Bulletin de veille du réseau d'écotoxicologie terrestre et aquatique N°47

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Edito

Voici notre 47ème bulletin de veille, toujours riche en informations !
Nous vous rappelons le séminaire trisannuel de notre réseau Ecotox, qui se tiendra les lundi 16 novembre après midi, et la journée du mardi 17 en webinaire. Le thème retenu cette année est « L'écotoxicologie du continuum sol-eau, opportunités suite à la fusion INRA-Irstea ». Vous trouverez les informations utiles comme le receuil des résumés sur la page dédiée de notre site ECOTOX :
https://www6.inrae.fr/ecotox/Manifestations/Seminaires-du-reseau/2020

Nous vous proposons dans ce bulletin une tribune présentant PestiEcotox, une expertise scientifique collective relative aux effets non intentionnels des produits phytopharmaceutiques sur la biodiversité et les services écosystémiques. 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-29-octobre-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 lecture de ce bulletin !

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Tribune libre

Une expertise scientifique collective relative aux effets non intentionnels des produits phytopharmaceutiques sur la biodiversité et les services écosystémiques

Largement utilisés à des fins de protection des cultures et d'entretien des jardins, espaces végétalisés et infrastructures (JEVI), les produits phytopharmaceutiques sont retrouvés dans de nombreux compartiments de l'environnement allant des sols aux grands fonds océaniques en passant par les milieux aquatiques continentaux et côtiers, et dans le compartiment aérien. Au sein de ces différents milieux, les substances actives et leurs co-formulants peuvent avoir des effets à différents niveaux d'organisation biologique allant de perturbations moléculaires à des atteintes populationnelles voire écosystémiques. L'utilisation des produits phytopharmaceutiques, la contamination de l'environnement qui en découle et ses conséquences sur la biodiversité, les services écosystémiques associés, ainsi que sur la santé humaine, sont des sujets importants de préoccupation citoyenne dont les pouvoirs publics se sont saisis avec le Plan ECOPHYTO.

Mis en place en 2009 suite au Grenelle de l'Environnement, le Plan ECOPHYTO ambitionnait initialement de réduire le recours, les risques et les effets des produits phytopharmaceutiques. Son objectif phare consistait à réduire leur utilisation de 50% en 10 ans, soit entre 2008 et 2018. Publiée en 2018, la dernière version du Plan ECOPHYTO (ECOPHYTO 2+) renouvelle cette ambition en donnant une place plus importante à la recherche et à l'innovation. C'est dans ce contexte que les ministères respectivement en charge de la recherche, de l'environnement et de l'agriculture, ont confié à INRAE (Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement) et à Ifremer (Institut Français de Recherche pour l'Exploitation de la Mer) la réalisation d'une expertise scientifique collective (ESCO) traitant des effets des produits phytopharmaceutiques conventionnels et de biocontrôle sur la biodiversité et les services écosystémiques (Fig. 1). Cet exercice permettra d'établir un bilan des connaissances scientifiques disponibles sur cette thématique afin d'éclairer les politiques publiques en matière d'utilisation des produits phytopharmaceutiques et les besoins de recherche associés.

Un périmètre large en réponse à un enjeu global

Cette ESCO n'est pas une première sur le sujet des produits phytopharmaceutiques et de leurs effets. Elle fait suite aux ESCO « Pesticides, Agriculture et Environnement » et « Agriculture et Biodiversité » réalisées en 2005 et 2008. Ce nouvel exercice propose toutefois un périmètre élargi afin de prendre en considération le développement important des questionnements et travaux scientifiques portant sur ces molécules et leurs effets sur la biodiversité et les services écosystémiques.

Ce périmètre élargi se traduit d'abord par la prise en compte du continuum terre-mer. En effet, si les produits phytopharmaceutiques sont utilisés en milieu terrestre, différents mécanismes de transfert vont conduire à la contamination des écosystèmes aquatiques continentaux, des eaux de transition (estuaires, mangroves), des zones littorales et in fine du milieu marin. La récente communication du Conseil National de la Mer et des Littoraux portant sur l'accélération de la stratégie maritime en faveur de la relance souligne d'ailleurs le besoin d'accompagner l'évolution vers de nouveaux modèles agricoles permettant de diminuer les intrants et donc de reconquérir la qualité des eaux côtières (CNML, 2020). L'utilisation des produits phytopharmaceutiques et la contamination des différents compartiments environnementaux n'étant pas limitées à la métropole, l'ESCO prendra en

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compte les spécificités des départements et territoires ultra-marins qu'il s'agisse de molécules, de pratiques culturales ou d'utilisations spécifiques mais aussi de la contamination liée au transport atmosphérique à longue distance de certaines molécules ou à la migration des espèces.

