally relevant conditions of exposure

Authors: Revel M, Yakovenko N, Caley T, Guillet C, Chatel A, Mouneyrac C

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3574-3583, 2020, DOI: 10.1007/s11356-018-3497-6

Abstract: The presence of plastic debris < 5 mm called microplastics (MPs) which results mainly from macroplastic's fragmentation has been reported in aquatic ecosystems. Several studies have shown that MPs are persistent and their accumulation was observed in various aquatic species. However, the majority of studies focused on marine species, and much less on continental and estuarine biota. The goal of the present study was to investigate the effects of a mixture of two types of MPs (polyethylene and polypropylene), frequently found in natural environments, towards the ragworm Hediste

diversicolor to determine their accumulation in organisms exposed through the water phase or sediment. Two concentrations of exposure were selected for medium and heavily contaminated areas reported for water phase (10 and 100 µg/L) and sediment (10 and 50 mg of MPs/kg). To study the potential toxic effect of MPs, immune parameters were selected since they are involved in many defense mechanisms against xenobiotics or infectious agents. An average number of MP items/worm ranging from 0 to 2.5 and from 1 to 36 were identified in animals exposed to the lowest and the highest concentration of MPs through water exposure. In worms exposed through sediment, less than 1 MP/worm was found and a greater number of particles were identified in depurated sediment. For immunotoxic impact, MP exposure induced a decrease in coelomocytes viability, but no alteration of phagocytosis activity, phenoloxydase, and acid phosphatase was measured. This study brings new results on the potential accumulation and immunotoxicity of MPs for the ragworm H. diversicolor who plays a key role in the structure and functioning of estuarine ecosystem.

A new assay of bacterial selection with Pb reveals an unexpected effect of Pb on bacterial behavior: implications for remediation

Authors: Bouquet D, Lepinay A, Gaudin P, Jean-Soro L, Le Guern C, Lichtfouse E, Lebeau T

Source: ENVIRONMENTAL CHEMISTRY LETTERS Early Access, 2020, DOI: 10.1007/s10311-020-00986-y

Abstract: Soil pollution by lead (Pb) is a major health concern due to Pb toxicity. Phytoextraction could remove Pb, but this technique is limited by the low Pb mobility in soils. Pb mobility can be increased by bioaugmentation, which consists in adding selected bacteria in soil to increase Pb bioavailability. Nonetheless, many bioaugmentation and phytoextraction experiments have failed because bacterial selections did not take into account the presence of metals. Therefore, we developed a microplate assay with Pb-enriched growth media for the rapid selection of bacterial strains. Selection criteria included the ability of bacteria to grow in soils, to promote plant growth and to increase Pb availability. Results show that 100-250 µM Pb induced a decrease of production of indole acetic acid (IAA), a plant growth promotor, by up to 49% for *Cupriavidus metallidurans*, compared to the control without Pb. This finding implies that application in real soil conditions with *C. metallidurans* would have probably failed, thus strengthening the value of our selection method in the presence of Pb. By contrast, 100-250 µM Pb induced a 8.5-11-fold higher degradation of aminocyclopropane carboxylic acid (ACC) by *C. metallidurans*. Surprisingly, *Pseudomonas putida* did not degrade ACC without Pb, but degraded ACC at 100-250 µM Pb. This observation means that Pb activates ACC degradation, which should reduce plant stress because ACC is the precursor of the ethylene phytohormone. Overall, our selection method in the presence of Pb allows to reveal new bacterial properties, which would not have been disclosed by current methods that do not take into account the effect of metals. Our method allows also to test simultaneously about 200 bacterial isolates. In addition, our findings show for the first time that Pb changes the production of IAA and the degradation of ACC.

Effects of in vivo exposure to tritium: a multi-biomarker approach using the fathead minnow, *Pimephales promelas*

Authors: Gagnaire B, Gosselin I, Festarini A, Walsh S, Cavalié I, Adam-Guillermin C, Della-Vedova C, Farrow F, Kim SB, Shkarupin A, Chen HQ, Beaton D, Stuar, M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3612-3623, 2020, DOI: 10.1007/s11356-018-3781-5

Abstract: Tritium (H-3) is a radioactive isotope of hydrogen. In the environment, the most common form of tritium is tritiated water (HTO). However, tritium can also be incorporated into organic molecules, forming organically bound tritium (OBT). The present study characterized the effects of tritium on the health of the fathead minnow, *Pimephales promelas*. Fish were exposed to a gradient of HTO (activity concentrations of 12,000, 25,000, and 180,000 Bq/L) and OBT using

food spiked with tritiated amino acids (OBT only, with an activity concentration of 27,000 Bq/L). A combined exposure condition where fish were placed in 25,000 Bq/L water and received OBT through feed was also studied. Fish were exposed for 60 days, followed by a 60-day depuration period. A battery of health biomarkers were measured in fish tissues at seven time points throughout the 120 days required to complete the exposure and depuration phases. HTO and OBT were also measured in fish tissues at the same time points. Results showed effects of increasing tritiumactivity concentrations in water after 60 days of exposure. The internal dose rates of tritium, estimated from the tissue free-water tritium (TFWT) and OBT activity concentrations, reached a maximum of 0.65 mu Gy/h, which is relatively low considering background levels. No effects were observed on survival, fish condition, and metabolic indices (gonado-, hepato-, and spleno-somatic indexes (GSI, HSI, SSI), RNA/DNA and proteins/DNA ratios). Multivariate analyses showed that several biomarkers (DNA damages, micronucleus frequency, brain acetylcholinesterase, lysosomal membrane integrity, phagocytosis activity, and reactive oxygen species production) were exclusively correlated with fish tritium internal dose rate, showing that tritium induced genotoxicity, as well as neural and immune responses. The results were compared with another study on the same fish species where fish were exposed to tritium and other contaminants in natural environments. Together with the field study, the present work provides useful data to identify biomarkers for tritium exposure and better understand modes of action of tritium on the fathead minnow.

Assessment of swimming behavior of the Pacific oyster D-larvae (*Crassostrea gigas*) following exposure to model pollutants

Authors: Gamain P, Romero-Ramirez A, Gonzalez P, Mazzella N, Gourves PY, Compan C, Morin B, Cachot J

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27 (4):3675-3685, 2020, DOI: 10.1007/s11356-019-04156-8

Abstract: This study describes an image analysis method that has been used to analyze the swimming behavior of native oyster D-larvae (*Crassostrea gigas*) from the Arcachon Bay (SW, France). In a second time, this study evaluated the impact of copper and S-metolachlor pollutants on D-larvae swimming activity and the possible relationship between developmental malformations and abnormal swimming behavior. Analyses in wild and cultivated oyster D-larvae were investigated during two breeding-seasons (2014 and 2015) at different sampling sites and dates. In controlled conditions, the average speed of larvae was 144 mu m s(-1) and the maximum speed was 297 mu m s(-1) while the trajectory is mainly rectilinear. In the presence of environmental concentration of copper or S-metolachlor, no significant difference in maximum or average larval speed was observed compared to the control condition but the percentage of circular trajectory increased significantly while the rectilinear swimming larvae significantly declined. The current study demonstrates that rectilinear trajectories are positively correlated to normal larvae while larvae with shell anomalies are positively correlated to circular trajectories. This abnormal behavior could affect the survival and spread of larvae, and consequently, the recruitment and colonization of new habitats.

Sensitivity to cadmium of the endangered freshwater pearl mussel *Margaritifera margaritifera* from the Dronne River (France): experimental exposure

Authors: Baudrimont M, Gonzalez P, Mesmer-Dudons N, Legeay A

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3715-3725, 2020, DOI: 10.1007/s11356-019-05025-0

Abstract: *Margaritifera margaritifera* is a critically endangered species in Europe. Among the causes explaining its decline, metal pollution had never been deeply studied. Thus, an ecotoxicological investigation was developed on this species which comes from the Dronne River (South-West of France). Cadmium (Cd) exposure of mussels at 2 and 5 µg/L for 7 days was

conducted to test their vulnerability to this metal, and also the potential endocrine disruption power of Cd. Morphometric analyses, gonad histological observations, metal bioaccumulation, metallothionein (MTs) production, measures of malondialdehyde (MDA), and finally quantitative relative expression analysis of genes involved in various metabolic functions were performed. The main results showed Cd accumulation increasing in a dose-dependent manner, especially in the gills. The same trend was observed for gene expression relative to oxidative stress. Histological analysis of the gonads highlighted a predominance of hermaphrodite individuals, but after 7 days of exposure to Cd, the percentage of female was largely increased compared with controls, from 17 to 33%. These results demonstrate the endocrine disruption effect of Cd on freshwater pearl mussels. The pearl mussel Margaritifera margaritifera is sensitive to cadmium since the metallothioneins are poorly induced, gene expression reveals oxidative stress, and gonads tend to be feminized.

Bioaccumulation dynamics and gene regulation in a freshwater bivalve after aqueous and dietary exposures to gold nanoparticles and ionic gold

Authors: Arini A, Pierron F, Mornet S, Baudrimont M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3637-3650, 2020, DOI: 10.1007/s11356-018-4009-4

Abstract: Gold nanoparticles (AuNPs) are being developed and produced for a wide variety of industrial and biomedical applications, which raises the concern about their release and potential effects in the environment. In this study, we aim to assess the effects of PEGylated AuNPs and ionic gold on the freshwater bivalve *Corbicula fluminea*. As NP bioavailability is conditioned by many factors of variability, we focused on the determination of biodynamic parameters which control AuNP uptake and elimination in bivalves. Three experiments were conducted: (1) a waterborne exposure (0-24 mg/L for AuNPs and 0-12 mg/L for ionic gold), (2) a dietborne exposure (0-48 mg/L for AuNPs and 0-24 mg/L for ionic gold), and (3) an elimination phase (after waterborne exposure to 12 mg/L for AuNPs and 24 mg/L for ionic gold), to calculate rate constants for uptake from water(kuw), from food (kuf), and for the physiological elimination (ke) for AuNPs and AuCl(OH)(3)(-). Jointly, the relative expression of several genes was investigated in the hemolymph cells to relate AuNPs and gold ion exposures to detoxification, oxidative stress, immune, and apoptosis responses in *C. fluminea*. Results show that kuw and kuf were around 10 and 30 times higher for AuNPs compared to AuCl(OH) 3-, respectively. The ke was also faster in clams exposed to AuNPs meaning that they also had greater excretion capacities in comparison to gold ions. Water seems to be the main exposure pathway for C. fluminea according to kuw and kuf values for AuNPs and AuCl(OH)(3)(-) (kuw = 0.28 and 0.03, kuf = 0.009 and 0.001, respectively). The gene analyses pointed out important responses against oxidative stress, strong activations of genes of the immunity, and apoptosis after the waterborne exposure to AuNPs and to a lesser extent after exposure to gold ions. Very few responses were observed after the dietary exposure to both forms of gold, probably due to valve closure in response to contamination. While some studies suggest that the toxicity of nanoparticlesmay come from the release of metal ions, our results showed that theAuNPs we used were very stable (less than 1% of ion release) and generated more effects at the gene level than ionic gold. Therefore these results highlight the strong potential of toxicity of AuNPs compared to ionic gold and raise new concerns about the toxicity inherent to NPs in the environment.

Benefits of ozonation before activated carbon adsorption for the removal of organic micropollutants from wastewater effluents

Authors: Guillossou R, Le Roux J, Brosillon S, Mailler R, Vulliet E, Morlay C, Nauleau F, Rocher V, Gasperi J

Source: CHEMOSPHERE 245:125530, 2020, DOI: 10.1016/j.chemosphere.2019.125530

Abstract: Advanced processes for the removal of organic micropollutants (OMPs) from wastewater

effluents include adsorption onto activated carbon, ozonation, or a combination of both processes. The removal of 28 OMPs present in a real wastewater effluent was studied by ozonation coupled to activated carbon adsorption and compared to a sole adsorption. The influence of the specific ozone dose (0.09-1.29 gO(3)/gDOC) and the influence of the powdered activated carbon (PAC) dose (2, 5 and 10 mg/L) were first studied separately. OMPs removal increased with both the specific ozone dose (up to 80% for a dose higher than 0.60 gO(3)/gDOC) and the PAC dose. Ozonation performances decreased in presence of suspended solids, which were converted to dissolved organic carbon. A correction of the specific ozone dose according to the suspended solids levels, in addition to nitrite, should be considered. The influence of ozonation (0.09, 0.22, 0.94 and 1.29 gO(3)/gDOC) on OMPs adsorption was then assessed. OMPs adsorption didn't change at low specific ozone doses but increased at higher specific ozone doses due to a decrease in DOM adsorption and competition with OMPs. At low ozone doses followed by adsorption (0.22 gO(3)/gDOC and 10 mg/L PAC), the two processes appeared complementary as OMPs with a low reactivity toward ozone were well absorbed onto PAC while most OMPs refractory to adsorption were well eliminated by ozone. Improved removals were obtained for all compounds with these selected doses, reaching more than 80% removal for most OMPs while limiting the formation of bromate ion.

Health indicators and contaminant levels of a critically endangered species in the Gironde estuary, the European sturgeon

Authors: Acolas ML, Davail B, Gonzalez P, Jean S, Clerandeau C, Morin B, Gourves PY, Daffe G, Labadie P, Perrault A, Lauzent M, Pierre M, Le Barh R, Baudrimont M, Peluhet L, Le Menach K, Budzinski H, Rochard E, Cachot J

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(4):3726-3745, 2020, DOI: 10.1007/s11356-019-05139-5

Abstract: The European sturgeon, Acipenser sturio, is a highly endangered species that almost disappeared in the last decades. Thanks to yearly restocking of the population, this species is still found in the Gironde estuary (France), where juveniles grow during several years before leaving to the ocean. The aims of this study were to evaluate the pressure exerted on these fish by known organic and inorganic contaminants during their stay at the Gironde estuary, and to get information on the fish's health in this context. Monthly captures over the year 2014 provided 87 fish from the cohorts 2012 and 2013 mainly, and from cohorts 2008, 2009, and 2011, all fish born in hatchery. We report the very first analyses of contaminant levels and of biological markers measured in the blood of these fish. Low inorganic contamination was found, composed of seven metals mainly Zn (< 5 µg mL(-1)), Fe (< 1.5 µg mL(-1)), Cu (< 0.8 µg mL(-1)), Se (< 0.8 µg mL(-1)), As (< 0.25 µg mL(-1)), Co (< 0.14 µg mL(-1)), and Mn (< 0.03 µg mL(-1)). Concerning persistent organic contaminants, the sum of seven PCBs varied from 1 to 10 ng g(-1) plasma, that of eight OCPs from 0.1 to 1 ng g(-1), and that of eight PBDEs from 10 to 100 pg g(-1). Higher levels of contaminants were measured during spring as compared to summer. The sex steroid hormone plasma levels (estradiol, testosterone, and 11-ketotestosterone) were quite low, which was predictable for juveniles. The transcription of reproduction-involved genes (EstR, AR, LHR, sox9) in blood cells was demonstrated for the first time. Some of them were correlated with organic contaminant levels PCBs and OCPs. Other gene transcriptions (sodCu and bax) were correlated with PCBs and OCPs. However, the DNA damage level measured here as comet tail DNA and micronuclei ratio in red blood cells were in the very low range of the values commonly obtained in fish from pristine areas. The data presented here can serve as a reference base for future monitoring of this population of sturgeons.

Towards simple tools to assess functional effects of contaminants on natural microbial and invertebrate sediment communities

Authors: Pesce S, Campiche S, Casado-Martinez C, Ahmed AM, Bonnineau C, Dabrin A, Lyautey E, Ferrari BJD

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(6):6680-6689, 2020, DOI: 10.1007/s11356-019-07331-z

Abstract: Surface sediments can accumulate contaminants that affect microorganisms and invertebrates and disturb benthic ecological functions. However, effects of contaminants on ecological functions supported by sediment communities are understudied. Here, we tested the relevance of two simple tools to assess the ecotoxicological effects of metal contamination on natural sediment communities using particulate organic matter breakdown and decomposition as a functional descriptor. To this aim, we performed a 21-day laboratory microcosm experiment to assess the individual and combined effects of Cu and As (nominal concentration of 40 mg kg(-1) dw each) using the bait-lamina method (cellulose, bran flakes, and active coal in PVC strips) as well as artificial tablets (cellulose, bran flakes and active coal embedded in an agar matrix). Sediment toxicity was also evaluated using the standardized ostracod toxicity test. Both the bait-lamina and artificial tablet methods showed low effects of As on organic matter breakdown and decomposition but strong effects of Cu on this important ecological function. Both also showed that the presence of Cu and As in mixture in the sediment induced total inhibition of organic matter breakdown and decomposition. The ostracod toxicity test also showed high toxicity of Cu-spiked and Cu-plus-As-spiked sediments and low toxicity of As-spiked sediments. Besides confirming that artificial organic matter substrates are relevant and useful for assessing the functional effects of contaminants on sediment micro- and macro-organism communities, these results suggest that the proposed methods offer promising perspectives for developing tools for use in assessing functional ecotoxicology in the sediment compartment.

Evaluation of the environmental and human health risk related to metallic contamination in agricultural soils in the Mediterranean semi-arid area (Saiss plain, Morocco)

Authors: Kouchou A, El Ghachtouli N, Duplay J, Ghazi M, Elsass F, Thoisy JC, Bellarbi M, Ljjaali M, Rais N

Source: ENVIRONMENTAL EARTH SCIENCES 79(6):131, 2020, DOI: 10.1007/s12665-020-8880-1

Abstract: In the plain of Saiss, the most agricultural region of Morocco, the studies concerning the assessment of environmental and human risks related to metal contamination of agricultural soils are severely missing. To overcome the lack of such studies, trace-element analyses were carried out on six sampling sites of agricultural surface soils (66 sampling points), irrigated by superficial watercourses with high heavy metal contents. The average trace-element contents were 78, 55, 33, and 119 (mg kg(-1)), respectively, for Cr, Cu, Ni, and Zn. These values are above average worldwide soil and geochemical background levels. Multivariate statistical analyses, principal component, and cluster analyses suggest that soil contamination by Cr, Cu, and Zn is mainly due to wastewater irrigation, with the exception of Ni, which is probably of pedo-lithogenic origin. To provide further information on contamination transmission, the bioavailability and distribution of the four heavy metals in the soils were studied by sequential and single extractions. The results indicate that Cu and Zn are potentially available and can constitute a potential risk to the environment. The risk assessment of soil contamination was also carried out using risk assessment code, enrichment factor, contamination factor, degree of contamination, pollution lead index, geoaccumulation index, and potential ecological risk factors. The health risk evaluation by the Hazard Index was used to derive a combined risk of soil ingestion, dermal contact, and inhalation for adults and children. According to these indices, the soils present a moderate-to-high contamination for Cu and Zn elements, respectively. Hazard Index values indicate the relative absence of health risks associated to heavy metals for both adults and children.

Barrage fishponds, a funnel effect for metal contaminants on headwater streams

Authors: Le Cor F, Slaby S, Gaillard J, Dauchy X, Feidt C, Banas D,

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(6):6228-6238, 2020, DOI: 10.1007/s11356-019-07195-3

Abstract: Fishponds are man-made shallow water bodies that are still little studied because of their small size. They represent high value ecosystems, both environmentally (biodiversity hotspot) and economically (fish production). They can have a high place on the hydrographic network, so their influence on water quality is of first importance for rivers and water bodies located downstream and monitored under theWater Framework Directive. These small water bodies can be a source of contaminants during draining period or an efficient buffer for pesticides. We wanted to evaluate whether these ponds could also be a remediation tool against metals by following the annual evolution of upstream/downstream flows. Cadmium, copper, lead and zinc concentrations were quantified in the dissolved phase upstream and downstream of three ponds, each one having a specific agricultural environment (traditional or organic). Metal concentration was quantified in sediments and water. For the dissolved phase, the predictive noneffect concentration was often exceeded, suggesting an environmental risk. Results highlighted also greater quantity of metals at the downstream of the pond compared to the upstream, suggesting remobilization into the ponds or direct cross-sectional contributions from the watershed (e.g. runoff from crops) or even remobilization. Regarding sediments, minimal contamination was shown but a high mineralogical variability. No buffer effect of ponds, which could reduce the risk of acute or chronic toxicity, was detected.

Biomarker responses and accumulation of polycyclic aromatic hydrocarbons in *Mytilus trossulus* and *Gammarus oceanicus* during exposure to crude oil

Authors: Turja R, Sanni S, Stankeviciute M, Butrimaviciene L, Devier MH, Budzinski H, Lehtonen KK

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 2020, DOI: 10.1007/s11356-020-07946-7

Abstract: In the brackish water Baltic Sea, oil pollution is an ever-present and significant environmental threat mainly due to the continuously increasing volume of oil transport in the area. In this study, effects of exposure to crude oil on two common Baltic Sea species, the mussel *Mytilus trossulus* and the amphipod *Gammarus oceanicus*, were investigated. The species were exposed for various time periods (M. trossulus 4, 7, and 14 days, *G. oceanicus* 4 and 11 days) to three oil concentrations (0.003, 0.04, and 0.30 mg L-1 based on water measurements, nominally aimed at 0.015, 0.120, and 0.750 mg L-1) obtained by mechanical dispersion (oil droplets). Biological effects of oil exposure were examined using a battery of biomarkers consisting of enzymes of the antioxidant defense system (ADS), lipid peroxidation, phase II detoxification (glutathione S-transferase), neurotoxicity (acetylcholinesterase inhibition), and geno- and cytotoxicity (micronuclei and other nuclear deformities). In mussels, the results on biomarker responses were examined in connection with data on the tissue accumulation of polycyclic aromatic hydrocarbons (PAH). In M. trossulus, during the first 4 days of exposure the accumulation of all PAHs in the two highest exposure concentrations was high and was thereafter reduced significantly. Significant increase in ADS responses was observed in *M. trossulus* at 4 and 7 days of exposure. At day 14, significantly elevated levels of geno- and cytotoxicity were detected in mussels. In G. oceanicus, the ADS responses followed a similar pattern to those recorded in M. trossulus at day 4; however, in *G. oceanicus*, the elevated ADS response was still maintained at day 11. Conclusively, the results obtained show marked biomarker responses in both study species under conceivable, environmentally realistic oil-in-seawater concentrations during an oil spill, and in mussels, they are related to the observed tissue accumulation of oil-derived compounds.

Design of a degenerate primer pair to target a bacterial functional community: The hppd bacterial gene coding for the enzyme targeted by herbicides, a study case

Authors: Thiour-Mauprivez C, Devers-Lamrani M, Mounier A, Beguet J, Spor A, Calvayrac C, Barthelmebs L, Martin-Laurent F

Source: JOURNAL OF MICROBIOLOGICAL METHODS 170:105839, 2020, DOI: 10.1016/j.mimet.2020.105839

Abstract: The present work aimed to design a degenerate primer pair to target a large part of the hppd soil bacterial community, possibly affected by herbicides. We validated these primers by qPCR and high-throughput sequencing analysis of soil samples.

Wastewater-based epidemiology approach to assess population exposure to pesticides: a review of a pesticide pharmacokinetic dataset

Authors: Devault DA, Karolak S

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(5):4695-4702, 2020, DOI: 10.1007/s11356-019-07521-9

Abstract: Wastewater-based epidemiology is an innovative approach to estimate a population's intentional and unintentional consumption of chemicals based on biomarker assays found in wastewater. This method can provide real-time objective information on the xenobiotics to which a population is directly or indirectly exposed. This approach has already been used to assess the population exposure to four classes of pesticides: organochlorines (chlordecone), triazines, organophosphates, and pyrethroids. This review aims to obtain the data (excretion rates) and characteristics (pesticide and metabolites stability, including in-sewer one) for other pesticides to broaden the scope of this new method. Excretion rates and stability descriptions for 14 pesticides, namely 2,4-d, aldrin, carbaryl, chlorobenzilate, dieldrin, diquat, ethion, glufosinate, glyphosate, folpet, malathion, parathion, penconazole, and tebuconazole, will be discussed in a practical framework.

Trophic transfer of pesticides: The fine line between predator-prey regulation and pesticide-pest regulation

Authors: Baudrot V, Fernandez-de-Simon J, Coeurdassier M, Couval G, Giraudoux P, Lambin X

Source: JOURNAL OF APPLIED ECOLOGY, 2020, DOI: 10.1111/1365-2664.13578

Abstract: Understanding pesticide impacts on populations of target/non-target species and communities is a challenge to applied ecology. When predators that otherwise regulate pest densities ingest prey contaminated with pesticides, this can suppress predator populations by secondary poisoning. It is, however, unknown how species relationships and protocols of treatments (e.g. anticoagulant rodenticide [AR]) interact to affect pest regulation.

To tackle this issue, we modelled a heuristic non-spatialized system including montane water voles, specialist vole predators (stoats, weasels) and a generalist predator (red fox) which consumes voles, mustelids and other prey. By carrying out a broad-range sensitivity analysis on poorly known toxicological parameters, we explored the impact of five farmer functional responses (defined by both AR quantity and threshold vole density above which AR spreading is prohibited) on predator-prey interactions, AR transfer across the trophic chain and population effects.

Spreading AR to maintain low vole densities suppressed mustelid and fox populations, leading to vole population dynamics being entirely regulated by AR use. Such vole-suppression treatment regimes inhibited predation ecosystem services and promoted pesticide dependence.

Keeping vole density below acceptable bounds by spreading AR while maintaining sufficient voles as prey resources led to less AR being applied and extended periods without AR in the environment, benefiting predators while avoiding episodes with high vole density. This may meet farm production interests while minimizing the impact on mustelid and fox populations and associated ecosystem processes. These alternating phases of mustelids and farmer regulation highlight the consequence

of intraguild relationship where mustelids may rescue foxes from poisoning. Both global and wide-range sensitivity analysis illustrate the tightrope between predator-prey regulation and pesticide-pest regulation.

Synthesis and applications. Different pesticide protocols lead to a rich variety of predator-prey dynamics in agro-ecosystems. Our model reveals the need to maintain refuges with sufficient non-poisoned voles for sustaining specialist mustelids, to conserve the predator community given the potential of secondary poisoning with rodenticides. We suggest that long periods without pesticide treatment are essential to maintain predator populations, and that practices of pesticides use that attempt to permanently suppress a pest over a large scale are counterproductive.

How effective are strategies to control the dissemination of antibiotic resistance in the environment? A systematic review

Authors: Goulas A, Belhadi D, Descamps A, Andremont A, Benoit P, Courtois S, Dagot C, Grall N, Makowski D, Nazaret S, Nelieu S, Patureau D, Petit F, Roose-Amsaleg C, Vittecoq M, Livoreil B, Laouenan C

Source: ENVIRONMENTAL EVIDENCE 9(1):4, 2020, DOI: 10.1186/s13750-020-0187-x

Abstract: Background Antibiotic resistance is a major concern for public and environmental health. The role played by the environment in disseminating resistance is increasingly considered, as well as its capacity for mitigation. We reviewed the literature on strategies to control dissemination of antibiotic-resistant bacteria (ARB), antibiotic resistance genes (ARG) and mobile genetic elements (MGE) in the environment. Methods This systematic review focused on three main strategies: (i) restriction of antibiotic use (S1), (ii) treatments of liquid/solid matrices (S2) and (iii) management of natural environment (S3). Articles were collected from seven scientific databases until July 2017 and from Web of Science until June 2018. Only studies reporting measurements of ARB, ARG or MGE in environmental samples were included. An evidence map was drawn from metadata extracted from all studies eligible for S1, S2 and S3. Subsets of studies were assessed for internal and external validity to perform narrative and quantitative syntheses. A meta-analysis was carried out to assess the effects of organic waste treatments (random-effect models). Review findings Nine hundred and thirty-one articles representing 1316 individual studies (n) were eligible for S1 (n = 59), S2 (n = 781) and S3 (n = 476) strategies, respectively. Effects of interventions to control the dissemination of antibiotic resistance in the environment were primarily studied in strategy S2. A partial efficiency of wastewater treatment plants (WWTPs) to reduce antibiotic resistance in treated effluent was reported in 118 high validity studies. In spite of the heterogeneity in published results, the meta-analysis showed that composting and drying were efficient treatments to reduce the relative abundance of ARG and MGE in organic waste, by 84% [65%; 93%] and 98% [80%; 100%], respectively. The effect of anaerobic digestion was not statistically significant (51% reduction [- 2%; 77%]) when organic waste treatments were compared together in the same model. Studies in strategies S1 and S3 mainly assessed the effects of exposure to sources of contamination. For instance, 28 medium/high validity studies showed an increase of antibiotic resistance in aquatic environments at the WWTP discharge point. Some of these studies also showed a decrease of resistance as the distance from the WWTP increases, related to a natural resilience capacity of aquatic environments. Concerning wildlife, nine medium/high validity studies showed that animals exposed to anthropogenic activities carried more ARB.

Refinement of an OECD test guideline for evaluating the effects of endocrine disrupting chemicals on aromatase gene expression and reproduction using novel transgenic cyp19a1a-eGFP zebrafish

Authors: De Oliveira J, Chadili E, Piccini B, Turies C, Maillot-Marechal E, Palluel O, Pardon, P, Budzinski H, Cousin X, Brion F, Hinfray N

Source: AQUATIC TOXICOLOGY 220:105403, 2020, DOI: 10.1016/j.aquatox.2020.105403

Abstract: Transgenic fish are powerful models that can provide mechanistic information regarding the endocrine activity of test chemicals. In this study, our objective was to use a newly developed transgenic zebrafish line expressing eGFP under the control of the cypl9ala promoter in the OECD Fish Short Term Reproduction Assay (TG 229) to provide additional mechanistic information on tested substances. For this purpose, we exposed adult transgenic zebrafish to a reference substance of the TG 229, i.e. prochloraz (PCZ; 1.7, 17.2 and 172.6 µg/L). In addition to "classical" endpoints used in the TG 229 (reproductive outputs, vitellogenin), the fluorescence intensity of the ovaries was monitored at 4 different times of exposure using in vivo imaging. Our data revealed that 172.6 µg/L PCZ significantly decreased the number of eggs laid per female per day and the concentrations of vitellogenin in females, reflecting the decreasing E2 synthesis due to the inhibition of the ovarian aromatase activities. At 7 and 14 days, GFP intensities in ovaries were similar over the treatment groups but significantly increased after 21 days at 17.2 and 172.6 µg/L. A similar profile was observed for the endogenous cyp19a1a expression measured by qPCR thereby confirming the reliability of the GFP measurement for assessing aromatase gene expression. The overexpression of the cyp19a1a gene likely reflects a compensatory response to the inhibitory action of PCZ on aromatase enzymatic activities. Overall, this study illustrates the feasibility of using the cyp19a1a-eGFP transgenic line for assessing the effect of PCZ in an OECD test guideline while providing complementary information on the time- and concentration-dependent effects of the compound, without disturbing reproduction of fish. The acquisition of this additional mechanistic information on a key target gene through in vivo fluorescence imaging of the ovaries was realized without increasing the number of individuals.

Influence of dissolved organic matter on the removal of 12 organic micropollutants from wastewater effluent by powdered activated carbon adsorption

Authors: Guillossou R, Le Roux J, Mailler R, Pereira-Derome CS, Varrault G, Bressy A, Vulliet E, Morlay C, Nauleau F, Rocher V, Gasperi J

Source: WATER RESEARCH 172:115487, 2020, DOI: 10.1016/j.watres.2020.115487

Abstract: The presence of dissolved organic matter (DOM) in wastewater effluents is recognized as the main factor limiting the adsorption of organic micropollutants (OMPs) onto activated carbon. The degree of the negative effect that DOM, depending on its quality, exerts on OMPs adsorption is still unclear. The influence of the interactions between DOM and OMPs on their removal is also not fully understood. Adsorption isotherms and conventional batch tests were performed in ultra-pure water and in wastewater effluent to study the influence of DOM on the adsorption of 12 OMPs onto powdered activated carbon. Best fit of adsorption pseudo-isotherms was obtained with the Freundlich equation and showed, as expected, that OMPs adsorption was higher in ultra-pure water than in wastewater effluent due to the presence of DOM leading to pore blockage and competition for adsorption sites. LC-OCD analysis revealed that biopolymers and hydrophobic molecules were the most adsorbed fractions while humic acids were not removed after a contact time of either 30 min or 72 h. The presence of DOM had a negative impact on the removal of all OMPs after 30 min of adsorption, but similar removals to ultra-pure water were obtained for 6 OMPs after 72 h of adsorption. This demonstrated that competition between DOM and OMPs for adsorption sites was not a major mechanism as compared to pore blockage, which only slowed down the adsorption and did not prevent it. The charge of OMPs had a clear impact: the adsorption of negatively charged compounds was reduced in the presence of wastewater effluent due to repulsive electrostatic interactions with the adsorbed DOM and the PAC surface. On the other hand, the removal of positively charged compounds was improved. A 24 h pre-equilibrium between OMPs and DOM improved their removal onto PAC, which suggest that OMPs and DOM interacted in solution which decreased the negative effects caused by the presence of DOM, e.g. through co-adsorption of an OMP-DOM complex. (C) 2020 Elsevier Ltd. All rights reserved.

Development and environmental implication of pedotransfer functions of Cd desorption rate coefficients in historically polluted soils

Authors: Lin ZB, Zou XY, Zhang RD, Nguyen C, Huang JS, Wang K, Wu JW, Huang S

Source: ENVIRONMENTAL POLLUTION 257:113602, 2020, DOI: 10.1016/j.envpol.2019.113602

Abstract: The desorption rate is an important factor determining cadmium (Cd) ecotoxicity and pollution remediation in soils. The pedotransfer functions (PTFs) of desorption rate coefficients of fresh Cd in soils have been developed in literature. We hypothesized that the aging of Cd pollution would alter Cd desorption process. Taking historically polluted soils as the object, this study aimed at testing the hypothesis and developing new PTFs of desorption rate coefficients for historical Cd. 15 d batch extraction experiments and 13 kinetic models were employed to define Cd desorption rate coefficients in 27 historically polluted soil samples. Compared with fresh Cd, the desorption rate coefficients of historical Cd were lower, and the break time of biphasic desorption processes was retarded to 3 d (4320 min). Different with the usual models for fresh Cd desorption (e.g. parabolic diffusion and two constant rate models), the best models to mimic the historical Cd desorption processes were the pseudo first order, logarithmic, Elovich, and simple Elovich models. The rate-limiting step controlling Cd desorption was changed from the intraparticle diffusion to the interface reaction with aging of pollution. New PTFs of desorption rate coefficients of historical Cd were established (R2 ≥ 0.71). Cd desorption rate coefficients increased with organic matter and clay contents, but decreased with oxalate extractable Fe content, solution pH, cation exchange capacity, and silt content. The key soil properties influencing desorption rate coefficients were not altered by the aging of pollution. The developed PTFs could guide us to adjusting the ecotoxicity and pollution remediation of Cd in historically polluted field soils. (C) 2019 Elsevier Ltd. All rights reserved.

Exposure to environmental radionuclides alters mitochondrial DNA maintenance in a wild rodent

Authors: Kesaniemi J, Lavrinienko A, Tukalenko E, Moutinho AF, Mappes T, Moller AP, Mousseau TA, Watts PC

Source: EVOLUTIONARY ECOLOGY Early Access: JAN 2020, DOI: 10.1007/s10682-019-10028-x

Abstract: Mitochondria are sensitive to oxidative stress, including that derived from ionizing radiation. To quantify the effects of exposure to environmental radionuclides on mitochondrial DNA (mtDNA) dynamics in wildlife, bank voles (Myodes glareolus) were collected from the chernobyl exclusion zone (CEZ), where animals are exposed to elevated levels of radionuclides, and from uncontaminated areas within the CEZ and elsewhere in Ukraine. Brains of bank voles from outside the CEZ were characterized by low mtDNA copy number and low mtDNA damage; by contrast, bank voles within the CEZ had high mtDNA copy number and high mtDNA damage, consistent with putative damaging effects of elevated radiation and a compensatory response to maintain sufficient functioning mitochondria. In animals outside the CEZ, the expression levels of PGC-1 alpha gene and mtDNA copy number were positively correlated as expected from this gene's prominent role in mitochondrial biogenesis; this PGC-1 alpha-mtDNA copy number association is absent in samples from the CEZ. Our data imply that exposure to radionuclides is associated with altered mitochondrial dynamics, evident in level of mtDNA and mtDNA damage and the level of activity in mitochondrial synthesis.

An energy-based model to analyze growth data of earthworms exposed to two fungicides

Authors: Bart S, Pelosi C, Nélieu S, Lamy I, Péry ARR

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(1):741-750, 2020, DOI: 10.1007/s11356-019-06985-z

Abstract: The pesticide risk assessment for earthworms is currently performed using standardized tests, the model species Eisenia fetida, and the analyses of the data obtained are performed with ad hoc statistical tools. We assessed the impact of two fungicides on the entire growth pattern of the earthworm species *Aporrectodea caliginosa*, which is highly representative of agricultural fields. Individuals of three different ages (from hatching to 56 days old) were exposed to Cuprafor micro (R) (copper oxychloride) and Swing (R) Gold (dimoxystrobin and epoxiconazole). Data were analyzed with an energy-based toxicodynamicmodel coupled with a toxicokinetic model. The copper fungicide caused a drastic growth inhibition once the no effect concentration (NEC), estimated at 65 mg kg(-1) of copper, was exceeded. The Swing (R) Gold negatively affected the growth with NEC values estimated at 0.387 mg kg(-1) and 0.128 mg kg(-1) for the dimoxystrobin and the epoxiconazole in this fungicide formulation, respectively. The time-profile of the effects on *A. caliginosa* individuals was fully accounted for by the model, whatever their age of exposure. Furthermore, toxicity data analyses, supported by measurements of fungicide concentrations in earthworm at the end of the experiment, allowed bettering understanding of the mechanisms of action of the fungicides towards earthworm growth.