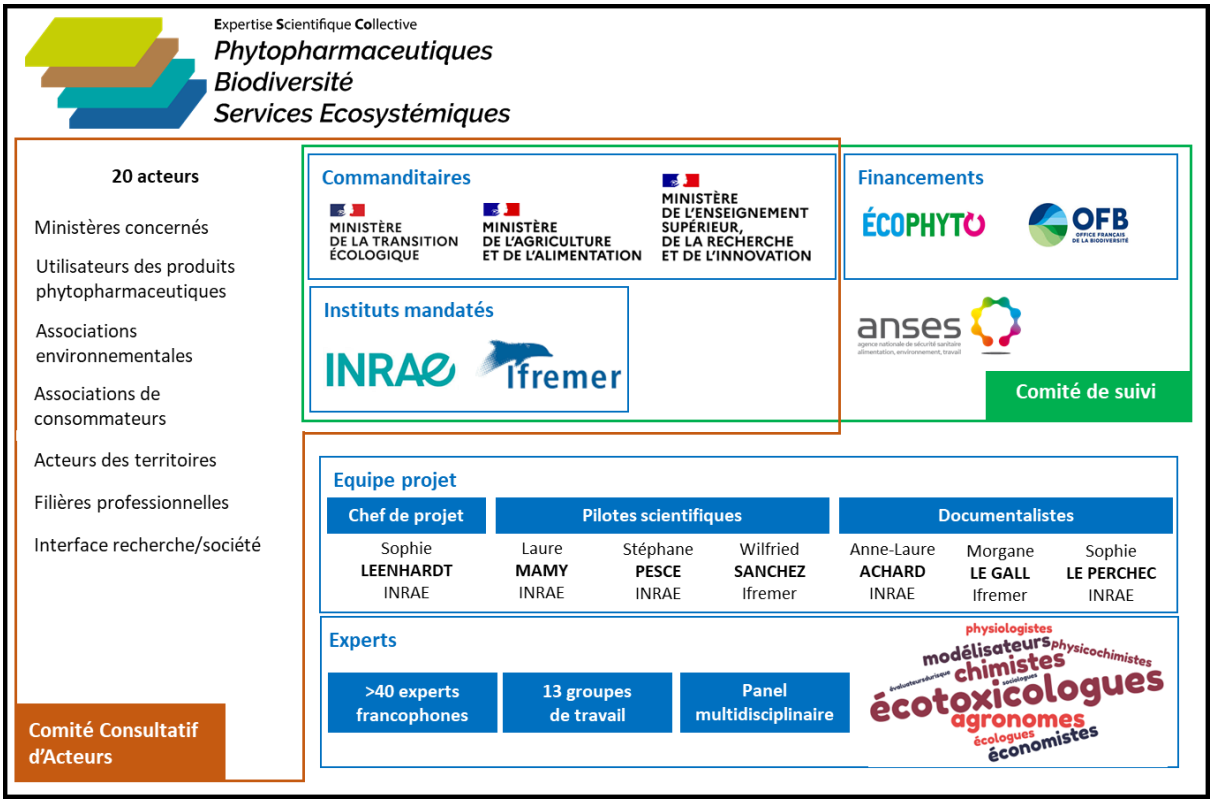

Figure 1. Organisation de l'Expertise Scientifique Collective relative aux effets des produits phytopharmaceutiques sur la biodiversité et les services écosystémiques

Le périmètre considéré en matière de substances est également large. Naturellement, il porte sur les produits phytopharmaceutiques conventionnels actuellement utilisés ainsi que sur leurs produits de dégradation car les évolutions analytiques permettent, pour certains, de les détecter dans des conditions environnementales et de les caractériser. Il porte également sur les substances désormais interdites mais dont les propriétés physico-chimiques intrinsèques et/ou les conditions environnementales conduisent à des phénomènes de persistance et donc à de potentiels effets. Enfin, ce périmètre inclut également les produits de biocontrôle. En plein essor, le biocontrôle s'appuie sur l'utilisation de substances naturelles d'origine végétale, animale ou minérale, de médiateurs chimiques (phéromones...) et de micro et macroorganismes dont la présence dans l'environnement et les effets potentiels sur la biodiversité doivent aussi être considérés pour une approche holistique de la question.

Parce que les produits phytopharmaceutiques ne sont pas utilisés uniquement dans un objectif de protection des cultures, cette ESCO intègrera les utilisations non agricoles (i.e. JEVI) notamment à des fins d'entretien des jardins, des espaces végétalisés (i.e. golfs et autres terrains de sports, cimetières) et des infrastructures de transports (i.e. routes, pistes cyclables, voies ferrées, infrastructures de transport de l'énergie et de l'information).

En matière d'effets à considérer, le périmètre est également élargi par rapport à celui des ESCO précédentes. Si les effets directs et indirects des produits phytopharmaceutiques sur la biodiversité non cible intra et inter spécifique seront abordés, cette ESCO traitera aussi des effets sur les

fonctions écologiques et les services écosystémiques. Les récents travaux conduits dans le cadre de l'évaluation française des écosystèmes et des services écosystémiques (EFESE) ont en effet mis en évidence les fortes interactions entre l'agriculture et les services écosystémiques, décrits comme des avantages socio-économiques retirés par l'homme de son utilisation durable des fonctions écologiques des écosystèmes (Tibi et Thérond, 2017). Il est donc apparu comme particulièrement pertinent de traiter, dans ce travail, les effets que les produits phytopharmaceutiques pourraient avoir sur ces services écosystémiques en considérant aussi bien les aspects monétaires que non monétaires.

Du diagnostic à la surveillance et à la réduction des effets non intentionnels

Si la première question posée porte sur l'état des lieux de la contamination de l'environnement par les produits phytopharmaceutiques, des risques associés et des effets sur la biodiversité, les fonctions écologiques et les services écosystémiques qui en découlent, cette ESCO propose d'aller au-delà de ce diagnostic. Ainsi, elle questionne également les méthodes courantes et innovantes pouvant conduire à une amélioration de la surveillance et de la réduction de cette contamination et de ses effets.

Les procédures réglementaires dans ce domaine s'appuient sur un nombre limité de tests connus pour leur robustesse et leur normalisation, tandis que la recherche académique développe de nombreux outils permettant d'évaluer, souvent dans des conditions propres à chaque laboratoire, les effets de substances ou de mélanges de substances sur une cible donnée. L'ESCO interrogera le périmètre de validité scientifique de ces différentes tests physico-chimiques et écotoxicologiques ainsi que des outils de modélisation dont le développement est de plus en plus important, porté par les exigences de réduction de l'expérimentation animale.

Par ailleurs, elle se penchera aussi sur les méthodes et innovations qui permettent de maîtriser et de réduire l'utilisation, la dispersion et les effets des produits phytopharmaceutiques. En effet, il peut s'agir de leviers mis en œuvre au niveau de l'application, de pratiques culturales innovantes, de gestion paysagère, ou de voies de remédiation face à des contaminations persistantes, qui conduit au développement de nombreuses recherches dont l'ESCO devra réaliser un bilan au regard de leur efficacité dans des conditions réelles.

Ce second volet de l'ESCO doit donc apporter un éclairage aux pouvoirs publics et aux instances d'évaluation des risques et de gestion environnementale pouvant contribuer à l'amélioration continue des processus d'homologation et de suivi des produits ainsi qu'à la préservation de la qualité chimique et écologique des milieux qui y sont exposés. Comme pour la partie relative à l'état de la contamination et des effets, ce second volet devra aussi prendre en considération les spécificités des départements et territoires ultra-marins.

Méthode de travail et enjeux

Lancée début 2020 pour 2 ans, cette ESCO est animée par une équipe projet composée d'une chef de projet, de 3 pilotes scientifiques et de 3 documentalistes issus d'INRAE et d'Ifremer. Elle s'appuie sur un collectif pluridisciplinaire de plus de 40 experts francophones (nationaux et internationaux) permettant de couvrir les nombreuses disciplines nécessaires à cette expertise (Fig. 1). Ecotoxicologues, physiologistes, agronomes, chimistes et physico-chimistes, modélisateurs, évaluateurs du risque mais aussi économistes et sociologues sont ainsi répartis en 13 groupes de travail couvrant les différentes questions posées par les commanditaires (i.e. ministères en charge de la recherche, de l'environnement et de l'agriculture) dans la lettre de saisine.

Tout au long du travail, un comité de suivi permet de garder le lien avec les commanditaires afin d'échanger sur l'avancement du travail, leurs attentes et les ajustements nécessaires au regard du

travail réalisé par le collectif d'experts, en accord avec les directions scientifiques d'INRAE et d'Ifremer. De plus, en lien avec la préoccupation plus globale d'ouverture de l'expertise à la société, un comité consultatif d'acteurs est mis en place. Composé de structures à l'interface recherche/société (e.g. comité français de l'Union Internationale pour la Conservation de la Nature (UICN), Fondation pour la Recherche sur la Biodiversité (FRB)), de représentants des utilisateurs de produits phytopharmaceutiques ou de certaines filières professionnelles, d'associations environnementales et de consommateurs ainsi que d'acteurs des territoires, cette instance vise à recueillir les préoccupations et attentes des acteurs mais aussi à échanger autour des conclusions de l'expertise attendues au premier trimestre 2022.

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Pour en savoir plus

Plan ECOPHYTO 2+ : http://www.consultation-ecophyto2plus.gouv.fr/IMG/pdf/plan-ecophyto_2_-_bat.pdf

EFESE : http://www.ecologie.gouv.fr/levaluation-francaise-des-ecosystemes-et-des-services-ecosystemiques

Bibliographie citée

CNML (Conseil National de la Mer et des Littoraux), 2020. Recommandations pour une accélération de la stratégie maritime en faveur de la relance mer et littoral. 20p.

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ERA / PUBLICATIONS SCIENTIFIQUES

Ecotoxicology of strobilurin fungicides

Authors: Zhang C, Zhou T, Xu Y, et al.