Effects of cadmium, inorganic mercury and methyl-mercury on the physiology and metabolomic profiles of shoots of the macrophyte Elodea nuttallii

Authors: Cosio C, Renault D

Source: ENVIRONMENTAL POLLUTION 257:113557, 2020, DOI: 10.1016/j.envpol.2019.113557

Abstract: Macrophytes are known to bioaccumulate metals, but a thorough understanding of tolerance strategies and molecular impact of metals in aquatic plants is still lacking. The present study aimed to compare Hg and Cd effects in a representative macrophyte, *Elodea nuttallii* using physiological endpoints and metabolite profiles in shoots and cytosol. Exposure 24 h to methyl-Hg (30 ng L-1), inorganic Hg (70 ng L-1) and Cd (280 µg L-1) did not affect photosynthesis, or antioxidant enzymes despite the significant accumulation of metals, confirming a sublethal stress level. In shoots, Cd resulted in a higher level of regulation of metabolites than MeHg, while MeHg resulted in the largest number of regulated metabolites and IHg treatment regulated no metabolites significantly. In cytosol, Cd regulated more metabolites than IHg and only arginine, histidine and mannose were reduced by MeHg exposure. Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analysis of data suggested that exposure to MeHg resulted in biochemical changes including aminoacyl-tRNA biosynthesis, glycine, serine and threonine metabolism, nitrogen metabolism, arginine and proline metabolism, cyanoamino acid metabolism, while the treatment of Cd stress caused significant variations in aminoacyl-tRNA biosynthesis and branched-chain amino acids pathways. Data supports an impact of MeHg on N homeostasis, while Cd resulted in an osmotic stress-like pattern and IHg had a low impact. Marked differences in the responses to MeHg and IHg exposure were evidenced, supporting different molecular toxicity pathways and main impact of MeHg on non-soluble compartment, while main impact of IHg was on soluble compartment. Metabolomics was used for the first time in this species and proved to be very useful to confirm and complement recent knowledge gained by transcriptomics and proteomics, highlighting the high interest of multi-omics approaches to identify early impact of environmental pollution.

Increased soil pH and dissolved organic matter after a decade of organic fertilizer application mitigates copper and zinc availability despite contamination

Authors: Laurent C, Bravin MN, Crouzet O, Pelosi C, Tillard E, Lecomte P, Lamy I

Source: SCIENCE OF THE TOTAL ENVIRONMENT 709:135927, 2020, DOI: 10.1016/j.scitotenv.2019.135927

Abstract: Long-term organic fertilizer (OF) application on agricultural soils is known to induce

soil Cu and Zn contamination, along with pH and organic matter changes, which in turn alter the soil Cu and Zn availability. Our study was aimed at assessing Cu and Zn availability in long-term OF-amended soils by distinguishing the importance of increased contamination levels versus pH and organic matter changes in soil. Seventy-four soil samples were collected over time from fields corresponding to three soil types upon which no, mineral, or organic fertilization had been applied over a decade, and thus exhibited a gradient of Cu and Zn contamination, pH, and organic matter concentration. Soil Cu and Zn contamination (i.e. total and DTPA-extractable Cu and Zn concentration), soil solution chemistry (i.e. pH and dissolved organic matter concentration and aromaticity) and Cu and Zn availability (i.e. total concentration and free ionic activity in solution and DGT-available concentration in soil) levels were measured. The Windermere humic aqueous model (WHAM) was used to estimate Zn2+ activity and dissolved organic matter (DOM) binding properties in soil solution. Regardless of the soil type, organic fertilization increased Cu and Zn contamination in soil, in addition to the pH and the DOM concentration, aromaticity and binding properties in soil solution. The pH increase prompted a decrease in the total Zn concentration and Zn2+ activity in soil solution. The concomitant pH increase and DOM concentration, aromaticity and binding properties boosted the total Cu concentration but decreased the Cu2+ activity in soil solution. DGT-available Cu and Zn varied very little between the three fertilization modalities. Our results suggest that pH and DOM changes were able to regulate Cu and Zn availability in long-term OF amended soils by exerting a protective effect that offset the concomitant increase in soil Cu and Zn contamination.

Realistic environmental exposure to microplastics does not induce biological effects in the Pacific oyster Crassostrea gigas

Authors: Revel M, Chatel A, Perrein-Ettajani H, Bruneau M, Akcha F, Sussarellu R, Rouxel J, Costil K, Decottignies P, Cognie B, Lagarde F, Mouneyrac C

Source: MARINE POLLUTION BULLETIN 150:110627, 2020, DOI: 10.1016/j.marpolbul.2019.110627

Abstract: The aim of the present study was to evaluate the presence and potential toxic effects of plastic fragments (< 400 µm) of polyethylene and polypropylene on the Pacific oyster *Crassostrea gigas*. Oysters were exposed to environmentally relevant concentrations (0, 0.008, 10, 100 µg of particles/L) during 10 days, followed by a depuration period of 10 days in clean seawater. Effects of microplastics were evaluated on the clearance rate of organisms, tissue alteration, antioxidant defense, immune alteration and DNA damage. Detection and quantification of microplastics in oyster's tissues (digestive gland, gills and other tissues) and biodeposits using infrared microscopy were also conducted. Microplastics were detected in oyster's biodeposits following exposure to all tested concentrations: 0.003, 0.006 and 0.05 particles/mg of biodeposits in oysters exposed to 0.008, 10 and 100 mu g of particles/L, respectively. No significant modulation of biological markers was measured in organisms exposed to microplastics in environmentally relevant conditions.

Identification of new microbial functional standards for soil quality assessment

Authors: Thiele-Bruhn S, Schloter M, Wilke BM, Beaudette LA, Martin-Laurent F, Cheviron N, Mougin C, Rombke J

Source: SOIL 6(1):17-34, 2020, DOI: 10.5194/soil-6-17-2020

Abstract: The activity of microorganisms in soil is important for a robust functioning of soil and related ecosystem services. Hence, there is a necessity to identify the composition, diversity, and function of the soil microbiome in order to determine its natural properties, functioning, and operating range as well as to assess eco-toxicological effects due to anthropogenic activities. Numerous microbiological methods currently exist in the literature and new, more advanced methods continue to be developed; however, only a limited number of these methods are standardised. Consequently, there is a need to

identify the most promising non-standardised methods for assessing soil quality and to transform them into standards. In agreement with the "Ecosystem Service Approach", new methods should focus more on soil microbial functions, including nutrient cycling and greenhouse gas emission, pest control and plant growth promotion, carbon cycling and sequestration, as well as soil structure development and filter function. The few existing standardised methods available that focus on the function of the soil microbiome mostly include measurements, like basal respiration, enzyme activities, and biodegradation of organic matter, under well-defined conditions in the lab. This paper sets out to summarise and expand on recent discussions within the International Organization for Standardization (ISO), Soil Quality - Biological Characterization sub-committee (ISO TC 190/SC 4), where a need was identified to develop scientifically sound methods which would best fulfil the practical needs of future users for assessing soil quality, going beyond the existing test systems. Of particular note is the current evolution of molecular methods in microbial ecology that use quantitative real-time PCR (qPCR) to produce a large number of new functional endpoints which are more sensitive as compared to "classical" methods. Quantitative PCR assesses the abundance of microbes that catalyse major transformation steps in nitrogen and phosphorus cycling, greenhouse gas emissions, chemical transformations including pesticide degradation, and plant growth promotion pathways based on the assessment of marker gene sequences that drive the related processes. In the assessment of soil quality methods, it was found that most methods focus on bacteria and related endpoints. Techniques to describe fungal communities as well as their functional traits are far less represented. As such, techniques to analyse fungal enzyme activities are proposed. Additionally, methods for the determination of microbial growth rates and efficiencies, including the use of glomalin as a biochemical marker for soil aggregation, are discussed. Furthermore, field methods indicative of carbon turnover, including the litter bag test and a modification to the tea bag test, are presented. However, it is obvious that with increasing developments in high throughput sequencing technologies and big data analyses, including metagenomics analysis, it will be possible to implement these technologies into the standardisation process for assessing the functions of the soil microbiome. Overall, it is suggested that endpoints should represent a potential function of soil microorganisms rather than actual activity levels, as the latter can largely be dependent on short-term variable soil properties such as pedoclimatic conditions, nutrient availability, and anthropogenic soil cultivation activities.

Azadirachtin, a natural pesticide with multiple effects

Authors: Aribi N, Denis B, Kilani-Morakchi S, Joly D

Source: M S-MEDECINE SCIENCES 36(1):44-49, 2020, DOI: 10.1051/medsci/2019268

Abstract: There are many studies devoted to the negative impact of conventional pesticides that effectively control pests, but cause widespread environmental pollution. As a result, interest is growing in pesticides of a natural origin with a lower environmental impact. Among them, azadirachtin, sold under various formulations (neem oil, Neem-Azal, Bioneem, etc.), is still the most widely recommended molecule in agricultural ecosystems. Azadirachtin has also been used in traditional medicine for centuries, and studies published over the past few years have tended to support its therapeutic use. Yet the argument that azadirachtin is harmless to the environment has been offset by its notable collateral and controversial effects on non-target organisms. The present paper summarizes the work already done in this field.

Tritiated Water Exposure in Zebrafish (*Danio rerio*): Effects on the Early-Life Stages

Authors: Gagnaire B, Arcanjo C, Cavalie I, Camilleri V, Simon O, Floriani M, Orjollet D, Adam-Guillermin C

Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY, 2020, DOI: 10.1002/etc.4650

Abstract: Tritium, a radioactive isotope of hydrogen of natural and anthropogenic origin, is ubiquitously present in the environment. Effluents of nuclear centers of production are significant

anthropogenic sources. With the upcoming project of thermonuclear fusion, tritium releases in the environment may increase. It is therefore important to characterize the ecological risk linked to tritium. The effects of tritiated water (HTO) were therefore studied in zebrafish larvae exposed for 10 d to different dose rates, 1.1 x 10(2), 4.1 x 10(2), and 3.8 x 10(3) µGy/h for larvae corresponding, respectively, to a water contamination of 10(4), 10(5), and 10(6) Bq/mL of HTO. Those dose rates were higher than 10 mu Gy/h, which is the threshold recommended to start monitoring ecosystems where radiological contaminants are present. Mortality, embryo-larval development, immune toxicity, genotoxicity, neurotoxicity, and alterations of tissues were investigated. The results showed that HTO exposure induced DNA damage and reactive oxygen species production and modulated the expression of genes involved in detoxification processes. Moreover, modifications of the muscular tissues (degradation of myofibrils at 4 d post fertilization and disorganization of mitochondria at later stages) were observed. The results differed with HTO dose rates and with developmental stages. These results will drive future research for the development of new HTO-sensitive biomarkers and will allow us to progress in the characterization of the modes of action of tritium in fish.

In Situ Reproductive Bioassay with Caged *Gammarus fossarum* (Crustacea): Part 2-Evaluating the Relevance of Using a Molt Cycle Temperature-Dependent Model as a Reference to Assess Toxicity in Freshwater Monitoring

Authors: Lopes C, Chaumot A, Xuereb B, Coulaud R, Jubeaux G, Queau H, Francois A, Geffard O

Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY, 2020, DOI: 10.1002/etc.4656

Abstract: Active biomonitoring approaches are now recognized as relevant for monitoring water contamination and toxicity. Nevertheless, due to the confounding influence of variable and uncontrolled environmental conditions such as temperature, biological markers measured on transplanted individuals to assess water quality are difficult to interpret. The purpose of the present study is to propose a methodology for adapting a laboratory test of chronic sublethal toxicity based on the molting cycle of Gammarus fossarum to in situ assays. To this end, we 1) adapted the molt cycle temperature-dependent model developed in Part 1 (Chaumot et al. 2020, this issue) to the fluctuating temperatures measured in the field; 2) assessed the predictive power of our approach as a "reference value" from gammarids caged in 9 nonimpacted sites at different seasons; and 3) tested the relevance of our tool to interpret in situ reproductive bioassays from 5 upstream/downstream studies and a large-scale deployment in 12 sites. Our approach based on modeling the progress of gammarid molting cycle as a function of temperature appeared to be a relevant and robust tool for interpreting in situ observations in different environmental contexts in time and space. By avoiding using a "reference" or upstream situation as a baseline from which water quality could be assessed, this approach provides a real added value to water quality diagnosis in biomonitoring programs.

Metabolome response to anthropogenic contamination on microalgae: a review

Authors: Gauthier L, Tison-Rosebery J, Morin S, Mazzella N

Source: METABOLOMICS 16(1):8, 2019, DOI: 10.1007/s11306-019-1628-9

Abstract: Background Microalgae play a key role in ecosystems and are widely used in ecological status assessment. Research focusing on such organisms is then well developed and essential. Anyway, approaches for a better comprehension of their metabolome's response towards anthropogenic stressors are only emerging. Aim of review This review presents the biochemical responses of various microalgae species towards several contaminants including metals and chemicals as pesticides or industrial compounds. We aim to provide a comprehensive and up-to-date overview of analytical approaches deciphering anthropogenic contaminants impact on microalgae metabolome dynamics, in order to bring out relevant biochemical markers that could

be used for risk assessment. Key scientific concepts of review Studies to date on ecotoxicological metabolomics on microalgae are highly heterogeneous in both analytical techniques and resulting metabolite identification. There is a real need for studies using complementary approaches to determine biomarkers usable for ecological risk assessment.

Bioaccessibility of metal(loid)s in soils to humans and their bioavailability to snails: A way to associate human health and ecotoxicological risk assessment?

Authors: Louzon M, Pelfrene A, Pauget B, Gimbert F, Morin-Crini N, Douay F, de Vaufleury

Source: JOURNAL OF HAZARDOUS MATERIALS 384:121432, 2020, DOI: 10.1016/j.jhazmat.2019.121432

Abstract: Human health risk assessment (HHRA) and ecotoxicological risk assessment (ERA) of contaminated soils are frequently performed separately and based on total soil concentrations without considering the concepts of mobility, bioaccessibility and bioavailability. However, some chemical and biological assays rarely used in combination can be applied to more accurately assess the exposure of organisms to metal(loid)s and thus to better estimate the links between soil contamination and effects. For humans, the unified bioaccessibility method (UBM) assesses oral bioaccessibility, while for soil fauna such as land snails, the bioaccumulation test reflects the bioavailability of contaminants. The aim of this study is to explore the relationship between oral bioaccessibility and the bioavailability of arsenic, cadmium and lead in twenty-nine contaminated soils. The results show a modulation of bioaccumulation and bioaccessibility of metal(loid)s by soil physicochemical parameters (organic matter especially). For the three metal(loid)s studied, strong relationships were modelled between the UBM and snail tests ($0.77 < r^2adj < 0.95$), depending on the parameters of the linear regressions (contaminant and phases of the UBM test). The original models proposed demonstrate the feasibility of linking bioaccessibility to humans and bioavailability to snails and the relevance of their association for an integrative risk assessment of contaminated soils.

Influence of the properties of 7 micro-grain activated carbons on organic micropollutants removal from wastewater effluent

Authors: Guillossou R, Le Roux J, Mailler R, Morlay C, Vulliet E, Nauleau F, Rocher V, Gasperi

Source: CHEMOSPHERE 243:UNSP 125306, 2020, DOI: 10.1016/j.chemosphere.2019.125306

Abstract: Most studies dedicated to organic micropollutants (OMPs) removal from wastewater effluents by adsorption onto activated carbon (AC) only consider a few conventional AC properties. The link between OMPs removal and these properties is often missing, which limits the understanding of the adsorption process and the interpretation of the results. The chemical, physical and textural properties of seven newly commercialized micro-grain activated carbons (mu GACs) were determined to assess their influence on the removal of 28 OMPs. Conventional batch tests with wastewater effluent showed that a high percentage of microporous volume (>65%) was detrimental for the removal of 10 OMPs, probably due to a higher blockage of micropores by dissolved organic matter (DOM). The removal of 5 OMPs was correlated with mu GACs surface chemistry properties (i.e. charge) which were potentially modified by DOM adsorption or inorganic species, thus favoring the adsorption of positively-charged compounds. A combination of OMPs properties including their charge, hydrophobicity and minimal projection area could explain their removal. Correlations were found between the removal of several OMPs and UV254, suggesting that DOM and OMPs interacted with each other or followed similar adsorption mechanisms. A decrease in mu GACs particle size had a positive impact on UV254 removal under continuous-flow conditions in columns representative of a large-scale pilot due to better expansion.

REVUE DE PRESSE / ALTERNATIVES / BIOPESTICIDES

Une alternative aux produits phytos ? BASF et De Sangosse vont tester les produits d'Amoeba

Terre-Net 31/03/20

BASF et De Sangosse vont tester en plein champ et sous serre les produits de biocontrôle d'Amoeba, que ce dernier présente comme une alternative aux pesticides chimiques.

« Ces tests à grande échelle présentent un important potentiel de valorisation pour la société et sont une étape essentielle vers d'éventuels partenariats commerciaux », a souligné mardi dans un communiqué le fondateur d'Amoeba, Fabrice Plasson. Le groupe lyonnais, qui a connu de nombreux déboires dans ses tentatives pour faire homologuer ses produits, avait annoncé à l'automne dernier qu'il lui faudrait trouver de nouveaux financements d'ici juillet. Les applications agricoles sont pour Amoeba une piste relativement récente. [...]

Accès au document

Corteva lance Inatreq contre la septoriose

Cultivar 20/03/20

Corteva Agriscience annonce l'homologation du premier produit à base d'Inatreq™ active en Europe, fongicide d'origine naturelle.

Questar™, à base d'Inatreq™ active, a reçu son autorisation de mise sur le marché en France. Inatreq™ active est un nouveau fongicide d'origine naturelle qui offre un contrôle sur toutes les souches de septoriose, permettant une stratégie de protection fongicide durable, indique l'entreprise. [...]

Accès au document

Biocontrôle : Céline Barthet, élue présidente d'IBMA France

Terre-Net 19/03/20

Céline Barthet, directrice homologation et affaires réglementaires de Sumi Agro France, succède à Antoine Meyer, en tant que présidente d'IBMA France, l'association française des entreprises de produits de biocontrôle.

« Je suis très honorée de représenter le secteur du biocontrôle en France. Tout en veillant à une parfaite continuité dans les actions initiées, nous affinerons dans les prochaines semaines, avec nos adhérents, le plan "IBMA France 2030" qui dressera la feuille de route stratégique de l'association de cette décennie », présente Céline Barthet, récemment élue présidente d'IBMA France. [...]

Accès au document

REVUE DE PRESSE / ASSOCIATIONS

Alerte aux pucerons : les betteraviers démunis à cause des mesures dites « environnementales »

Alerte Environnement 30/04/20

C'était le dogmatisme écolo et un quasi-suicide de toute la profession betteravière ou l'autorisation d'utiliser un insecticide dès le stade 2 feuilles, le Teppeki (flonicamide, normalement autorisé au stade 6 feuilles). En effet, depuis le 20 avril, la quasi-totalité des régions de production de betteraves en France sont touchées par une infestation de pucerons verts que d'aucuns qualifient de « très précoce et fulgurante ». À la clef, un risque « très élevé » de jaunisse, donc de perte de rendement de 30 à 50% (Cf. le témoignage vidéo infra) alors même que le prix actuel de la tonne de betteraves (autour de 20 euros) permet à peine de rentabiliser une production normale… [...]

Accès au document

Pourquoi il est urgent de soutenir l'Initiative Citoyenne Européenne pour une sortie des pesticides « Sauvez les abeilles et les agriculteurs » ?

Générations futures 29/04/20

Deux documents importants, devant contenir des objectifs de réduction des pesticides, devaient être publiés par la Commission européenne au début de l'année, mais ont été reportés au 29/04 puis probablement au 20/05, en raison des efforts de lobbying massifs du lobby des agriculteurs conventionnels.

Progressivement, les versions divulguées du document mettent en évidence une réduction de l'ambition (par exemple, plus d'objectifs de réduction des pesticides obligatoires), se dirigeant vers un scénario de « statu quo ». L'agro-industrie affaiblit l'accord vert européen sur la réduction des pesticides et la protection de la biodiversité [...]