Sources: Science of The Total Environment, 742, 2020, DOI: 10.1016/j.scitotenv.2020.140611

Abstract: The toxicities of strobilurins to terrestrial and aquatic biota were summarized. The residue, fate, and transportation of strobilurin fungicides were summarized. Strobilurin fungicides are highly toxic to aquatic and soil organisms...but current toxicology studies are more focused on acute or chronic toxicity, but the underlying mechanisms are still unclear and require further analysis. Future studies may focus on more toxicological mechanisms of strobilurin fungicides. The analysis methods are needed to compare the toxicity difference of strobilurins.

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / COMMUNAUTES MICROBIENNES AQUATIQUES

The roles of phytohormones in metal stress regulation in microalgae

Authors: Nguyen HN, Kisiala AB, Emery RJN

Source: JOURNAL OF APPLIED PHYCOLOGY Early access, 2020, DOI: 10.1007/s10811-020-02271-5

Abstract: The constant spread of heavy metal contamination creates an increasing global environmental issue that results in considerable deterioration of land and water ecosystems leading to a decline in the health of plants, animals and humans. Novel, algal-based filtration technologies have been gaining a great deal of attention given their eco-friendly, effective and easy to implement processes. This review focuses on the potential roles that phytohormones can play in heavy metal stress response in microalgae. It emphasizes phytohormone efficiency and proposes the use of these signaling molecules for enhanced metal stress alleviation in microalgae. Furthermore, future implications for algal-based filtration technologies involving modifications of phytohormone metabolism towards improved heavy metal biodegradation rates are presented.

Accès au document

Physiological and morphological responses of green microalgae Chlorella vulgaris to silver nanoparticles

Authors: Romero N, Visentini FF, Marquez VE, Santiago LG, Castro GR, Gagneten AM

Source: ENVIRONMENTAL RESEARCH 189:109857, 2020, DOI:1 0.1016/j.envres.2020.109857

Abstract: The toxic effects of silver nanoparticles (AgNPs) on the physiology and morphology of the green microalga *Chlorella*

vulgaris were studied. AgNPs were characterized by particle size distribution, zeta potential measurement, and atomic force microscopy (AFM). *Chlorella vulgaris* was exposed to 90-1440 µg/L of AgNPs range in Bold's Basal Medium for 96 h. The inhibition of algae growth rate and changes in the concentrations of chlorophyll-a, chlorophyll-b, pheophytin, and carotenoids was determined at the beginning and end of the trial. Cell diameter and volume, carbohydrate, total lipids, and protein content were also determined. Our data strongly suggest that the toxic effects of the AgNPs resulted in concentration and time-dependent. AgNPs altered *C. vulgaris* growth kinetics and cell metabolism expressed in photosynthetic pigments and biochemical composition. Our study confirmed the cytotoxicity of AgNPs through the algal growth inhibition with an EC50 value of 110 µg/L. Also, changes of chlorophyll-a, chlorophyll-b, pheophytin, and carotenoids concentrations were observed associated with a color shift from green to pale brown of algae cultures exposed to AgNPs for 96 h. Furthermore, algae cell concentration, diameter, and volume, plus total lipid, protein, and carbohydrates contents in the presence of AgNPs, were significantly altered compared to untreated cells. In synthesis, this study highlighted AgNPs toxic effects on morphological and physiological traits of *C. vulgaris* and warns about possible impacts on energy flow and aquatic food web structure, and on the transfer efficiency of energy to higher trophic levels.

Accès au document

Short-term effect of cadmium on the motility of three flagellated algal species

Authors: Novosel N, Kasum D, Zutinic P, Legovic T, DeNardis NI

Source: JOURNAL OF APPLIED PHYCOLOGY Early Access, 2020, DOI: 10.1007/s10811-020-02283-1

Abstract: The present work aims to develop a fast and reliable procedure for motility analysis of a short-term effect of heavy metal cadmium on the algal cell response in laboratory conditions. Three unicellular motile species similar in cell length, while differing in the cell wall and the flagellar system are used as model algae. We quantitatively characterise motility in terms of swimming speed and search radius following addition of 1 mg Cd L-1. Both swimming speed and search radius determined in control algal cultures reflect morphological features of the corresponding flagellated system. After 1 h of cell exposure to a toxic concentration of cadmium, a statistically significant decrease in swimming speed is determined with predominant erratic cell movement on the spot in all examined cultures. After 3 h of cell exposure to cadmium, swimming speed in most of the examined cell cultures recovered close to the control value, indicating quick cell adaptation to elevated cadmium concentration. The results support the implementation of swimming speed and search radius as motility parameters for direct screening of cell physiological state, which is applicable to ecotoxicological studies providing insight into the mechanism of cell adaptation under stress, as well as a better understanding of the spatial distribution of algal cells in aquatic systems.

Accès au document

Cytotoxicological evaluation of copper oxide nanoparticles on green algae, bacteria and crustacean systems

Authors: Janani B, Al Farraj DA, Raju LL, Elshikh MS, Alkubaisi NA, Thomas AM, Das A, Khan SS

Source: JOURNAL OF ENVIRONMENTAL HEALTH SCIENCE AND ENGINEERING Early Access, 2020, DOI: 10.1007/s40201-020-00561-1

Abstract: Copper oxide (CuO) nanoparticles (NPs) have been utilized in several industries

including textile, consumer products, medical, automobiles etc. The discharge of industrial effluents in environment increased the probability of CuO NPs contamination in the ecosystem. The present investigation used CuO NPs to determine the toxic effect onLyngbyaspecies, fresh water algae isolated from natural pond, bacterial species Pseudomonas aeruginosa and *Staphylococcus aureus* and a crustacean species *Daphnia magna*. The NPs average diameter and zeta potential was estimated to be 45 +/- 3 nm and 29 +/- 1.78 mV respectively. The results showed that 0.1 mu g/mL CuO NPs showed the growth inhibition of 47 +/- 2% on *Lyngbya* sp. after 5 days of incubation. The CuO NPs also showed toxic effect to bacterial systems such as P. aeruginosa and S. aureus and crustacean system D. magna. Further, there was an increased lipid peroxidation and generation of reactive oxygen species (ROS) in algal cells observed up on NPs exposure. The exposure of NPs suppressed the antioxidant defense system. The amount of glutathione was reduced after the exposure of NPs. The study suggested the role of ROS in toxicity of algal and bacterial systems. The present study pointed out the potent toxicity of CuO NPs to the organisms present in the aquatic environment.

Accès au document

Responses to iron oxide and zinc oxide nanoparticles in echinoderm embryos and microalgae: uptake, growth, morphology, and transcriptomic analysis

Authors: Geneviere AM, Derelle E, Escande ML, Grimsley N, Klopp C, Menager C, Michel A, Moreau H

Source: NANOTOXICOLOGY Early Access, 2020, DOI: 10.1080/17435390.2020.1827074

Abstract: We investigated the toxicity of Iron oxide and Zinc oxide engineered nanoparticles (ENPs) on *Paracentrotus lividus* sea urchin embryos and three species of microalgae. Morphological responses, internalization, and potential impacts of Fe (2)O (3)and ZnO ENPs on physiology and metabolism were assessed. Both types of ENPs affected P. lividus larval development, but ZnO ENPs had a much stronger effect. While growth of the alga Micromonas commoda was severely impaired by both ENPs, *Ostreococcus tauri* or *Nannochloris* sp. were unaffected. Transmission electron microscopy showed the internalization of ENPs in sea urchin embryonic cells while only nanoparticle interaction with external membranes was evidenced in microalgae, suggesting that marine organisms react in diverse ways to ENPs. Transcriptome-wide analysis in *P. lividus* and *M. commoda* showed that many different physiological pathways were affected, some of which were common to both species, giving insights about the mechanisms underpinning toxic responses.

Accès au document

Diatoms as indicators of environmental health on Korean islands

Authors: Park J, Bergey EA, Han T, Pandey LK

Source: AQUATIC TOXICOLOGY 227:105594, 2020, DOI: 10.1016/j.aquatox.2020.105594

Abstract: Diatoms are highly sensitive to perturbations in their environment and are thus useful as bioindicators for anthropogenic impacts such as pollution. However, there is no consensus about what aspects of diatom populations to measure (e.g., diversity, physiology, or morphology) and efficient and reliable survey protocols are lacking. Here, we evaluated the ecological status of diatom communities using both traditional and relatively novel methods on two islands (Deokjeok island and Daeijak island) affected by anthropogenic activities due to extensive agricultural practices and exploitation and that are under consideration for representative touristic sites in South Korea.

Dissolved concentrations of metals and metalloid (As, Cu, Cr, Cd, Ni, Hg, Pb, and Zn) were below the ecological screening and toxicity reference values in water fractions but were above these values for sediment, particularly at one island, Deokjeok. The tested methods were generally consistent in finding little evidence for disruption of diatom communities, with dominance by *Navicula* and *Gyrosigma*, relatively high diversity, and typical abundance of lipid bodies and morphological deformities. However, analysis of lipid bodies and morphological deformities suggested greater potential anthropogenic disturbance at one site in Deokjeok. Future planning is required to ensure the maintenance of the near-pristine environments present on these islands.

Accès au document

The effects of ionizing radiation on the structure and antioxidative and metal-binding capacity of the cell wall of microalga Chlorella sorokiniana

Authors: Vojvodic S, Lukovic JD, Zechmann B, Jevtovic M, Pristov JB, Stanic M, Lizzul AM, Pittman JK, Spasojevic I