Accès au document

Retour sur l'affaire glyphosate : affaire de gros sous aux USA, combat idéologique en Europe

Alerte Environnement 27/04/20

La France Agricole du 27 mars donne la parole à Gil Rivière-Wekstein, auteur du livre Glyphosate, l'impossible débat, paru en février 2020. Il explique que « cette affaire est la plus grande manipulation de l'opinion publique depuis le début du siècle. Il y a cinq ans, le glyphosate était un non-sujet. Tous les jardiniers du monde en avaient. Parmi tous les produits utilisés, ce n'est pas seulement le plus efficace, c'est aussi le moins toxique ». La manipulation a eu lieu en quatre grandes étapes :

C'est l'avis du Centre International de Recherche contre le Cancer (CIRC) classant la molécule comme « cancérigène probable » qui est « l'élément déclencheur », explique Gil Rivière-Wekstein. « Cet avis est contesté par l'ensemble des agences sanitaires du monde, qui estiment qu'il s'agit d'une surinterprétation des études ». Le journaliste juge « douteux » le rôle joué par le toxicologue américain Christopher Portier, connu pour avoir été employé par une ONG antipesticides américaine – l'Environmental Defense Fund. [...]

Accès au document

Recours juridiques : Le COVID ne justifie pas d'épandre des pesticides au ras des habitations

Générations futures 23/04/20

9 ONG saisissent la justice en urgence pour stopper les dérogations aux distances d'épandage.

Sous le prétexte que le Covid 19 empêcherait les consultations du public, le Gouvernement recule de nouveau en accordant des réductions supplémentaires pour épandre les pesticides à des distances encore plus faibles des habitations que celles pourtant insuffisamment protectrices imposées en décembre. Afin de protéger les riverains contre cet abus manifeste, 9 ONG déposent deux recours devant le Conseil d'Etat contre cette décision inadmissible. [...]

Accès au document

Billet du président - Pesticides - L'inadmissible décision gouvernementale !

Que Choisir 23/04/20

Trop, c'est trop ! Après avoir avalisé fin 2019 via des textes réglementaires des distances minimales d'épandage près des habitations ridiculement faibles (10, 5 mètres contre les 50 réclamés par les ONG et certaines autorités), le gouvernement profite aujourd'hui du confinement pour permettre, en catimini, des réductions supplémentaires, au moment même où les épandages débutent !

En effet, un communiqué du Ministère de l'Agriculture indique clairement qu'en raison de la situation empêchant des concertations locales, une instruction permet aux utilisateurs de déroger aux distances minimales (évidemment à la

baisse !) jusqu'en juin 2020 (bref pendant toute la période où se concentrent habituellement les épandages de pesticides) si les utilisateurs se sont engagés dans un simple projet de charte de bonnes pratiques … sans besoin qu'il soit concerté ! [...]

Accès au document

Glyphosate : toujours pas de solution pour le remplacer et une échéance qui approche en plein chaos économique

Alerte-environnement

Plus personne ne l'ignore, sous la pression des ONG, le gouvernement a pour objectif de sortir de l'essentiel des usages du glyphosate au 1er janvier 2021, et de tous les usages au 1er janvier 2023. Dans le même temps, plus de trois agriculteurs sur quatre n'identifient pas d'alternatives au glyphosate, selon une enquête des instituts techniques Acta, Arvalis, Fnams, ITB, Terres Inovia réalisée sur un échantillon de 7677 producteurs en grandes cultures et publiée le 17 avril. Plus précisément, 77,5% disent ne pas savoir comment faire sans cet herbicide. [...]

Accès au document

Animal Fodder – A Driver of the Global Highly Hazardous Pesticides (HHPs) Industry

Beyond Pesticides, April 30, 2020

Chemical-intensive farming of crops for animal fodder powers the global market for highly hazardous pesticides (HHPs), according to data analyzed by Unearthed, and the Swiss NGO Public Eye. Animal fodder production not only intensifies global pollution, but it also increases pesticide exposure and degrades human, animal, and environmental health. This data analysis supports advocates advancing pesticide policies to eliminate HHPs by identifying which toxic chemicals lead global pesticide sales. However, it will take more than eliminating the worst chemicals to address the impending biodiversity collapse and the climate crisis, according to experts who point to the need for an urgent shift to organic land and agricultural management practices. United Nations' (UN) special rapporteur on toxic substances and human rights, Baskut Tuncak, says, "There is nothing sustainable about the widespread use of highly hazardous pesticides for agriculture. Whether they poison workers, extinguish biodiversity, persist in the environment, or accumulate in a mother's breast milk, these are unsustainable, cannot be used safely, and should have been phased out of use long ago." [...]

Accès au document

One Quarter of Global Insect Population Lost Since 1990

Beyond Pesticides, April 28, 2020

Roughly a quarter of the global insect population has been wiped out since 1990, according to new research published in the journal Science. Billed as one of the most comprehensive assessments to date, the study finds significant overall insect declines, but notes of some specific bright spots. While variation in the ongoing crisis is to be expected, ultimately the trends in the data show the need for immediate policy and regulatory action to protect the insect world as the foundation of global food webs. [...]

Accès au document

Monarch Butterfly Larvae Adversely Affected by Pesticide Drift from Contiguous Soybean and Maize Crop Fields

Beyond Pesticides 23/04/20

Pesticide spray drift from adjacent farmlands expose butterfly larvae to lethal pesticide concentrations, according to research published in Environmental Toxicology and Chemistry by Iowa State University (ISU). Lack of previous experimental pesticide toxicity data makes it unclear as to what degree insecticides impact monarch butterfly (*Danaus plexippus*) productivity in milkweed (*Asclepias* spp.) habitats near pesticide-treated pasture. This study adds weight to the idea that pesticides are playing a

role in the ongoing decline of this iconic butterfly, as researchers find insecticide drift from adjacent fields to be strongly associated with larval mortality. Future monarch butterfly conservation efforts should consider risks stemming from pesticide exposure when developing butterfly rehabilitation efforts, according to advocates. As co-author Niranjana Krishnan (ISU graduate student) states, "In order to make the best decisions about how and where to plant milkweed, we first need to find basic toxicity and exposure data." [...]

Accès au document

Gironde : « on va droit dans le mur, tu viens avec nous ? » dit la filière agricole aux ONG…

Alerte-environnement 20/04/20

Voilà un bel exemple de surenchère ! Et elle mène tout droit les agriculteurs dans le mur. Sans pour autant calmer les ONG écologistes. Il s'agit de la Charte départementale du bien vivre ensemble (sic !) en Gironde. Elle est en consultation publique jusqu'au 30 avril 2020. On doit l'initiative au Conseil interprofessionnel du vin de Bordeaux (CIVB), à la chambre d'agriculture 33 et à l'Association des Maires de Gironde.

On s'en souvient, la filière viticole en Gironde s'était déjà engagée à supprimer les produits phytosanitaires classés CMR (cancérigènes, mutagènes et reprotoxiques). A grand renfort de communication.

Cette année, la nouveauté réside dans l'ajout des fongicides SDHI pour lesquels la filière demande à ce qu'ils soient supprimés de la boîte à outils des agriculteurs de Gironde. [...]

Accès au document

Les étranges considérations du Sénateur Corbisez sur les pesticides

Alerte-Environnement 17/04/20

Alors que notre pays est en confinement depuis quelques semaines, nos institutions continuent « à tourner ». Ainsi en est-il du Secrétariat général du gouvernement qui répond toujours aux questions des parlementaires. Une d'entre elles a attiré cette semaine notre attention, celle du Sénateur du Pas-de-Calais Corbisez.

La voici in extenso :

Arrêt de l'usage des pesticides

Jean-Pierre Corbisez attire l'attention de M. le ministre de l'agriculture et de l'alimentation concernant le décret n° 2019-1500 du 27 décembre 2019 et l'arrêté sur les distances dites « de sécurité » qui sont parus au Journal officiel le 29 décembre 2019. [...]

Accès au document

Épandage des pesticides : Les préfets doivent protéger les riverains, pas aggraver la situation !

Que Choisir 16/04/20

Après avoir dénoncé et attaqué devant le Conseil d'Etat les distances minimales ridiculement faibles d'épandage de pesticides près des habitations, nos organisations1 sonnent l'alerte quant à l'aggravation actuelle de la situation avec des réductions supplémentaires inadmissibles en cette période de confinement. Nos ONG appellent à la mobilisation générale pour que les préfets interdisent les pulvérisations de pesticides près des habitations et que soient reportées sine die les consultations publiques autour des chartes « pesticides ».

Nombre d'organisations2 et de riverains3 ont souhaité attirer l'attention des autorités sur la situation particulièrement pénible actuellement vécue par de nombreuses personnes confinées à leur domicile - comme l'ensemble de la population française - et qui doivent subir les dérives de pesticides pulvérisés à très faible distance de leurs domiciles. Alors que les analyses réalisées par l'UFC-Que Choisir sur les productions de l'agriculture conventionnelle4 confirment régulièrement la présence de pesticides potentiellement dangereux, ces décisions conduisent à augmenter encore l'exposition des riverains à des produits toxiques, et à durcir les conditions de leur confinement. Alors qu'il serait justifié, dans de telles circonstances sanitaires, d'éloigner les pulvérisations de pesticides des

domiciles des riverains des zones cultivées, l'instruction du 3 février dernier relayée par certains préfets sous forme de dérogations rend possible l'inverse et permet de passer outre l'obligation faite dans la loi de respecter des zones sans traitement ! [...]

Notes

(1) Alerte Médecins **Pesticides**, Eau & Rivières de Bretagne, Générations Futures, Greenpeace France, Justice **Pesticides**, Mouvement de l'Agriculture Bio-Dynamique, MIRAMAP, Terre & Humanisme, UFC-Que Choisir, Union syndicale Solidaires.

(2) A titre d'exemple Générations Futures a écrit fin mars sur ce point au Premier Ministre.

(3) Certains riverains et collectifs ont écrit à des préfets pour s'inquiéter de ces situations.

Accès au document

Pollinis et Générations Futures déposent un recours contre la cellule Déméter

Génération futures 14/04/20

POLLINIS et Générations futures ont déposé un recours devant le tribunal administratif de Paris pour obtenir l'annulation de la convention de partenariat entre le ministère de l'Intérieur, la FNSEA et les Jeunes Agriculteurs permettant la mise en oeuvre de la cellule Déméter.

Signée le 13 décembre dernier, mais rendue publique deux mois plus tard par le quotidien Le Monde, cette convention marque le lancement d'une cellule de renseignement officiellement dédiée au « suivi des atteintes au monde agricole ». Ce partenariat choquant entre la gendarmerie nationale et des organismes privés, fervents défenseurs du modèle agricole conventionnel, permet en réalité la mise en place d'un dispositif de surveillance dont les contours sont dangereusement flous. [...]

Accès au document

Farmed Salmon during Covid-19 Pandemic Subject to Increased Pesticide Use in Scotland

Beyond Pesticides, April 17, 2020

As the novel coronavirus pandemic upends much of human activity, some governments are acting to loosen environmental regulations — purportedly, in the interests of public health in the face of Covid-19 threats, and/or in deference to economic concerns of certain industrial sectors. There has been little analysis, to date, of what the "on the ground" impacts of these relaxed rules may be, but news out of Scotland illustrates some kinds of concerns critics and advocates have about such loosening of regulations. The Scottish Environment Protection Agency (SEPA) has issued new, temporary rules that allow some salmon farms both to ignore newly established limits on the amount of emamectin, an insecticide used to control sea lice that plague the salmon, and to boost use of azamethiphos, another insecticide used against the lice, beyond previous 24-hour limits. [...]

Accès au document

Farmland Birds' Exposure to Neonicotinoid-Treated Seeds (during Winter Seeding) Confirmed by Blood Plasma Tests

Beyond Pesticides, April 16, 2020

Pesticide exposure in farmland birds is a concomitant of pesticide-treated muesli (cereal) seed commonly planted during winter months, according to research published in Science of the Total Environment by United Kingdom (UK) scientists. Not only do pesticide-treated seeds pose the highest dietary risk to birds, but pesticide-treated seeds also go underreported as farmers often lack knowledge of what pesticides are on the seeds they plant. This study emphasizes the global effects of treated seeds, and their corresponding pesticide exposure, on bird species. Future risk assessments for bird should address these implications when implementing agricultural pesticide policies. [...]

Accès au document

Household Pesticide Use During Pregnancy Linked to Nephroblastoma Kidney Cancer

Beyond Pesticides, April 15, 2020

Home pesticide use during pregnancy is associated with an increased risk of a child developing the kidney cancer nephroblastoma, or Wilms' tumor, according to research published in Cancer Epidemiology by a team of French scientists. Wilms' tumor is one of the most common childhood cancers but has an inscrutable etiology. This study adds weight to the theory that pesticides are a driver of the tumor's development, as pesticide use was more strongly associated than other widely investigated causes, including parental smoking and alcohol consumption during pregnancy. [...]

Accès au document

Federal Dietary Guidelines Needed to Promote Sustainably Grown Food for a Healthy Public and Environment, According to Report

Beyond Pesticides, April 13, 2020

Since 1990, Congress has required an every-five-years review of its Dietary Guidelines — recommendations that are supposed, minimally, to promote public health and prevent chronic diseases. The next review and a draft updated iteration, the 2020–2025 Dietary Guidelines for Americans, are currently underway. The Union of Concerned Scientists (and several colleagues) have examined recent studies on dietary patterns and sustainability; their analysis reveals that the current federal guidelines on diet are unlikely to support sustainability of the food system in the long-term. Beyond Pesticides concurs, and maintains that a transition to sustainable, organic, regenerative agriculture is the path to both improved human health and long-term sustainability of the natural world essential to life.

The Union of Concerned Scientists' (UCS's) report — In Support of Sustainable Eating: Why U.S. Dietary Guidelines Should Prioritize Healthy People and a Healthy Planet — identifies this next version of the federal guidelines as a critical opportunity to shift the direction of the U.S. food and agricultural system toward far greater sustainability. UCS asserts that such a shift is beyond due: the food system in the U.S. has huge environmental impacts on pollution, use of chemical pesticides, biodiversity, and emissions that significantly worsen the myriad impacts of the climate crisis — in addition to its effects on public health. [...]

Accès au document

Replay: Les agriculteurs vont-ils sauver la planète?

Générations futures 26/03/20

Le magazine « Pièces à conviction » du 25 mars 2020 est revenu sur l'échec du plan Ecophyto, qui prévoyait de réduire de moitié l'usage des pesticides en dix ans.

Dans ce documentaire, intitulé « Les agriculteurs vont-ils sauver la planète ? » la réalisatrice revient sur l'échec du plan Ecophyto censé nous permettre d'atteindre l'objectif de réduction de 50% des pesticides en 10 ans soit en … 2018! Le constat est là, point de baisse mais au contraire une augmentation de l'utilisation de ces produits nocifs.

Au-delà de ce constat d'échec, la réalisatrice dresse le portrait d'agriculteurs qui tentent une métamorphose. Mettant en avant le fait que ces derniers traversent des crises graves : le prix des denrées qu'ils produisent ne cesse de baisser, et parfois leurs productions se raréfient. Beaucoup d'entre eux, tenus par des investissements qu'ils n'arrivent plus à rembourser, jettent l'éponge. Pour sauver leur métier, beaucoup réfléchissent à changer leurs pratiques. « Pièce à conviction » est parti à la rencontre des ces agriculteurs et agricultrices qui s'essayent à de nouvelles méthodes de culture : une révolution dans ce monde réputé conservateur.

Accès au document

Lawsuit Challenges TruGreen Chemical Lawn Care Company for Deceptive Safety Claims; Pesticide Applications Stopped by Some States During COVID-19 Crisis as Nonessential

Beyond Pesticides, March 30, 2020

NOTICE: Beyond Pesticides urges Governors to stop the use of lawn pesticides during the COVID-19 crisis because the toxic chemicals used are typically immune and respiratory system toxicants, elevating key risk factors for those vulnerable to coronavirus hazards. Contact your Governor to classify chemical lawn care as non-essential.

Last week, Beyond Pesticides sued TruGreen, the national chemical landscaping company, for misrepresenting the safety of the toxic chemicals that it uses to treat lawns. The case is Beyond Pesticides v. TruGreen (DC Superior Court, Case No. 2020CA001973B, March, 20, 2020). At the same time, the organization is urging all states to prohibit toxic chemical spraying in neighborhoods as non-essential and hazardous. Widespread exposure to lawn pesticides, which are immune system and respiratory toxicants, can elevate serious risk factors associated with COVID-19 (coronavirus). [...]

Accès au document

Les priorités hallucinantes de Générations Futures

Alerte-environnement 25/03/20

Des centaines de personnes décèdent du Coronavirus, le nombre de morts et de contaminés explose, l'économie est à l'arrêt quasi-total… mais ne croyez pas que le lobby pro-bio et antiphyto Générations Futures va changer son agenda militant. On pourrait tous y passer qu'on aurait quand même le droit à sa « semaine pour les alternatives aux pesticides » ! Ce non-événement devait avoir lieu du 20 au 30 mars. Si « tous les événements physiques, conférences, projections ou visites de fermes devront être reportés, l'association diffusera chaque jour sur son site des articles valorisant les alternatives aux pesticides » explique Agrafil suite à un communiqué de l'association. Qui devrait, cette fois-ci, trouver des médias trop occupés pour leurs habituels articles complaisants. C'est ce qui s'appelle pisser dans un violon, mais pas volontairement cette fois-ci, et sans glyphosate (sauf selon BioCheck). Le communiqué de Générations Futures rappelle aussi que deux de ses initiatives en ligne se poursuivent : le concours « À vos coquelicots » destiné aux jeunes élèves et l'outil Shake ton politique, qui permet de proposer aux élus dix engagements pour la réduction des produits phytosanitaires. Bref, pendant la fin du monde, la propagande, les fake news et le lobbying continuent !

Accès au document

Agriculture conventionnelle et agriculture biologique : trop de biais dans les comparaisons - Agriculture conventionnelle et agriculture biologique -Trop de biais dans les comparaisons

Que Choisir 19/03/20

Si le coronavirus n'accaparait pas toute notre attention, l'étude de l'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (Inrae) pourrait faire du bruit. Elle dénonce en effet les biais des analyses de cycle de vie pour comparer les modèles agricoles.

La collaboration est européenne. Des chercheurs danois, suédois et, pour la France, de l'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (Inrae) publient une étude qui pourrait faire date.

Ils y démontrent que la méthode la plus courante pour évaluer les impacts sur l'environnement de l'agriculture et de l'alimentation, à savoir l'analyse de cycle de vie (ACV), est « trop simpliste et passe à côté d'avantages majeurs de l'agriculture biologique ». Cette méthode peut notamment amener à conclure que l'agriculture biologique a plus d'impact que la conventionnelle en raison de

ses rendements plus faibles qui mobilisent plus de terres. [...]

Accès au document

Maryland Legislature Passes Limited Ban on Chlorpyrifos Insecticide

Beyond Pesticides, March 24, 2020

Last week, Maryland became the latest state to prohibit use of the brain-damaging insecticide chlorpyrifos, after a measure cleared both the state Senate and House. Although the legislation implements a limited ban that sunsets after four years, advocates consider this action a step in the right direction that will protect the health and safety of Maryland residents. "Even amidst our current public health crisis, the Maryland legislature acted to protect all Marylanders' health for years to come by banning this toxic pesticide, and we are so grateful," said Ruth Berlin, Executive Director of the Maryland Pesticide Education Network to WBOC. [...]

Accès au document

Farmworkers and Conservationists Sue EPA for Re-Approving Monsanto/Bayer's Cancer-Causing Pesticide, Glyphosate/Roundup

Beyond Pesticides, March 23, 2020

Ignoring science to side with Monsanto/Bayer, EPA has repeatedly failed to assess glyphosate's impacts on public health and endangered species.

Last week, a broad coalition of farmworkers, farmers, and conservationists, filed a federal lawsuit against the Environmental Protection Agency (EPA) over its January 2020 re-approval of the pesticide glyphosate, best known as the active ingredient in Monsanto's Roundup pesticides. With Center for Food Safety (CFS) serving as legal counsel, the suing organizations are Beyond Pesticides, the Rural Coalition, Organización en California de Lideres Campesinas, and the Farmworker Association of Florida. [...]

Accès au document

Infectious Human Disease, Snail Fever, Worsened by Pesticide Run-Off into Fresh Waterways

Beyond Pesticides, March 18, 2020

Freshwater habitats are threatened now—more than ever—by the adverse effects of pesticide pollution, according to a report published in Scientific Reports by a collaborative research team from the Helmholtz Centre for Environmental Research (UFZ) and the Kenya-based International Centre of Insect Physiology and Ecology (ICIPE). Pesticide pollution, attributed to runoff from agricultural farms, indirectly increased the rate of the tropical disease schistosomiasis, which infects over 280 million people (2018). This research underlines the range of uncertainties that exist as a result of pesticide contamination, making it critically important that subtropical areas where this disease threat exists move toward organic and pesticide-free approaches. [...]

Accès au document

Monarch Population, Under Threat from Pesticide Use and Habitat Loss, Decline by Half in One Year

Beyond Pesticides, March 17, 2020

The number of monarch butterflies overwintering in Mexico is down 53% from last year, according to a count conducted by World Wildlife Fund (WWF) Mexico. While WWF indicates the decline was expected due to unfavorable weather conditions during the species southward migration, other environmental groups are raising red flags. "Scientists were expecting the count to be down slightly, but this level of decrease is heartbreaking," said Tierra Curry, a senior scientist at the Center for Biological Diversity. "Monarchs unite us, and more protections are

clearly needed for these migratory wonders and their habitat." [...]

Accès au document

Global Growth of Organic Farmland Further Advances UN Sustainable Development Goals

Beyond Pesticides, March 11, 2020

Worldwide, organic farming practices quadrupled from 2000 to 2018, with over 180 countries leading a global transition to organic agriculture. Newly published global survey data by the Research Institute of Organic Agriculture (FiBL) and International Federation of Organic Agriculture Movements – Organics International (IFOAM) reveal global organic agriculture to be at an all-time high, with 71.5 million hectares (mha) of farmland in production. Organic agriculture's rise in popularity makes important progress toward the United Nations Sustainable Development Goals, as organic agriculture is essential for a sustainable future; it is a solution to the global food crisis and eliminating the health risks engendered by chemical-intensive farming. [...]

Accès au document

L'Union européenne porte un nouveau coup dur au secteur agricole marocain

Maghress 04/03/20

L'étau est-il en train de se resserrer sur les exportations agricoles marocaines ?

En effet, après la décision en janvier dernier du Luxembourg d'interdire totalement l'usage du glyphosate qui risque de créer un effet boule de neige chez le reste des pays européens, une nouvelle interdiction est venue frapper, il y a quelques jours, les importations européennes des fruits et légumes traités au chlorpyrifos, un autre pesticide jugé également dangereux pour la santé humaine. Et cette fois-ci, ce sont tous les Etats membres de l'Union européenne qui ont convenu d'une telle interdiction. Or, à l'instar du glyphosate (un herbicide largement décrié à l'échelle mondiale pour ses risques cancérigènes pour l'humain), le chlorpyrifos continue d'être commercialisé au Maroc à travers 53 produits homologués, selon l'index phytosanitaire de l'ONSSA, aux fins de lutter contre des ravageurs touchant de nombreuses cultures. [...]

La question lancinante qui se pose donc : que va faire l'ONSSA alors que l'article 5 de la loi n°42-95 relative au contrôle et à l'organisation du commerce des produits pesticides à usage agricole stipule que « lorsqu'à la suite d'un fait nouveau… ou, éventuellement, après un nouvel examen, un produit ne satisfait plus aux conditions d'efficacité et d'innocuité à l'égard de l'homme, des animaux ou de leur environnement, l'homologation ou l'autorisation de vente est retirée ». Affaire à suivre.

Accès au document

Maryland Senate votes to ban pesticide chlorpyrifos

Washingtonpost 04/03/20

The Maryland Senate has voted to ban a pesticide that has been found to damage children's brain development.

The Senate voted 31-14 on Tuesday for the measure, which now goes to the House.

The Senate measure bans the pesticide called chlorpyrifos for four years, beginning Dec. 31. Supporters of a complete ban hope to make it permanent this legislative session. Supporters of the measure say the pesticide also poses threats to aquatic life and the Chesapeake Bay.

The Maryland Department of Agriculture announced last month it would develop regulations to phase out the regular use of the pesticide, but supporters of the legislation are pushing for a ban in the law.

California, Hawaii and New York have approved bans on the pesticide.

Accès au document

Future Policy Award for the Protection from Hazardous Chemicals

SAICM 09/03/20

This year, the world renowned Future Policy Award, also known as the "Oscars on best policies", will celebrate the world's best laws, policies, and legal frameworks that regulate or ban the use of chemicals that threaten the environment and human health. Each year, the World Future Council, in collaboration with UN agencies, highlights exemplary policies in one field where innovation and action are particularly urgent.

Around 40,000-60,000 chemicals are in use worldwide, some of which cause irreversible harm to humans and the environment; many of these are particularly problematic chemicals that end up in our food chain and the environment. The World Health Organization (WHO) estimated the burden of disease from exposure to selected chemicals at 1.6 million lives in 2016, and many more cases of illness. Children are especially vulnerable, and can be affected already before birth with long-lasting effects. [...]

Accès au document

As the World Bans Highly Toxic Wood Preservative, Pentachlorophenol, a Low-Income U.S. Community May Be Home to the Last Production Plant

Beyond Pesticides, March 10, 2020

Orangeburg, South Carolina may be the last place in the world to produce one of the most toxic pesticides known to humanity, pentachlorphenol. Despite a global ban on "penta" in 2016, in force in 186 countries, the United States has continued to import and use this hazardous wood preservative on telephone poles and railroad ties throughout the country. Now, with Mexico set to close one of the last production plants in the world, Gulbrandsen Chemicals Inc. wants to make Orangeburg, a majority black community with a population three times the poverty rate, the new epicenter for penta manufacturing. [...]

Accès au document

Ce que coûterait le retrait du glyphosate en arboriculture : entre 120 et 432 euros par hectare

Alerte-Environnement 06/03/20

L'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement vient de rendre public un rapport sur l'évaluation économique des pratiques alternatives au glyphosate en arboriculture et il n'est pas rassurant pour le monde agricole français : leur surcoût va de 120 euros par hectares à 432 euros par hectares. La faute au désherbage mécanique qui 1° augmente le temps de travail, 2° implique l'achat du matériel spécifique, 3° est susceptible de provoquer des blessures sur les racines et 4° nécessite une modification du système d'irrigation. Toutefois « ces éléments peuvent être pris en considération lors du renouvellement des vergers, en utilisant des porte-greffes présentant un système racinaire plus profond et en installant un système d'irrigation adapté », estime l'Inrae. L'arrêt du glyphosate devrait dans tous les cas être valorisé par des prix plus élevés ce qui pose la question de la distorsion de la concurrence des pays européens ou autres qui continueront à l'utiliser, et si cette question était réglée, ultimement du pouvoir d'achat des Français. Tout cela alors que les risques pour l'homme de l'utilisation du glyphosate n'ont jamais été prouvés malgré de nombreuses études sur le sujet.

Accès au document

Tests urinaires à la recherche de glyphosate : les agris donnent de leur personne pour rassurer

Alerte-Environnement 06/03/20

37 céréaliers de l'Indre ont fait tester leur urine auprès du CHU de Limoges (analyses par chromatographie liquide couplée à la spectrométrie de masse, la référence internationale en la matière) et du laboratoire allemand BioCheck de Leipzig (test Elisa, « totalement inadapté dans le cas de l'urine, où l'on retrouve différents déchets produits par

notre métabolisme » selon le toxicologue et ancien expert auprès du ministère de la Santé François Hubert). Le premier a trouvé du glyphosate dans l'urine de neuf d'entre eux (moins de un sur quatre) contre neuf sur dix chez le second. Pour le CHU de Limoges, la moyenne des résultats s'établit à 0,1 µg/l (sachant qu'il est possible de détecter du glyphosate à une concentration de 0,05 µg/l. Il y a deux ou trois ans, bon nombre de « positifs » d'aujourd'hui auraient été jugés « négatifs ») contre 0,54 µg/l pour BioCheck, soit respectivement 1% et 5,4% de la dose journalière admissible pour une exposition chronique par voie orale. Selon le CHU de Limoges, auteur de centaines de dosages urinaires de glyphosate ces derniers mois, il n'y a pas plus de tests positifs chez les agris que chez les Français en général. Enfin, d'après la base de données Biotox de l'Institut national de recherche et de sécurité (INRS), le glyphosate est rapidement éliminé dans les fèces et les urines, quasiment sous forme inchangée. Il ne s'accumule pas dans l'organisme. [...]

Accès au document

Vidéo virale sur les pesticides dans l'eau : pourquoi l'électrolyse ne prouve rien

Alerte Environnement 06/03/20

Encore une fake news environnementale. Dans une vidéo devenue virale sur Twitter (vue plus d'un million de fois depuis le 10 février, aimée plus de 25 000 fois et retweetée plus de 15 000 fois en moins de 24 heures), un homme prétend prouver que l'eau minérale de la marque Cristalline est polluée aux pesticides. Sa conclusion s'appuie sur une démonstration mensongère, ainsi que nous l'explique le quotidien Le Parisien :

« Cette expérience ne sert pas à mettre en évidence une pollution d'eaux, mais plutôt leur capacité à conduire le courant », grâce aux minéraux qu'elles contiennent, avait déjà expliqué à l'AFP Fréderic Maillard, directeur de recherche au CNRS (LEPMI de Grenoble), spécialisé dans l'électrochimie et la science des matériaux, après une autre vidéo du même type, en novembre dernier. « « Plus vous avez de minéraux, plus la réaction est violente, et plus le résultat est marquant. Mais ça ne veut dire en aucun cas que l'eau est particulièrement polluée. Elle contient certains minéraux dont notre corps a besoin ».

Accès au document

Pesticides interdits en Europe, mais vendus dans les pays du sud

Michèle Rivasi 04/03/20

Suite à mon interpellation le 19 février au Parlement européen, la commissaire en charge des partenariats internationaux me répond qu'il n'y a en fait aucune information complète sur les #pesticides interdits dans l'UE, mais quand même vendus aux pays ACP (Afrique, Caraïbes et Pacifique) et sur leur utilisation et leurs résidus notamment dans les produits importés vers l'Europe.

Nous devons absolument travailler sur cette question des pesticides interdits et tout de même exportés. Ce point doit faire partie du #greendeal ! ON ne peut dire ici qu'on interdits les pesticides les plus dangereux, mais ensuite laisser les entreprises occidentales les produire et se faire du bénéfice en les vendant dans les pays pauvres. [...]

Accès au document

Baby Bees' Brain Growth Adversely Affected by Neonicotinoid Insecticides

Beyond Pesticides, March 6, 2020

Scientists from Imperial College London have just published their recent research on impacts of pesticides on larval bumblebees exposed through neonicotinoid-contaminated food sources. Many studies have looked at the devastating impacts of pesticides on adult insects, including pollinators — and bees, in particular. This research, however, examines how exposure to the neonicotinoid imidacloprid, through consumption of contaminated nectar and pollen during the larval stage, affects bumblebees (Bombus terrestris audax). It finds that these exposures cause abnormal brain growth in some parts of the bees' brains, and significantly impairs learning ability compared to bees who were not exposed.

Advocates maintain that neonicotinoid pesticides should be banned for their widespread and severe damage to insects and the environment broadly, in addition to human health concerns. [...]

Accès au document

Locust control campaigns spark health concerns

PAN 06/03/20

As East African farmers and communities scramble to cope with swarms of desert locusts this spring, they are also raising concerns about the impacts of the widespread use of pesticides to control them.

Locust swarms are moving through several countries in the region, including Kenya, Somalia, Tanzania and Uganda. The threat to food security in the region is very real — in one day, a single swarm can destroy crops that would feed 35,000 people.

Government officials are moving quickly to control the locusts with large scale spray operations, using both backpack sprayer and helicopter applications. The chemicals being sprayed are organophosphate (OP) pesticides, including the neurotoxic insecticide chlorpyrifos. [...]

Accès au document

Glyphosate Causes Biodiversity Loss in Freshwater Ecosystems

Beyond Pesticides, March 5, 2020

Glyphosate, the active ingredient in Bayer/Monsanto's Roundup, is the most commonly used pesticide in the world. Runoff from chemical-intensive agriculture contaminates most freshwater ecosystems - glyphosate is even found in phytoplankton (microscopic marine algae). With its current ubiquity in nature, a new study conducted by researchers at McGill University looks at phytoplankton's response and resilience to Roundup exposure. "Community rescue in experimental phytoplankton communities facing severe herbicide pollution" was published in Nature Ecology & Evolution. Researchers found that the algae could develop resistance to contamination, but surviving phytoplankton communities are much less diverse. Diversity loss is cause for concern as it could hinder adaptation to other potential stressors, such as climate change. [...]

Accès au document

HEAL response to the Beating Cancer Plan roadmap

HEAL 04/03/20

On 4 February 2020, the European Commission launched an EU-wide public consultation on Europe's Beating Cancer Plan running for 12 weeks as well as a consultation on the roadmap for said plan, which closed yesterday.

HEAL has responded to the consultation on the roadmap, with four main action points:

Fight cancer with the most vulnerable in mind, apply prevention and precaution and reduce workplace exposure by making occupational cancer data visible.

Prevent cancer by ensuring that the Farm to Fork Strategy strives to end the use of pesticides in our food and revamp the outdated EU food contact materials legislation which allows harmful chemicals to be used in food packaging.

Prevent cancer through zero-pollution in every part of the environment, by closing the current endocrine disruptors legislative gap, linking the Beating Cancer Plan to a comprehensive EU Chemical's Strategy for Sustainability and other chemical policy frameworks, preparing a non-toxic environment strategy, and action to detoxify the circular economy. Finally, speed up the process of aligning EU legal air pollution limits with the WHO guidelines to enter into force by the end of the current mandate.

Revise the European Code Against Cancer to raise people's awareness on limiting carcinogens in their daily life.

Accès au document

Chemical-Intensive Agriculture Increases Pregnant Mother's Risk of Her Child Developing Leukemia

Beyond Pesticides, March 3, 2020

Pregnant mothers living in areas where carcinogenic pesticides have been used are at increased risk of their child developing an acute form of leukemia, according to research published last month in the International Journal of Hygiene and Environmental Health by researchers at the University of California, Los Angeles. The findings are based on a review of pesticide use data in rural, agricultural areas of California, where many minority, low-income and farmworking communities live. Under current laws, the U.S. Environmental Protection Agency (EPA) permits the use of cancer-causing pesticides with an expectation that a certain number of cancers (anywhere from 1 in 1,000 to 1 in 1,000,000, based on the pesticide in question) should be considered 'acceptable risk. [...]

Accès au document

REVUE DE PRESSE / RECHERCHE ET MEDIAS

Cocktail de pesticides dans l'alimentation : la réglementation actuelle est suffisante selon l'Efsa

Actu-environnement 30/04/20

Faut-il renforcer la réglementation sur les pesticides dans l'alimentation si l'on prend en compte l'effet cocktail ? C'est à dire si on inclut les effets cumulés des différentes molécules retrouvées sur les aliments ? C'est à cette question que l'Autorité européenne de sécurité des aliments (Efsa) a tenté de répondre en réalisant deux évaluations pilotes. L'une sur les effets chroniques sur le système thyroïdien, l'autre portant sur les effets aigus sur le système nerveux. [...]

Accès au document

Smoking during pregnancy results in an increased risk of asthma even in adulthood

EurekAlert! 30/04/20

A recently completed study indicates that smoking by pregnant mothers caused roughly an 1.5-fold asthma risk in their offspring at the ages between 31 and 46.

Exposure to cigarette smoke is known to increase the risk of asthma in childhood, but research findings on its later effects are scarce.

A study published in the European Respiratory Journal investigated 5,200 individuals born in Northern Finland in 1966. The mother's smoking during pregnancy resulted in an approximately 1.5-fold asthma risk in the child at the ages between 31 and 46. The risk was higher for those who had reported suffering from respiratory symptoms previously or who were carriers of the RUNX-1 susceptibility gene. [...]

Accès au document

Antibiotic exposure can 'prime' single-resistant bacteria to become multidrug-resistant

EurekAlert! 27/04/20

Antibiotics save lives -- but using them also helps antibiotic-resistant strains evolve and spread. Each year, antibiotic-resistant bacteria infect some 2.8 million people in the United States, killing more than 35,000, according to the Centers for Disease Control and Prevention. Infections by multidrug-resistant -- or MDR -- bacteria, which are resistant to two or more antibiotics, are particularly difficult to treat.

Scientists at the University of Washington and the University of Idaho have discovered just how readily MDR bacteria can emerge. In a paper published April 6 in Nature Ecology & Evolution, the researchers report that, for a bacterial pathogen already resistant to an antibiotic, prolonged exposure to that antibiotic not only

boosted its ability to retain its resistance gene, but also made the pathogen more readily pick up and maintain resistance to a second antibiotic and become a MDR strain. [...]

Accès au document

Breastfeeding moms' exposure to nicotine linked to infant skull defect

EurekAlert! 27/04/20

Lactating mothers who use e-cigarettes or nicotine replacement therapies may be putting their breastfed babies at risk for skull defects, a new study in animals suggests.

Cigarette smoking has already been linked to increased risk for these abnormalities in previous research. This study tested the effects of nicotine alone on head and face development.

Researchers added nicotine to the drinking water of adult female mice that were nursing litters of newborn pups. The nicotine exposure was the equivalent of about one-half to a full pack of cigarettes per day.

Scientists found in 15-day-old pups that the skull joints across the top of their heads were narrowed, putting them on a path to fuse earlier than normal. Because mouse pups at this age don't drink water, breast milk was the only possible source of their nicotine exposure. [...]

Accès au document

Dramatic loss of food plants for insects

EurekAlert! 24/04/20

Just a few weeks ago, everyone was talking about plummeting insect numbers. Academic discourse focused on three main causes: the destruction of habitats, pesticides in agriculture and the decline of food plants for insects. A team of researchers from the Universities of Bonn and Zurich and the Swiss Federal Institute for Forest, Snow and Landscape Research WSL have now demonstrated for the first time that the diversity of food plants for insects in the canton of Zurich has dramatically decreased over the past 100 years or so. This means that bees, flies and butterflies are increasingly deprived of their food base. The study, which is representative for all of Central Europe, has now been published in the journal "Ecological Applications". [...]