Source: CHEMOSPHERE 260:127553, 2020, DOI: 10.1016/j.chemosphere.2020.127553

Abstract: The impact of ionizing radiation on microorganisms such as microalgae is a topic of increasing importance for understanding the dynamics of aquatic ecosystems in response to environmental radiation, and for the development of efficient approaches for bioremediation of mining and nuclear power plants wastewaters. Currently, nothing is known about the effects of ionizing radiation on the microalgal cell wall, which represents the first line of defence against chemical and physical environmental stresses. Using various microscopy, spectroscopy and biochemical techniques we show that the unicellular alga *Chlorella sorokiniana* elicits a fast response to ionizing radiation. Within one day after irradiation with doses of 1-5 Gy, the fibrilar layer of the cell wall became thicker, the fraction of uronic acids was higher, and the capacity to remove the main reactive product of water radiolysis increased. In addition, the isolated cell wall fraction showed significant binding capacity for Cu2+, Mn2+, and Cr3+. The irradiation further increased the binding capacity for Cu2+, which appears to be mainly bound to glucosamine moieties within a chitosan-like polymer in the outer rigid layer of the wall. These results imply that the cell wall represents a dynamic structure that is involved in the protective response of microalgae to ionizing radiation. It appears that microalgae may exhibit a significant control of metal mobility in aquatic ecosystems via biosorption by the cell wall matrix.

Accès au document

The "Plastisphere" of Biodegradable Plastics Is Characterized by Specific Microbial Taxa of Alpine and Arctic Soils

Authors: Ruthi J, Bolsterli D, Pardi-Comensoli L, Brunner I, Frey B

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8:562263, 2020, DOI:10.3389/fenvs.2020.562263

Abstract: Plastic pollution poses a threat to terrestrial ecosystems, even impacting soils from remote alpine and arctic areas. Biodegradable plastics are a promising solution to prevent long-term accumulation of plastic litter. However, little is known about the decomposition of biodegradable plastics in soils from alpine and polar ecosystems or the microorganisms involved in the process. Plastics in aquatic environments have previously been shown to form a microbial community on the surface of the plastic distinct from that in the surrounding water, constituting the so-called "plastisphere." Comparable studies in terrestrial environments are scarce. Here, we

aimed to characterize the plastisphere microbiome of three types of plastics differing in their biodegradability in soil using DNA metabarcoding. Polylactic acid (PLA), polybutylene adipate terephthalate (PBAT), and polyethylene (PE) were buried in two different soils, from the Swiss Alps and from Northern Greenland, at 15 degrees C for 8 weeks. While physico-chemical characteristics of the polymers only showed minor (PLA, PBAT) or no (PE) changes after incubation, a considerably lower alpha-diversity was observed on the plastic surfaces and prominent shifts occurred in the bacterial and fungal community structures between the plastisphere and the adjacent bulk soil not affected by the plastic. Effects on the plastisphere microbiome increased with greater biodegradability of the plastics, from PE to PLA. Copiotrophic taxa within the phyla Proteobacteria and Actinobacteria benefitted the most from plastic input. Especially taxa with a known potential to degrade xenobiotics, including Burkholderiales, Caulobacterales, Pseudomonas, Rhodococcus, and Streptomyces, thrived in the plastisphere of the Alpine and Arctic soils. In addition, Saccharimonadales (superphylum Patescibacteria) was identified as a key taxon associated with PLA. The association of Saccharibacteria with plastic has not been reported before, and pursuing this finding further may shed light on the lifestyle of this obscure candidate phylum. Plastic addition affected fungal taxa to a lesser extent since only few fungal genera such as Phlebia and Alternaria were increased on the plastisphere. Our findings suggest that the soil microbiome can be strongly influenced by plastic pollution in terrestrial cryoenvironments. Further research is required to fully understand microbial colonization on plastic surfaces and the biodegradation of plastic in soils.

Accès au document

Plain polystyrene microplastics reduce the toxic effects of ZnO particles on marine microalgae *Dunaliella salina*

Authors: Gunasekaran D, Chandrasekaran N, Jenkins D, Mukherjee A

Source: JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING 8:104250, 2020, DOI: 10.1016/j.jece.2020.104250

Abstract: A critical literature survey on marine ecotoxicology reveals a lack of comprehensive studies to assess the impact of microplastics on the toxicity of engineered nanomaterials at environmentally relevant doses. Though ZnO and microplastics both are well known to be marine pollutants, the combined toxicity of ZnO particles with plain polystyrene (PS) microplastics are yet to be studied. Preliminary characterization of ZnO particles included examining particle size, morphology, and surface area. The amount of nominal and dissolved ions in the suspensions containing nano-sized ZnO particles was determined. The toxicity of bulk and nano-sized ZnO particles in combination with plain PS microplastics at low concentration (1 mg/L) was assessed towards marine algae *Dunaliella salina* at three exposure concentrations 1.22, 12.28 and 122.88 μM under UV-A and dark exposure conditions. As expected, a dose-dependent increment in the toxicity, ROS (extracellular & intracellular) generation and lipid peroxidation were noted for both bulk and nano-sized ZnO particles. The harmful effects of bulk and nano-sized ZnO particles were considerably reduced in the presence of plain PS microplastics. This study opens up new dimensions regarding the positive impact of microplastics at low concentration, where they lessen the toxic effects of co-pollutants in the marine ecosystem.