Accès au document

Adsorbent material developed with PET bottles for the removal of antibiotics from water

EurekAlert! 24/04/20

High-purity organic ligand was extracted from PET waste bottles and used to develop a high-efficiency adsorbent. The material maintained its adsorption properties even after repeated use, indicating wide applicability for water treatment

South Korea with its high antibiotic use is categorized as a country at high risk of the emergence of multi drug-resistant bacteria, or so-called "super bacteria." According to the Ministry of Environment, antibiotic substances have been detected at livestock wastewater treatment facilities, sewage treatment plants, and in rivers. [...]

Accès au document

Health impacts of pollution upon indigenous peoples

EurekAlert! 24/04/20

A new study from the University of Helsinki presents the current state of knowledge on the exposure and vulnerability of Indigenous Peoples to environmental pollution, reviewing the innumerable impacts that pollution poses on Indigenous communities from all over the world.

"While the number of studies examining the impacts of environmental pollution upon Indigenous Peoples is growing, most of this research is isolated and fragmented across disciplines and geographic regions", says Dr. Álvaro Fernández-Llamazares, from the Faculty of Biological and Environmental Sciences, who led the study. "In fact, few efforts have cut across disciplinary topics and/or regions, and until today there was no global review mapping out the

worldwide impacts of environmental pollution on Indigenous Peoples". [...]

Accès au document

RIT scientists develop first 3D mass estimate of microplastic pollution in Lake Erie

EurekAlert! 24/04/20

Rochester Institute of Technology scientists have developed the first three-dimensional mass estimate to show where microplastic pollution is collecting in Lake Erie. The study examines nine different types of polymers that are believed to account for 75 percent of the world's plastic waste.

Plastic behaves differently in lakes than in oceans; previous studies on both have indicated the levels of plastic pollution found on the surface are lower than expected based on how much is entering the water. While massive floating "islands" of accumulated plastic waste have been found in oceans, previous studies have indicated the levels of plastic pollution found on the surface of Lake Erie are lower than expected based on how much is entering the water. [...]

Accès au document

Exposure to air pollution during pregnancy is associated with growth delays

EurekAlert! 22/04/20

Prenatal exposure to air pollution has been linked to various adverse effects on children's health, including lower birth weight and respiratory and neurodevelopmental problems. However, very little is known about how air pollution affects physical growth in the first years of life. A new study by the Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, has found an association between exposure to air pollution during pregnancy and delays in physical growth in the early years after birth.

The Spanish study, published in Environment International, analysed data from more than 1,700 mother-child pairs from Asturias, Gipuzkoa, Sabadell and Valencia enrolled in the birth cohort of the INMA Environment and Childhood Project. [...]

Accès au document

How atrazine regulations have influenced the environment

EurekAlert! 22/04/20

To combat weeds, farmers use a variety of tools and methods. By understanding the strengths and downfalls of each tool, a farmer can make the best decisions for his or her operation to keep pesky weeds out of the field.

One tool farmers can turn to for weed control is applying herbicides. New research is helping us understand a specific herbicide even better: atrazine.

Atrazine is one of the most common herbicides used in the United States. It can be used to manage weeds in crops like corn, sorghum, sugarcane and turf. The chemical kills weeds by preventing photosynthesis in the plant. [...]

Accès au document

CDC Finds Sharp Rise in Home Poisonings Tied to Disinfectant and Sanitizer Use during Covid-19 Pandemic; Safer Products Available

Beyond Pesticides, April 24, 2020

The Centers for Disease Control and Prevent (CDC) has released a study showing a sharp increase—62% in some cases—in calls to poison hotlines about exposures to toxic household cleaners and disinfectants. This poisoning comes with the advent of the novel Coronavirus pandemic, as public health and government officials, and many media outlets have sensibly recommended that people regularly disinfect “high touch” surfaces and objects in their homes and other surroundings, but have not issued warnings on toxic effects nor the availability of lower toxicity or least-toxic products. Compliance with cleaning (sanitizers) and disinfection recommendations is

an important public and personal health undertaking, but in this Covid-19 rigor lies a poison problem: the toxicity, as Beyond Pesticides has explained, of some cleaning and disinfecting products that are permitted by the Environmental Protection Agency (EPA) for sale and use. There are safer ways to disinfect those light switches, TV remotes, doorknobs, faucets, etc. [...]

Accès au document

Report de 3 mois du délai de commercialisation du chlorprophame (CIPC)

Arvalis-Info 22/04/20

Dans une note du 16 avril, l'ANSES apporte des précisions sur l'impact de l'ordonnance n°2020-306 du 25 mars 2020 liée aux mesures d'urgence face à la crise du Covid-19. Cette note modifie notamment les délais de grâce initialement accordés aux produits phytosanitaires en cours de retrait.

Concernant le chlorprophame, la note de l'ANSES précise que toutes les spécialités commerciales en contenant pourront être distribuées et commercialisées jusqu'au 8 juillet 2020 au lieu du 8 avril. [...]

Accès au document

ZNT : Des députés dénoncent une réduction des distances d'épandage

Terre-Net 22/04/20

Vingt-cinq députés, dont une majorité de marcheurs et MoDem, ont dénoncé mardi une division par deux des « distances de précaution pour pulvériser les pesticides » à proximité des habitations dans 25 départements, dans une lettre ouverte au ministre de l'agriculture.

« L'arrêté pris en date du 27 décembre 2019 portait pourtant les distances de sécurité minimales pour la pulvérisation des pesticides à proximité des lieux habités, à 5 m pour les cultures basses, type maraîchage, et à 10 m pour les cultures hautes », rappellent les députés, parmi lesquelles l'élue LREM du Finistère Sandrine Le Feur qui accueillera mercredi le président Macron dans sa circonscription.

« Or, depuis ce mois d'avril, 25 départements (dont tous les départements bretons), ont permis de revoir ces distances à 3 m pour les cultures basses et 5 m pour les cultures hautes », déplorent-ils, évoquant la « validation par certains préfets de chartes permettant » cette mesure. [...]

Accès au document

Réduction des pesticides : les pistes du coordinateur interministériel pour vraiment changer les pratiques

Actu-environnement 22/04/20

Constatant lui aussi l'échec des plans Écophyto, Pierre-Étienne Bisch dresse des pistes d'action pour engager une réelle mutation des pratiques agricoles. Formation, rémunération et lutte contre la concurrence déloyale en font partie.

Après avoir rencontré pendant plusieurs mois les parties prenantes de chaque région française, le coordinateur interministériel du plan de réduction de l'usage des produits phytosanitaires fait un premier constat sans appel, dans une note d'étape publiée le 20 avril : « *Il ressort de notre mission que toute tentative de réduction de l'utilisation de produits phytopharmaceutiques aura des effets limités si l'agriculteur ne recherche qu'à optimiser le coût des traitements, par le biais de la seule réduction des quantités utilisées* ». [...]

Accès au document

Pesticides : les ONG s'attaquent aux chartes dérogeant aux distances minimales d'épandage

Actu-environnement 23/04/20

Neuf associations saisissent la justice pour annuler les dérogations accordées aux agriculteurs pour l'épandage de pesticides dans certains départements. Du fait des consultations publiques

annulées, le ministère de l'Agriculture a validé des projets de chartes locales sans l'avis du public. Ces chartes étaient l'une des conditions pour réduire les distances d'épandage mises en place début 2020 près des habitations. [...]

Accès au document

« Nous souhaitons structurer l'offre ecotox pour développer le marché »

Actu-environnement 14/04/20

Les acteurs de la biosurveillance s'organisent pour créer leur syndicat. Un des objectifs : développer une demande pour ces outils qui s'appuient sur le vivant afin de comprendre les pollutions. Précision de Laurent Viviani, futur président du syndicat. [...]

Accès au document

Phytosanitaires : l'Anses publie la liste des substances préoccupantes à réévaluer rapidement

Actu-environnement 15/04/20

Dans le cadre du plan national d'action pour réduire le recours aux pesticides, l'agence de sécurité sanitaire a publié une liste de substances et produits qui devraient faire l'objet d'une réévaluation prioritaire.

Dans le cadre du plan national d'action visant à réduire l'usage des produits phytopharmaceutiques, le Gouvernement s'est engagé à interdire rapidement l'utilisation des substances les plus préoccupantes pour la santé et l'environnement. Une mission d'inspection avait établi, en 2017, une liste des substances actives jugées préoccupantes parmi les plus fréquemment détectées ou mentionnées dans les rapports de surveillance. Cette mission préconisait de s'opposer au report de l'approbation européenne pour les substances à échéance en 2018 (chlorotoluron, dimoxystrobin, flumioxazine, glufosinate, diflufenican(il), diquat) et d'étudier, pour les autres (epoxiconazole, profoxydim, quizalofop-P-tefuryl, metam-sodium, metsulfuron méthyle, sulcotrione), la possibilité de prendre une initiative au niveau national. [...]

Accès au document

Faster-degrading plastic could promise cleaner seas

EurekAlert! 20/04/20

To address plastic pollution plaguing the world's seas and waterways, Cornell University chemists have developed a new polymer that can degrade by ultraviolet radiation, according to research published in the Journal of the American Chemical Society.

"We have created a new plastic that has the mechanical properties required by commercial fishing gear. If it eventually gets lost in the aquatic environment, this material can degrade on a realistic time scale," said lead researcher Bryce Lipinski, a doctoral candidate in the laboratory of Geoff Coates, professor of chemistry and chemical biology at Cornell University. "This material could reduce persistent plastic accumulation in the environment." [...]

Accès au document

Princeton scientist solves air quality puzzle : Why does ozone linger long after its ban?

EurekAlert! 20/04/20

Drought-stressed plants are less able to remove ozone from the air, despite laws limiting pollution from cars, trucks and factories, report an international team led by Princeton atmospheric scientist Meiyun Lin

When high in the atmosphere, ozone protects Earth from harmful solar radiation -- but ozone at ground level is a significant pollutant. Exposure to high concentrations of ground-level ozone aggravates respiratory illnesses, thus exacerbating the negative health effects of heat and contributing to the catastrophic impacts of recent heatwaves and drought in Europe.

In Europe, despite laws limiting pollution from cars, trucks and factories, there has been little

improvement in ozone air quality. An international team led by atmospheric scientist Meiyun Lin found the surprising chain of causes: As global climate change leads to more hot and dry weather, the resulting droughts are stressing plants, making them less able to remove ozone from the air. [...]

Accès au document

Study describes cocktail of pharmaceuticals in waters in Bangladesh

EurekAlert! 20/04/20

In spring of 2019, researchers set out to investigate what chemicals could be found in the waters of Bangladesh.

The scientists -- from the University at Buffalo and icddr,b, a leading global health research institute in Bangladesh -- tested a lake, a canal and a river in Dhaka, Bangladesh's capital and the nation's largest city. The team also sampled water from ditches, ponds and drinking wells in a rural area known as Matlab.

In the lab, an analysis revealed that the waters held a cocktail of pharmaceuticals and other compounds, including antibiotics, antifungals, anticonvulsants, anesthetics, antihypertensive drugs, pesticides, flame retardants and more.

Not all of these chemicals were found at every location, and sometimes amounts detected were low.

But the ubiquity of contamination is concerning, says lead scientist Diana Aga, an environmental chemist at UB. [...]

Accès au document

Green chemistry approaches to the synthesis of coumarin derivatives

EurekAlert! 20/04/20

Coumarin derivatives (coumarins) are a class of compounds with a wide range of biological activities, which have found their application in medicine, pharmacology, cosmetics and food industry. Coumarin is found in a number of plants such as tonka beans and vanilla grass, among others. The biological activity and potential application of coumarins is highly dependent on their structure. Therefore, many researchers have been performing the synthesis of coumarin derivatives on a daily basis. High demands for their synthesis often result in an increased generation of different waste chemicals. In order to minimize the utilization and generation of toxic organic substances, green synthetic methods are applied in this manner. These methods are receiving more attention in the last few decades. [...]

Accès au document

Aquaculture at the crossroads of global warming and antimicrobial resistance

EurekAlert! 20/04/20

Aquaculture - rearing aquatic organisms such as fish and shellfish - plays a vital role in food security in many countries (it supplies more than half of the aquatic animals consumed by humans worldwide). It is particularly important for developing countries, for instance in Asia, which accounts for 90% of global output.

Fish farmers use large quantities of antimicrobials to treat or prevent disease on their farms. However, when used inappropriately, antimicrobials are ineffective and foster the development of resistant bacteria.

An index to assess the risks of antimicrobial resistance in aquaculture [...]

Accès au document

University of Kentucky's Superfund Research Center receives $8.7 million

EurekAlert! 20/04/20

The National Institute of Environmental Health Sciences (NIEHS) has awarded the University of Kentucky Superfund Research Center (UK-SRC) a five-year, $8.7 million grant to conduct research aimed at better understanding and minimizing the negative health and environmental impacts of chlorinated organic compounds found at

Superfund sites across the Commonwealth and the U.S.

Funded by the National Institutes of Health's NIEHS Superfund Research Program since 1997, the UK-SRC integrates multidisciplinary research, training and community engagement around a common theme: reducing risks posed by environmental contaminants in vulnerable communities.

Kentucky is home to 20 (13 active) Superfund sites that are on the Environmental Protection Agency's National Priorities List. They include manufacturing facilities, processing plants and landfills where hazardous waste has been improperly managed. [...]

Accès au document

MDI Biological Laboratory-led program reveals high arsenic in well water

EurekAlert! 15/04/20

A program to teach data literacy to Maine and New Hampshire students by analyzing data on arsenic in well water collected from their homes has found that 25 percent of samples exceed the New Hampshire maximum safety level of 5 parts per billion (ppb) and 15 percent exceed the U.S. Environmental Protection Agency (EPA) maximum safety level of 10 ppb.

The program also found that 62 percent of homeowners in the two states hadn't had their well water tested or didn't know if it had been tested despite the fact that the U.S. Centers for Disease Control and Prevention recommends testing at least once a year. [...]

Accès au document

ECOTOXicology Knowledgebase System User Guide Version 5.3

EPA 15/04/20

The ECOTOX Knowledgebase is a comprehensive, publicly available application providing chemical environmental toxicity data on aquatic life, terrestrial plants and wildlife compiled from over 49,000 references covering more than 11,700 chemicals and 12,900 species. ECOTOX data are used for all ecological risk assessments supporting pesticide registrations and re-registrations, all ambient water quality criteria for chemicals published since 1985, site-specific water quality criteria (by EPA Regions, States, and Tribes), and assessments used in emergency response. ECOTOX has established standard operating procedures that meet requirements for Agency systematic reviews of available information for use in Agency decision making. To meet the data needs of 21st century toxicological assessments, new tools have been integrated into ECOTOX to improve data mining capabilities for end users such that environmental regulatory, the regulated industry, and researchers can more effectively and efficiently search and use existing toxic effects data. These additions are highlighted and explained in the updated Quick Reference guide and User guide documents.

Accès au document

OSU research program awarded $12.7 million grant for Superfund research

EurekAlert! 13/04/20

An Oregon State University-led research program has been awarded a $12.7 million grant to serve the Pacific Northwest by studying harmful chemicals found at federally designated hazardous waste sites.

The Oregon State University Superfund Research Program received the five-year grant from the National Institute of Environmental Health Sciences. The program has now received more than $40 million from the NIEHS since 2009.

The program, which includes research partner Pacific Northwest National Laboratory (PNNL), will continue to focus on the effects of polycyclic aromatic hydrocarbons on human health. The pollutants, known as PAHs, are produced when coal, gas, oil and wood are burned. [...]

Accès au document

Skoltech researchers find a new HIT defense bacteria use against antibiotics

Eurekalert! 13/04/20

Scientists at the Severinov Laboratory in Skoltech and their colleagues from Russia and the US have uncovered a new mechanism of bacterial self-defense against microcin C, a potent antibiotic weapon in the microscopic world that can sometimes turn on its master.

Microcin C is a peptide-nucleotide antibiotic produced by some strains of Escherichia coli. It is essentially a Trojan horse: its peptide part helps it get into a cell, where the cell's own internal machinery turns it into what's called "processed McC". This compound completely blocks protein biosynthesis by interfering with its crucial component, aspartyl-tRNA synthetase. [...]

Accès au document

Nearly half of US breathing unhealthy air ; record-breaking air pollution in nine cities

Eurekalert 21/04/20

American Lung Association's 'State of the Air' report finds climate change is driving increases in unhealthy air, 150 million people at risk

American Lung Association

This year marks the 50th anniversary of the Clean Air Act, which is responsible for dramatic improvements in air quality. Despite this, a new report from the American Lung Association finds nearly half of the nation's population - 150 million people - lived with and breathed polluted air, placing their health and lives at risk. The 21st annual "State of the Air" report finds that climate change continues to make air pollution worse, with many western communities again experiencing record-breaking spikes in particle pollution due to wildfires. Amid the COVID-19 pandemic, the impact of air pollution on lung health is of heightened concern. [...]

Accès au document

Viruses that 'turn off' plant genes could help farmers battle herbicide-resistant weeds

GLP 15/04/20

A team of scientists from Rothamsted Research have successfully adapted genetic techniques developed for crop improvement to be used in weeds – allowing them, for the first time, to directly study the genetics responsible for herbicide resistance.

Since the invention of weed killers, farmers have been caught in a never-ending arms race with weeds – from the moment of first spraying weeds start to develop resistance to the chemicals – and year on year, the armory is shrinking.

Writing in the journal Plant Physiology, the group report they have used plant viruses to switch weed genes off, or alternatively, ramp up the production of specific proteins by weeds in the laboratory.

This means that these researchers can now directly show that a specific gene is required for herbicide resistance, or else is sufficient to confer it. [...]

Accès au document

Thixotropie « Réduire les doses de fongicides jusque -50 % » avec l'adjuvant 846

Terre-Net 15/04/20

Avec Le 846 (aussi appelé Oliofix selon les distributeurs), De Sangosse entend proposer aux agriculteurs une « innovation de rupture » permettant de limiter les pertes de pulvérisation et de concentrer les fongicides sur les feuilles de la culture cible.

Lancé cette campagne, l'adjuvant « Le 846 » vient compléter la famille des biosolutions De Sangosse, « composante stratégique de l'entreprise », présente Christophe Zugaj, responsable communication institutionnelle et affaires publiques. De Sangosse souhaite, en effet, « accompagner la transformation profonde des filières agricoles en mettant à la disposition des agriculteurs des biosolutions et outils de pilotage

permettant de nourrir, stimuler, protéger les cultures pour une triple performance économique, sociale et écologique ». [...]

Accès au document

Protection intégrée : des solutions rentables pas toujours dispos, mais des résultats encourageants

Terre-Net 20/04/20

Issue de l'Organisation internationale de lutte biologique (OILB), la notion de protection intégrée regroupe toutes les méthodes de protection des plantes limitant le recours aux produits phytopharmaceutiques. Même si des solutions rentables ne sont pas toujours disponibles, le biocontrôle produit déjà des résultats encourageants.

La protection intégrée des cultures privilégie la croissance de végétaux sains en veillant à perturber le moins possible les agroécosystèmes et encourage les mécanismes naturels de lutte contre les ennemis des cultures. Elle s'articule autour de quatre axes : les macro-organismes comme les insectes, nématodes, acariens... ; les micro-organismes tels que les virus, les bactéries, les champignons qui ont montré des résultats intéressants contre la septoriose et la fusariose du blé ; les médiateurs chimiques comme les phéromones qui sont utilisés pour créer une confusion sexuelle et enfin les substances naturelles d'origine minérale, végétale ou animale. [...]

Accès au document

L'encadrement des pesticides destinés aux jardiniers amateurs est précisé

Actu-environnement 10/04/20

L'encadrement de l'usage des produits phytosanitaires par le grand public est complété par un nouvel arrêté : celui du 6 avril relatif aux conditions d'autorisation d'un produit phytopharmaceutique pour la gamme d'usages « amateur ». Depuis le 1er janvier, la loi Labbé a interdit la mise sur le marché, la délivrance, l'utilisation et la détention des produits phytopharmaceutiques de synthèse chimique pour un usage non-professionnel. Certains produits restent toutefois autorisés. [...]

Accès au document

Une nouvelle étude lie pollution de l'air et létalité du coronavirus

Actu-environnement 10/04/20

Une nouvelle étude américaine publiée dans la revue médicale MedRxiv relie la pollution de l'air et la létalité du Covid-19.

En se basant sur 90 % des cas de décès liés au coronavirus aux États-Unis depuis le 4 avril, les chercheurs de l'université de Harvard (Boston) démontrent un taux de mortalité accru des patients exposés pendant quinze à vingt ans aux particules fines PM2,5.

Selon leurs conclusions, toute hausse de 1µg/m^3 de la teneur atmosphérique en PM2,5 entraînerait un taux de mortalité accru de 15 %. L'étude ne permet pas de trancher quant au rôle direct de la pollution, qui rendrait la population plus sensible au virus, ou sur des effets indirects, qui favoriseraient des maladies cardiovasculaires ou pulmonaires qui augmentent elles-mêmes le risque de mourir du virus. Ou si ces deux effets s'exercent en même temps.

Après une première étude italienne qui corrélait les taux de particules PM10 en suspension et le nombre de personnes atteintes du coronavirus, cette publication établit un nouveau facteur aggravant des effets de la pollution de l'air sur les personnes atteintes par ce virus. De nouvelles études doivent encore confirmer et affiner ces résultats.

La pollution de l'air diminuerait la résistance au coronavirus et faciliterait sa propagation (article paru le 20/03/2020). La pollution atmosphérique des grandes villes engendre des maladies qui induiraient une plus grande fragilité au coronavirus, et les particules fines pourraient aussi faciliter la diffusion de la maladie.

Accès au document

Résidus de pesticides dans les aliments : 4,5 % des échantillons dépassent la limite maximale

Actu-environnement 03/04/20

L'Autorité européenne de sécurité des aliments (Efsa) a publié, le 2 avril, son rapport annuel sur les résidus de pesticides présents dans les aliments de l'Union européenne. Verdict ? Pour l'année 2018, 95,5 % (contre 95,9 % en 2017) des quelque 91 000 échantillons analysés sont en-dessous de la limite maximale de résidus (LMR). Ce qui signifie que 4,5 % dépassent ce niveau, 2,7 % étant considérés comme non conformes, car dépassant toujours la LMR après prise en compte de l'incertitude des mesures. [...]

Accès au document

L'Anses propose d'identifier le résorcinol comme un perturbateur endocrinien avéré pour l'Homme

Actu-environnement 03/04/20

Le résorcinol est un perturbateur endocrinien avéré : c'est la conclusion d'une expertise réalisée par l'Agence nationale de sécurité sanitaire, de l'alimentation, de l'environnement et du travail (Anses) et rendue publique début avril. Cette substance est communément utilisée pour la fabrication de pneus, de produits dérivés du caoutchouc, de colles, de résines industrielles, mais également de produits de consommation courants, comme les colorations pour cheveux et les mascaras. Elle fait également office d'antioxydant pour des produits alimentaires, comme les crevettes, et d'antiseptique dans la composition de certains médicaments. [...]

Accès au document

Consultations publiques suspendues : le Gouvernement déroge aux distances d'épandage de pesticides

Actu-environnement 09/04/20

Face à l'impossibilité de consulter le public dans le contexte du confinement, une dérogation ministérielle permet aux agriculteurs de bénéficier d'un assouplissement des règles en vigueur en matière d'épandage de pesticides à proximité des habitations.

Jusqu'au 30 juin 2020, en raison des conséquences de la pandémie de Covid-19, les distances d'épandage de pesticides dont la cancérogénicité, la mutagénicité et la reprotoxicité ne sont pas avérées, pourront être réduites. Cette dérogation, accordée par le ministère de l'Agriculture et de l'alimentation, autorise temporairement les agriculteurs à épandre des pesticides à cinq ou trois mètres des habitations selon le type de cultures, et ce sans concertation publique, alors que le décret du 27 décembre 2019 sur les distances d'épandage, préconise de demander l'avis des riverains. (...]

Accès au document

L'IRSN fait le point sur la pollution radioactive liée aux feux de forêt à proximité de Tchernobyl

Actu-environnement 08/04/20

Le 4 avril, un feu de forêt s'est déclaré dans la zone d'exclusion de Tchernobyl. Une centaine d'hectares a été touchée. Dans un premier temps, la presse locale a annoncé une hausse localisée de la radioactivité gamma. Mais, « les autorités ukrainiennes ont démenti, lundi 6 avril 2020, toute hausse de la radioactivité, y compris dans les territoires touchés par le feu », explique l'Institut de radioprotection et de sûreté nucléaire (IRSN). À cela, il ajoute que « [sa balise Téléray] installée sur l'Ambassade de France à Kiev (à 100 km de Tchernobyl, ndlr) en avril 2011, n'a pas détecté d'élévation du débit de dose gamma ambiant ces derniers jours».[...]
Accès au document

Plant protection : Communication instead of poison

EurekAlert! 01/04/20

Increasing drought and heat seriously affect plants. In the Upper Rhine area, for example, climate change results in the development of new plant diseases, an example being Esca, a disease that causes vines to die. Researchers of Karlsruhe Institute of Technology (KIT) and partners have now launched the DialogProTec project that focuses on new approaches to plant protection without herbicides and fungicides. In collaboration with colleagues from Germany, France, and Switzerland, the researchers are conducting research in dialog with winegrowers, farmers, and industry. The project is funded by the EU under the border-crossing Interreg Upper Rhine program. […]

Accès au document

Seafloor of Fram Strait is a sink for microplastic from Arctic and North Atlantic Ocean

EurekAlert! 28/03/20

A new study shows: Sea ice and ocean currents transport plastic particles into the deep sea from 2 directions.

Working in the Arctic Fram Strait, scientists from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) have found microplastic throughout the water column with particularly high concentrations at the ocean floor. Using model-based simulations, they have also found an explanation for this high level of pollution. According to their findings, the two main ocean currents in Fram Strait transport the microscopically small plastic particles into the region between Greenland and Spitsbergen from both the Arctic and the North Atlantic. While passing through the Strait, many particles eventually drift to the seafloor, where they accumulate. The experts report on this phenomenon in a study just released in the esteemed journal Environmental Science & Technology. [...]

Accès au document

Completely new antibiotic resistance gene has spread unnoticed to several pathogens

EurekAlert! 27/03/20

Aminoglycoside antibiotics are critically important for treating several types of infections with multi-resistant bacteria. A completely new resistance gene, which is likely to counteract the newest aminoglycoside-drug plazomycin, was recently discovered by scientists in Gothenburg, Sweden.

The bacterial gene the team discovered in river sediment from India does not resemble any known antibiotic resistance gene. But when the scientist compared its DNA sequence to already published bacterial DNA sequences, they found that it was already present in several pathogens, including Salmonella and Pseudomonas, from the USA, China and Italy. Until now, no one had realized that it was a resistance gene. [...]

Accès au document

Mount Sinai researchers unveil mechanisms to prevent Crohn's disease

EurekAlert! 26/03/20

In a series of four studies published today in Gastroenterology, a journal of the American Gastroenterological Association, Mount Sinai inflammatory bowel disease (IBD) researchers, describe the identification of predictive tools and a new understanding of environmental factors that trigger IBD. [...]

First Study to Evaluate Association of Metal Exposure and IBD.

In a study of metal exposure in the baby teeth of patients who eventually developed IBD later in life, Mount Sinai researchers and colleagues in Portugal collected data from 28 adult Portuguese patients, taking advantage of the country's long tradition of parents storing their children's baby teeth. Baby teeth, like the growth rings in trees,

retain information incrementally, storing evidence of environmental exposure from their initial development in the womb until they are shed. Investigators were able to retrieve the baby teeth of 12 IBD patients and 16 unaffected controls, allowing them to study for the first time the association between early-life metal exposures and future risk of IBD. "The data suggests that metal exposure during a critical window in early life may be a risk factor for IBD," says Manish Arora, PhD, Professor of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai. Researchers investigated four metals--lead, copper, zinc, and chromium--and the developmental time periods during which exposure took place going back to the 25th week of pregnancy. [...]

Accès au document

Air pollution linked to dementia and cardiovascular disease

EurekAlert! 30/03/20

People continuously exposed to air pollution are at increased risk of dementia, especially if they also suffer from cardiovascular diseases, according to a study at Karolinska Institutet in Sweden published in the journal JAMA Neurology. Therefore, patients with cardiovascular diseases who live in polluted environments may require additional support from care providers to prevent dementia, according to the researchers.

The number of people living with dementia is projected to triple in the next 30 years. No curative treatment has been identified and the search for modifiable risk and protective factors remains a public health priority. Recent studies have linked both cardiovascular disease and air pollution to the development of dementia, but findings on the air pollution-link have been scarce and inconsistent.

In this study, the researchers examined the link between long-term exposure to air pollution and dementia and what role cardiovascular diseases play in that association. Almost 3,000 adults with an average age of 74 and living in the Kungsholmen district in central Stockholm were followed for up to 11 years. Of those, 364 people developed dementia. The annual average level of particulate matter 2.5 microns or less in width (PM2.5) are considered low compared to international standards. [...]

Accès au document

Substances chimiques : 5 000 données de toxicité dans la base OpenFoodTox

Actu-environnement 30/03/20

L'agence européenne des produits chimiques (Efsa) a mis à jour sa base de données OpenFoodTox. Créée en 2017, elle contient désormais près de 5 000 données de toxicité sur les substances chimiques évaluées par l'Efsa depuis 2002. Pour chaque substance, les informations suivantes sont fournies : le secteur concerné de l'alimentation humaine ou animale (Par exemple additifs alimentaires, pesticides ou contaminants) et les populations affectées (humains, animaux d'élevage ou animaux sauvages). [...]

Accès au document

Pesticides et abeilles : troisième round de consultation sur les lignes directrices de l'Efsa

Actu-environnement 26/03/20

L'Autorité européenne de sécurité des aliments (Efsa) poursuit les consultations sur la révision des lignes directrices relatives à l'évaluation des risques liés aux pesticides pour les abeilles. Il s'agit de mettre à jour le document d'orientation actuel, qui date de 2013. Les nouvelles lignes directrices sont attendues pour 2021.

La révision porte notamment sur les protocoles de collecte et d'évaluation des données sur la mortalité des abeilles, les voies d'exposition aux pesticides (pulvérisation, traitement des semences, granulés…), les cultures attractives, les tests…

Accès au document

Pharma's potential impact on water quality

EurekAlert! 25/03/20

When people take medications, these drugs and their metabolites can be excreted and make their way to wastewater treatment plants. From there, the compounds can end up in waterways. Wastewater from pharmaceutical companies could start off with even larger amounts of these substances. In ACS' Environmental Science & Technology, researchers report that a single pharmaceutical manufacturing facility could be influencing the water quality of one of Europe's most important rivers. [...]

Accès au document

26 types of microplastics and rubbers detected in Dutch rivers

Wur 25/03/20

Researchers from Utrecht University, Wageningen University & Research and the University of Amsterdam have analysed microplastics and rubbers in Dutch rivers the Dommel, the Maas and Dutch sewage treatment plants in a precise way. They found 26 different plastics and rubbers.

The majority of all microplastics in seas and oceans origin from rivers, where microplastics come together from different sources. Knowledge about those sources and the distribution of microplastics is important for water managers. Results from previous studies are not as reliable due to sample contamination, and often only larger particles were detected - now smaller microplastics have also been analysed. With the results of this study, water managers - both those of surface water and drinking water - can better estimate whether and where potential risks from microplastics can be expected. The results of this research were recently published in the scientific journal Water Research. [...]

Accès au document

Advances in genetic, geospatial techniques aid efforts to fend off invasive insects

EurekAlert 19/03/20

In the fight to protect native ecosystems from invasive insects and related arthropod species, promising new tools are arising from rapid advances on a pair of research fronts: genetic analysis and geospatial technology.

At ports of entry in the United States, for instance, fruit flies hitchhiking in cargo can now be identified to species with DNA barcoding. And fine-scale environmental data combined with knowledge of insect lifecycles is putting simple maps that forecast pest emergence in the hands of forest managers across the country. These examples and more are showcased in a pair of new special collections in the Annals of the Entomological Society of America, published in a partnership between ESA and the National Invasive Species Council (NISC). [...]

Accès au document

Common anti-parasite treatments used on cattle have devastating impacts on wildlife

EurekAlert 17/03/20

Experts have stressed an urgent need to find alternatives to wormers and anti-ectoparasitic products used widely on cattle, following the findings of a study just published in Environmental Toxicology and Chemistry.

Researchers from the University of Sussex looked at a body of published evidence into the environmental impact of anthelmintics -- products used as wormers and anti-parasitic agents and widely applied across the world. They found that, across all drug classes, the products were having a devastating impact on dung beetles - species that are vital prey items for a range of bat and bird species. [...]

Accès au document

Climate and health impacts of residential wood combustion in Finland

Peer 17/03/20

According to the dissertation by Mikko Savolahti, a researcher at the Finnish Environment Institute, residential wood combustion causes 200 premature deaths in Finland each year. In addition, residential combustion is a contributing factor to accelerating climate change. Savolahti will defend his dissertation at Aalto University on Friday, 6 March. [...]

Accès au document

Ancient plant genes could increase food production without added fertilizer use, mitigating deadly algal blooms

Genetic Literacy Project 20/03/20

Some 500 million years ago — when our continents were connected in a single land mass and most life existed underwater — hornworts (Anthoceros) were one of the first groups of plants to colonize land. An international team led by University of Zurich (UZH) and the Boyce Thompson Institute has now sequenced three hornwort genomes, providing insights into the genetics underlying the unique biology of the group, an extant representative of the earliest land plants.

The research team began the project in 2011. "It took us three years to figure out how hornworts can be grown and pushed through its sexual life cycle under laboratory conditions, and another three years to properly assemble and annotate its genome," says Péter Szövényi, researcher at UZH and last author of the paper. [...]

Accès au document

USDA produce industry committee recommends EPA suspend registration of drift-prone dicamba herbicides

GeneticLiteracyProject 18/03/20

The USDA Fruit and Vegetable Industry Advisory Committee has recommended the suspension of dicamba registration to prevent produce crop harm resulting from off-target movement when the herbicide is applied to non-produce row crops.

The group asked that Agriculture Secretary Sonny Perdue work with the FDA and EPA to address concerns about dicamba, a multi-action herbicide used by soybean and cotton growers to control invasive weeds. [...]

Accès au document

Pesticide seed coatings are widespread but underreported

Science daily 23/03/20

Pesticide-coated seeds -- such as neonicotinoids, many of which are highly toxic to both pest and beneficial insects -- are increasingly used in the major field crops, but are underreported, in part, because farmers often do not know what pesticides are on their seeds, according to an international team of researchers. The lack of data may complicate efforts to evaluate the value of different pest management strategies, while also protecting human health and the environment. [...]

Accès au document

Phytosanitaires : la procédure à suivre lorsque la classification des produits évolue

Actu-environnement 24/03/20

Dans un avis du 24 mars publié au Journal officiel, le ministère de l'Agriculture fait le point sur les procédures à respecter, pour les titulaires d'autorisations de mise sur le marché (AMM) et de permis de commerce parallèle de produits phytopharmaceutiques, lorsque la classification de ces produits évolue.

Pour rappel, la réglementation européenne relative à la classification, à l'étiquetage et à l'emballage des substances et des mélanges (règlement CLP 30497) prévoit que « *tous les*

produits phytopharmaceutiques bénéficiant d'une autorisation de mise sur le marché doivent faire l'objet d'une classification préalable par les fabricants ». Cette classification peut définir des précautions et / ou restrictions d'usages, des mesures de protection pour les utilisateurs ou des mesures d'atténuation des risques. [...]

Accès au document

Pulvérisation Berthoud teste le spot spraying sur des exploitations européennes

Terre-Net 18/03/20

Berthoud continue son travail de recherche visant à offrir aux agriculteurs des pulvérisateurs capables de pulvériser entre 50 et 90 % de produits en moins. Objectif : enrichir le partenariat entre la marque et les deux start-ups Carbon Bee et Bilberry.

Berthoud accompagne les agriculteurs pour répondre aux enjeux environnementaux et sociétaux. Objectif : réduire la quantité de produits phytopharmaceutiques épandus. Le bureau d'études axe donc ses travaux de recherches vers les technologies permettant de répondre à ces attentes. [...]

Accès au document

Sous quelles conditions les distances peuvent-elles être réduites ?

Agri-mutuel 17/03/20

Instaurées depuis le 1er janvier 2020 pour la protection des riverains, les distances de non-traitement concernent les zones accueillant des personnes vulnérables et les zones d'habitation. S'appliquant pour le traitement des parties aériennes des plantes, elles varient selon les cultures et les produits utilisés. Elles peuvent également être adaptées, mais sous certaines conditions. Faisons le point ensemble ! [...]

Accès au document

La société Dow AgroSciences fait appel de la décision d'annuler la mise sur le marché de deux insecticides

Actu-environnement 19/03/20

La société Dow AgroSciences, filiale de la multinationale américaine DowChemical, a saisi, mardi 17 mars, la Cour administrative d'appel de Marseille afin d'obtenir l'annulation de l'interdiction de deux insecticides qu'elle commercialise, le « Closer » et le « Transform ». Ces insecticides contiennent tous deux du sulfoxaflor, une substance qui agit de manière similaire aux néonicotinoïdes et met en péril la santé reproductive des colonies de bourdons, selon une étude publiée dans la revue Nature en 2018. [...]

Accès au document

Pesticides : le Conseil d'État rejette les recours de la Coordination rurale sur les distances d'épandage

Actu-environnement 12/03/20

Le Conseil d'État a rejeté le 10 mars les recours en référé suspension engagés par la Coordination rurale et la Chambre d'agriculture de la Vienne contre l'arrêté ministériel établissant les zones de non traitement (ZNT) autour des habitations depuis le 1er janvier 2020.

« Si le Conseil d'État a reconnu que l'arrêté était de nature à porter une atteinte de manière immédiate aux exploitations, en particulier pour certaines catégories de cultures, il a jugé incomplète la démonstration de l'étendue des conséquences qui justifieraient une décision de suspension », fait savoir la Coordination rurale (CR) dans un communiqué le 11 mars 2020. [...]

Accès au document

Produits chimiques : l'Echa lance un outil pour aider les entreprises à respecter la législation

Actu-environnement 11/03/20

L'EUCLEF permettra aux entreprises d'avoir accès gratuitement à un panorama de quarante mesures législatives à respecter

L'Agence européenne des produits chimiques (Echa) lance ce mercredi un nouvel outil pour aider les entreprises à se conformer à la législation relative aux produits chimiques en Europe. Baptisé EUCLEF, pour EU Chemicals Legislation Finder (« moteur de recherche sur la législation relative aux substances chimiques de l'Union européenne », en français), ce service en ligne permettra aux entreprises d'avoir accès gratuitement à un panorama de quarante mesures législatives à...