Accès au document

Shifts in photosynthetic parameters and lipid production of the freshwater microalga *Selenastrum*

gracile (Chlorophyceae) under cadmium exposure

Authors: Rocha GS, Parrish CC, Espindola ELG

Source: JOURNAL OF APPLIED PHYCOLOGY Early Access, 2020, DOI: 10.1007/s10811-020-02255-5

Abstract: The amount of metals released into the environment can increase with anthropogenic activities and different trophic levels can be affected. In the present study, we evaluated the changes in growth, chlorophyll content, photosynthetic parameters, and lipid and fatty acid (FA) contents of the freshwater microalga *Selenastrum gracile* (Chlorophyceae) exposed to sublethal concentrations of cadmium for 72 h. Our results show that Cd negatively affected algal growth and chlorophyllaincreased per cell under Cd exposure. Photosynthetic parameters (maximum and operational yield, as well as quenching) were affected under Cd exposure, indicating damage to the photosynthetic apparatus. The amount of lipids and fatty acids increased with the increase of Cd in the medium. The most affected lipid classes under metal exposure were aliphatic hydrocarbon (HC), acetone mobile polar lipid (AMPL), and phospholipid (PL). Based on our results, we suggest that the production of algal lipids and fatty acids changed as a response to the amount of metal in the medium, avoiding photosynthetic damage at the lowest Cd concentration with the increase of polyunsaturated fatty acids (PUFA). However, at higher concentrations, the maintenance of the high values of PUFA was not observed and there was a decrease in the unsaturation of FA, resulting in higher amounts of MUFA. In addition, the percentage of structural lipids (sterol-ST-and PL) also decreased at the highest concentration. This, in combination with the decreased unsaturation of FA, suggests changes in membrane conformation and, consequently, damage to the photosynthetic machinery in the presence of Cd.

Accès au document

Assessing the Toxicity of Leachates From Weathered Plastics on Photosynthetic Marine Bacteria *Prochlorococcus*

Authors: Sarker I, Moore LR, Paulsen IT, Tetu SG

Source: FRONTIERS IN MARINE SCIENCE 7:571929, 2020, DOI: 10.3389/fmars.2020.571929

Abstract: Marine plastic pollution is a well-recognized, global problem. Research addressing plastic pollution has largely focused on investigating impacts on macroorganisms, with few studies investigating effects on marine microbes. We previously showed that marine Prochlorococcus, which are important contributors to oceanic primary production, suffer declines in growth and photosynthetic activity following exposure to leachates from new plastic bags (HDPE) and plastic matting (PVC). However, as such plastics reside in the environment they will be subject to weathering processes, so it is also important to consider how these may alter the composition and amounts of substances available to leach. Here we report on how plastic leachate toxicity is affected by environmental weathering (17- and 112-days in estuarine water) of these common plastic materials. We found that while toxicity was reduced by weathering, materials weathered for up to 112-days continued to leach substances that negatively affected Prochlorococcus growth, photophysiology and membrane integrity. Weathered plastics were found to continue to leach zinc, even after up to 112-days in the environment. The two Prochlorococcus strains tested, NATL2A and MIT9312, showed differences in the sensitivity and timing of their responses, indicating that exposure to leachate from weathered plastics may affect even closely related strains to different degrees. As many marine regions inhabited by Prochlorococcus are likely to be subject to continued accumulation of plastic pollution, our findings highlight the potential for ongoing impacts on these important primary producers.

Accès au document

Amelioration of copper toxicity to a tropical freshwater microalga: Effect of natural DOM source and season

Authors: Macoustra GK, Jolley DF, Stauber J, Koppel DJ, Holland A

Source: ENVIRONMENTAL POLLUTION 266:115141, 2020, DOI: 10.1016/j.envpol.2020.115141

Abstract: Australian tropical freshwaters can experience extreme seasonal variability in rainfall and run off, particularly due to pulse events such as storms and cyclones. This study investigated how seasonal variability in dissolved organic matter (DOM) quality impacted the chronic toxicity of copper to a tropical green alga (*Chlorella* sp.) in the presence of two concentrations of DOM (low: similar to 2 mg C/L; high: similar to 10 mg C/L) collected from three tropical waters. Copper speciation and lability were explored using diffusive gradients in thin-films (DGT) and modelled maximum dynamic concentrations (c(max)(dyn)) using data derived from the Windermere Humic Aqueous Model (WHAM VII). Relationships between copper lability and copper toxicity were assessed as potential tools for predicting toxicity. Copper toxicity varied significantly with DOM concentration, source and season. Copper toxicity decreased with increasing concentrations of DOM, with 50% growth inhibition effect concentrations (EC50) increasing from 1.9 mu g Cu/L in synthetic test waters with no added DOM (0.34 mg C/L) up to 63 mu g Cu/L at DOM concentrations of 9.9 mg C/L. Copper toxicity varied by up to 2-fold between the three DOM sources and EC50 values were generally lower in the presence of wet season DOM compared to dry season DOM. Linear relationships between DGT-labile copper and dissolved copper were significantly different between DOM source, but not concentration or season. Modelled c(max)(dyn) consistently under-predicted labile copper in high DOM treatments compared to DGT measurements but performed better in low DOM treatments, indicating that this method is DOM-concentration dependent. Neither speciation method was a good surrogate for copper toxicity in the presence of different sources of natural DOM. Our findings show that DOM source and season, not just DOM concentration, affect copper toxicity to freshwater biota. There-fore, DOM quality should be considered as a toxicity-modifying factor for future derivation of bioavailability-based site-specific water quality guideline values.