Accès au document

Ile-de-France : la pollution de l'air des écoles diminue mais reste un sujet de préoccupation

Actu-environnement 10/03/20

L'amélioration de la qualité de l'air dans les écoles franciliennes se poursuit même si la situation reste préoccupante dans 467 établissements, révèle l'association Respire. L'ONG a publié, lundi 9 mars, une carte actualisée des écoles polluées basée sur les données 2018 fournies par Airparif, l'association agrée de surveillance de la qualité de l'air. Les données portent sur l'air extérieur, et non sur la pollution de l'air intérieur, des différents établissements accueillant des enfants ou des adolescents : crèches, écoles, collèges, lycées. [...]

Accès au document

Qualité de l'air dans les cours d'écoles lyonnaises : des parents et des associations saisissent la justice

Actu-environnement 09/03/20

« Notre école symbolise particulièrement le manque de courage des responsables politiques à Lyon concernant la sortie du tout-voiture, dénonce Renaud Pierre, parent d'élève à l'école Michel Servet, une école dont la proximité avec le tunnel de la Croix Rousse à Lyon expose à des niveaux importants de pollution. Alors que l'urgence devrait être de mettre en place de vraies solutions, (…) les autorités ont condamné la cour de récré la plus proche du tunnel, et certains candidats aux municipales menacent même de la fermer ou la déménager ».

Un collectif de parents mobilisé contre la pollution de l'air, Greenpeace France et Alternatiba/ANV Rhône ont ainsi décidé de lancer deux procédures administratives pour inaction de la ville, de la métropole et de l'Etat. […]

Accès au document

Natural organic matter influences arsenic release into groundwater

EurekAlert! 11/03/20

Millions of people worldwide consume water contaminated with levels of arsenic that exceed those recommended by the World Health Organization. This could cause health problems, such as arsenic poisoning, cardiovascular disease and cancer. Microbes in groundwater release arsenic from sediments, and organic matter helps fuel this reaction. Now, researchers reporting in ACS' Environmental Science & Technology have discovered that the type of natural organic matter (NOM) influences the rate and level of arsenic release. [...]

Accès au document

Microplastics affect the survival of amphibians and invertebrates in river ecosystems

EurekAlert! 10/03/20

Concern about contamination caused by microplastics is growing; owing to their abundance, ubiquity and persistence over time, microplastics pose a potential risk for organisms and ecosystems. Yet studies into their distribution in freshwater systems, in both lakes and rivers, and their effects on the organisms in these waters are few and far between, and there is very little information about their potential effect on the functioning of these ecosystems.

In this context, in collaboration with the National Museum of Natural Sciences (CSIC-National Research Council) in Madrid, the UPV/EHU's Stream Ecology research group has studied "the effects of microplastics on freshwater ecosystems and on two of the most important groups of organisms that live in them: amphibians and invertebrates", explained Naiara López-Rojo, researcher in the UPV/EHU group. To do this they conducted lab experiments in which they replicated the conditions of the rivers and ponds where these animals live, and exposed them to different concentrations of fluorescent microplastics: "Replicas without microplastics (control), at a low, at an intermediate and at a high concentration, while the remaining characteristics were identical (light, temperature, etc.)." [...]

Accès au document

New findings of chemical differences between PM1 and PM2.5 might reshape air pollution studies

EurekAlert! 09/03/20

Current air pollution studies largely rely upon aerosol mass spectrometers, most of which can only measure submicron aerosol (PM1) species--particulate matter with aerodynamic diameter less than 1 μm. In many studies, PM1 aerosol species are therefore used to validate those of PM2.5 (particulate matter with aerodynamic diameter less than 2.5 μm) in chemical transport models, and estimate particle acidity (pH) and aerosol water content which are key parameters in studying heterogeneous reactions. However, are there chemical differences between PM1 and PM2.5 ? Will the differences bring uncertainties into air pollution studies, especially in highly polluted environment, e.g., China and India ? [...]

Accès au document

Pesticides increase the risk of schistosomiasis, a tropical disease

EurekAlert! 05/03/20

Schistosomiasis is a severe infectious disease caused by parasitic worms. As an intermediate host, freshwater snails play a central role in the life cycle of the parasite. In a recent study published in the journal Scientific Reports, researchers from the Helmholtz Centre for Environmental Research (UFZ) in cooperation with the Kenya-based International Centre of Insect Physiology and Ecology (icipe) succeeded in proving that snail populations in waterbodies contaminated with pesticides were significantly larger than in uncontaminated waterbodies. The pesticides used in agriculture may well be an outright driver for the risk of infection with schistosomiasis, the researchers warn. [...]

Accès au document

Air pollution is one of the world's most dangerous health risks

EurekAlert! 05/03/20

Polluted air is a public health hazard that cannot be evaded. It is widely known that long-term exposure to air pollution enhances the risks of cardiovascular and respiratory diseases. Scientists from the Max Planck Institute for Chemistry and the University Medical Center Mainz now calculated in a new study that the global, public loss of life expectancy caused by air pollution is higher than many other risk factors such as smoking, infectious diseases or violence. [...]

Accès au document

Des pesticides, oui, mais des bio !

Agri-mutuel 10/03/20

Les vignerons de Bordeaux ont acheté 15 % de plus de produits phytosanitaires en 2018 qu'en 2017, mais cette augmentation cache une forte chute des produits les plus toxiques pour la santé, et une hausse de ceux qui sont agréés en culture biologique, a affirmé la profession mardi à Paris.

Le Conseil interprofessionnel du vin de Bordeaux (CIVB) a souligné « la progression constante de l'utilisation des produits autorisés en agriculture biologique, dont le soufre et le cuivre » par l'ensemble des viticulteurs pour lutter contre les maladies de la vigne, notamment les moisissures. La part de ces produits arrivait ainsi à près de 50 % des fongicides employés en Gironde en 2018, alors qu'elle était de 25 % en 2008.

« Chaque fois qu'un viticulteur remplace un produit chimique par un produit bio ou de biocontrôle, les quantités de produits utilisés augmentent, car leurs doses d'utilisation sont tout simplement plus élevées », a expliqué Bernard Farges, président du CIVB lors d'une conférence de presse à Paris. [...]

Accès au document

EU neonic insecticide ban cut UK canola production from 1.8 million acres to 1.3 million annually

Genetic Literacy Project 09/03/20

In 2012, U.K. farmers seeded about 1.8 million acres of oilseed rape [canola]. But over the last eight years, acreage consistently dropped, sinking to 1.3 million in 2019 and possibly 1.04 million in 2020.

One large reason for the decline is neonicotinoids. Rather, the lack of neonics in the U.K., says a Syngenta rep. "Since we lost neonic seed treatments we are struggling, really struggling, to grow oilseed rape," said Scott Cockburn, business manager with Syngenta U.K. [...]

Accès au document

Will legal 'assault' on Bayer's Roundup weedkiller in US, EU threaten Africa's access to glyphosate ?

Genetic literacy project 06/03/20

A growing assault against glyphosate in the U.S. and Europe is threatening the future of the widely used weed killer in Africa due to the perceived concerns that it causes cancer.

The onslaught, which started with lawsuits in the U.S. before mutating to bans in Europe, is slowly gaining momentum, with regulatory authorities across the globe monitoring the unfolding events before deciding on the next course of action.

In Africa …. regulators have adopted a cautious approach while keenly following the events surrounding the controversial herbicide. This is despite pressure from civil society organizations to ban the weed killer developed by Monsanto. [...]

Accès au document

Pollution au chlordécone : Des associations réclament l'ouverture d'une nouvelle enquête aux Antilles

20minutes 05/03/20

Trois associations ont réclamé l'ouverture d'une nouvelle enquête sur l'enfouissement du chlordécone aux Antilles, rapporte Franceinfo, ce jeudi. Alors que l'Organisation mondiale de la Santé (OMS) avait alerté sur sa dangerosité en 1970, ce puissant pesticide a été utilisé jusqu'en 1993 dans les bananeraies. […] les associations Vivre, CRAN, et Lyannaj pou depolye Matinik ont demandé l'ouverture une nouvelle instruction sur des possibles stocks de chlordécone enfouis.

L'existence de ces stocks a été révélée par Joël Beaugendre, maire de Capesterre-Belle-Eau en Guadeloupe et ancien député lors d'une commission d'enquête parlementaire en septembre. Selon l'élu, des stocks de chlordécone ont été enterrés au Jardin d'Essai aux Abymes (Guadeloupe). [...]

Accès au document

Household Chemical Usage Related to Language Delays Among Kids

Medindia 05/03/20

Kids from low-income homes whose mothers reported regular use of toxic chemicals such as household cleaners were more likely to show language delays by age 2, according to a new study published online in the journal Clinical Pediatrics.

In addition, the children scored lower on a test of cognitive development. These developmental delays were evident even when the researchers took into account factors such as the education and income of mothers, which are also linked to their children's language and cognitive skills. [...]

Accès au document

Health Canada to ban strychnine to kill Richardson's ground squirrels

MedicineHatNews 05/03/20

Health Canada is moving forward with a ban on the use of the deadly pesticide strychnine to kill gophers.

The Health Canada website says an evaluation of scientific information confirms there are risks to other animals, including species at risk, for products registered to control Richardson's ground squirrels.

In 2018, Health Canada cited concerns about animals including the swift fox and the burrowing owl in its proposal. [...]

Accès au document

Africa must act on pesticide 'double standards'

Mail & Guardian 05/03/20

And yet, as a result of industrial-scale human pillage, the former abundance of sea fish is in steep decline across the world, a phenomenon our ancestors would surely have considered unimaginable. So, too, is there a global decline in wild bees and other essential pollinators.

Globally, nearly 90% of wild flowering plant species depend, at least in part, on the transfer of pollen by bugs and other animals, while more than 75% of our main food crops rely on nature's pollination services.

It is against this backdrop that leading African scientists have urged governments and policy makers to give serious consideration to banning, restricting or tightening up regulations for neonicotinoid pesticides on this continent. [...]

Accès au document

Nitrate problem worsening in rural Minnesota's drinking water

Startribune 05/03/20

Nitrate pollution in public drinking water across rural Minnesota is not only widespread but getting worse, a new report shows.

[…], the Environmental Working Group […] tracked the levels from 1995 to 2018. During that time, the nitrate levels rose in more than 60% of the affected water systems - or about 72 of 115 systems.

The average nitrate level in 1995 was 2.7 milligrams per liter of water; by 2018 the average was 4.4 milligrams. That is below the state and federal limit of 10 milligrams, but it could be high enough to pose potentially serious health risks based on newer health research, according to the report. [...]

Accès au document

Nine Delhi districts had contaminated groundwater in 2019 : Jal Shakti Minister

The Hindu 04/03/20

In the National Capital Region, which includes parts of Haryana, Rajasthan and Uttar Pradesh apart from Delhi, at least 30 districts had some form of pollutants in their groundwater, including arsenic, iron, heavy metals such as lead, cadmium

and chromium, flouride, nitrate and salinity, the data showed.

The data was presented by Jal Shakti Minister Gajendra Singh Shekhawat in a written response to a starred question asked by D.P. Vats, a BJP MP and retired Lt. General.

He had asked whether the government was aware of "increasing groundwater pollution" in Delhi-NCR and that what action is being taken to prevent over-exploitation of groundwater in these areas.

In response, the Jal Shakti Minister said that the Central Pollution Control Board's National Water Quality Monitoring Programme did not show any increasing or decreasing trends in Delhi's groundwater pollution levels in 2018 and 2019.

However, the Central Ground Water Board's quality monitoring data for 2019 showed that most districts in the Capital were partially affected by groundwater contaminants present at higher levels than declared permissible by the Bureau of Indian Standards, Mr. Shekhawat's response showed. [...]

Accès au document

It's not just chlorinated chicken: five foods a US trade deal could bring to the UK

The Guardian 04/03/20

Nothing symbolises British fears of a standard-slashing US trade deal better than chlorinated chickens : those zombie birds, barely able to move, cluck or feed, stuffed with chemicals that force them to grow to unbelievable sizes, sitting in their own waste, covered in sores rather than feathers. At the end of their miserable life of confinement, they are washed in chlorine or a similar chemical to get rid of the bacteria that infect them.

In fact, the wash is believed to hide rather than eliminate some bacteria, potentially driving much higher rates of food poisoning in the US, not to mention the appallingly treated workers in the industry who suffer "rashes, burns, destruction of the eye tissue, difficulty breathing, and inflammation of the respiratory system" as a result of exposure.

But chicken is only the tip of the iceberg. Despite government claims, here are five other unpleasant foods that could make their way to our menus as part of a UK-US trade deal.

Antibiotic meat

Much US meat is produced on an industrial scale, with conditions as bad as those in the chicken sheds. In particular, hormones, steroids and antibiotics are regularly used to make animals bigger and faster, and to prevent them getting ill in the unnaturally close conditions in which they are kept. Many cows and pigs never see sunlight, walk freely or eat grass. Many of the chemicals used are bad for us too – antibiotic overuse is threatening to make these vital drugs useless, and to bring down a pillar of modern medicine. Another chemical, ractopamine, is regularly fed to industrially farmed pigs in the US, despite making the animals collapse, turn aggressive, suffer liver and kidney dysfunction, and even die. But it probably affects humans too, which is why not just the EU but also Russia and China have banned this dangerous chemical, as well as US pork that contains it. [...]

Accès au document

Over quarter of city receiving chemical-laced water supply

Times of India 04/03/20

Ludhiana: Over a quarter of the industrial hub is receiving chemical-laced water supply. Of the 80 water samples the municipal corporation collected from residential areas of the city's all four zones over the past two months, 30 were found unfit for consumption. While 21 samples showed higher levels of nitrate, nine had selenium beyond permissible limit.

Even as the MC officials refused to name the areas that were receiving contaminated water, they stressed on the need to switch over from tubewells to canal-based water supply. "As many as 21 samples had nitrate between 80mg and 90mg against the permissible limit of 45mg. And nine samples showed high levels of selenium against the allowed limit of 0.1%. We are yet to ascertain the the exact cause behind it, as the samples were collected randomly from residential areas and not the industrial ones," said a civic body official. [...]

Accès au document

Filière CRC Premières céréales certifiées sans résidus de produits phytos pour 2021

Terre-Net 03/03/20

À l'approche de son 20e anniversaire, la filière CRC a profité du salon de l'agriculture pour présenter ses dernières avancées. Parmi les mesures phares, le lancement des premières céréales certifiées sans résidus de produits phytosanitaires pour 2021.

Avec cette annonce, la filière CRC entend « donner un indicateur clair aux meuniers, boulangers, industriels et consommateurs en quête de produits céréaliers bons pour les Hommes et l'environnement. Cela permettra à terme de garantir le "sans résidus de pesticides" sur une denrée quotidienne comme le pain », explique la filière. « Concrètement, les analyses des produits phytosanitaires vont être encore encore plus strictes et le cahier des charges, déjà très précis, est en cours d'évolution. » [...]

Accès au document

26e RDV agri « Protéger les plantes, mais aussi la santé humaine et l'environnement »

Terre-Net 03/03/20

Protéger les cultures pour qu'elles soient en bonne santé implique aussi, et même de plus en plus, « préserver les riverains et les agriculteurs ». Sur ce sujet, Thierry agriculteur d'aujourd'hui interrogera ce soir à 21 h, pour son 26e RDV agri sur sa chaîne Youtube, Eugénia Pommaret, directrice de l'Union des industries de la protection des plantes (UIPP), et Julien Durand-Réville, responsable santé. (…)

RDV agri est une émission de Thierry agriculteur d'aujourd'hui, dont Terre-net est partenaire. Elle est diffusée en direct sur sa chaîne Youtube un lundi sur deux à 21 h. Pendant une heure, Thierry « reçoit un agriculteur et/ou un expert pour traiter d'un sujet agricole à destination des professionnels ». [...]

Accès au document

Pollution plastique : un guide pour limiter les fuites tout au long de la chaîne de valeur

Actu-environnement 03/03/20

Une trentaine de parties prenantes publie les premières directives standardisées pour mesurer et prévoir la pollution plastique dans les différentes étapes de la chaîne de valeur des entreprises. Le document, rédigé par les consultants de Quantis et EA, est le fruit d'un travail qui a réuni des plasturgistes et leur fédération européenne (Dow, Braskem et PlasticsEurope), des industriels utilisateurs de plastique (Adidas, Decathlon, Mc Donald's et Mars, par exemple), l'éco-organisme Citeo, le Centre commun de recherche de la Commission européenne, le Programme des Nations unies pour l'environnement (Pnue), le Massachusetts Institute of Technology (MIT), ou encore le WWF. [...]

Téléchargez les directives (PDF)

Accès au document

Le taux de la taxe sur la vente de pesticides augmente à 0,9 % du chiffre d'affaires

Actu-environnement 03/03/20

Un arrêté interministériel, publié le 1er mars au Journal officiel, augmente de 0,2 à 0,9 % du chiffre d'affaires, le taux de la taxe sur les produits phytopharmaceutiques. En revanche, le taux reste inchangé à 0,1 % du chiffre d'affaires pour les produits de biocontrôle. La taxe est assise sur le montant total des ventes, hors TVA, de produits phytopharmaceutiques réalisées au cours de l'année civile précédente, à l'exclusion des ventes de produits expédiés vers un autre État membre de l'UE ou exportés hors de l'Union. [...]

Accès au document

Un Atlas dresse un panorama de la contamination au plastique

Actu-environnement 05/03/20

Même si les chiffres sont connus, leur rappel par l'Atlas du plastique est saisissant : 9,2 milliards de tonnes de plastique ont été produites depuis 1950. L'équivalent d'un camion de déchets plastiques est déversé toutes les minutes dans l'océan, soit 10 millions de tonnes chaque année. La pollution des sols est de 4 à 23 fois plus élevée ; ou encore, l'ingestion humaine serait équivalente à une carte de crédit (5 g) par semaine.

L'ouvrage (…) dresse un panorama de la contamination et de ses sources, mais également de ses conséquences. Il zoome aussi sur des expériences réussies d'alternatives ou de suppression de l'utilisation du plastique. [...]

Consulter l'atlas du plastique (PDF)

Accès au document

Plastiques : 14 États et 40 entreprises signent un pacte européen pour réduire la pollution

Actu-environnement 09/03/20

Ce vendredi 6 mars, 14 pays européens et 40 entreprises ont signé le Pacte plastique européen. Les acteurs de cette « coalition public-privé » s'engagent ainsi à « réduire [leurs] déchets plastique, utiliser moins de plastique dans la fabrication de [leurs] produits, et favoriser le recyclage et le réemploi ». « Les engagements sont volontaires, mais les signataires s'engagent à les respecter », assure le ministère français de la Transition écologique, à l'origine du pacte

Accès au document

How pest management strategies affect the bottom line

Eurekalert! 29/02/20

A study out of Mississippi State University evaluated the impact insect pest management strategies have on the economic return of small-scale tomato production. The results of this evaluation are published in the article "Economic Effect of Insect Pest Management Strategies on Small-scale Tomato Production in Mississippi" in the open access online journal HortTechnology. [...]

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