Accès au document

Metabolomic modulations in a freshwater microbial community exposed to the fungicide azoxystrobin

Authors: Zhang MW, Liu WY, Qu Q, Ke MJ, Zhang ZY, Zhou ZG, Lu T, Qian HF

Source: JOURNAL OF ENVIRONMENTAL SCIENCES 97:2-102-109, 2020, DOI: 10.1016/j.jes.2020.04.013

Abstract: An effective broad-spectrum fungicide, azoxystrobin (AZ), has been widely detected in aquatic ecosystems, potentially affecting the growth of aquatic microorganisms. In the present study, the eukaryotic alga *Monoraphidium* sp. and the cyanobacterium *Pseudanabaena* sp. were exposed to AZ for 7 days. Our results showed that 0.2-0.5 mg/L concentrations of AZ slightly inhibited the growth of *Monoraphidium* sp. but stimulated *Pseudanabaena* sp. growth. Meanwhile, AZ treatment effectively increased the secretion of total organic carbon (TOC) in the culture media of the two species, and this phenomenon was also found in a freshwater microcosm experiment (containing the natural microbial community). We attempted to assess the effect of AZ on the function of aquatic microbial communities through metabolomic analysis and further explore the potential risks of

this compound. The metabonomic profiles of the microcosm indicated that the most varied metabolites after AZ treatment were related to the citrate cycle (TCA), fatty acid biosynthesis and purine metabolism. We thereby inferred that the microbial community increased extracellular secretions by adjusting metabolic pathways, which might be a stress response to reduce AZ toxicity. Our results provide an important theoretical basis for further study of fungicide stress responses in aquatic microcosm microbial communities, as well as a good start for further explorations of AZ detoxification mechanisms, which will be valuable for the evaluation of AZ environmental risk.

Accès au document

Biochemical responses of the freshwater microalga *Dictyosphaerium* sp. upon exposure to three sulfonamides

Authors: Chen S, Li JY, Feng WB, Yuan MZ, Zhang W, Xu HT, Zheng XY, Wang LQ

Source: JOURNAL OF ENVIRONMENTAL SCIENCES 97:141-148, 2020, DOI: 10.1016/j.jes.2020.05.018

Abstract: Sulfonamides (SAs) are common antimicrobial drugs, which are frequently detected in surface water systems, and are difficult to degrade, posing a potential threat to the aquatic environment. However, little is known about the potential adverse effects of SAs on nontarget organisms (e.g., microalgae) in the aquatic ecosystem. In this study, the effect of SAs (sulfadiazine (SD), sulfamerazine (SM1), and sulfamethazine (SM2) at 1, 5, 20, and 50 mg/L concentrations, respectively) on the freshwater microalga Dictyosphaerium sp. was investigated, with respect to changes of biomass and chlorophyll a content and induction of extracellular polymer substances (EPS), including protein and polysaccharide contents. At the same time, the residue of SAs was determined. The results showed that Dictyosphaerium sp. was tolerant to the three SAs, and the chlorophyll a content in *Dictyosphaerium* sp. significantly decreased on day 7, followed by a "compensation phenomena". The increase in protein and polysaccharide contents played a defensive role in Dictyosphaerium sp. against antibiotic stress, and there was a strong positive correlation between polysaccharide contents and antibiotic concentrations. Dictyosphaerium sp. exhibited 35%-45%, 30%-42%, and 26%-51% removal of SD, SM1, and SM2, respectively. This study is helpful to understand the changes of EPS in the defense process of microalgae under the action of antibiotics, and provides a new insight for the ecological removal of antibiotic pollution in natural surface water system.

Accès au document

Secondary Effects of Antibiotics on Microbial Biofilms

Authors: Penesyan A, Paulsen IT, Gillings MR, Kjelleberg S, Manefield MJ

Source: FRONTIERS IN MICROBIOLOGY 11:2109, 2020, DOI: 10.3389/fmicb.2020.02109

Abstract: Biofilms are assemblages of microorganisms attached to each other, or to a surface, and encased in a protective, self-produced matrix. Such associations are now recognized as the predominant microbial growth mode. The physiology of cells in biofilms differs from that of the planktonic cells on which most research has been conducted. Consequently, there are significant gaps in our knowledge of the biofilm lifestyle. Filling this gap is particularly important, given that biofilm cells may respond differently to antibiotics than do planktonic cells of the same species. Understanding the effects of antibiotics on biofilms is of paramount importance for clinical practice due to the increased levels of antibiotic resistance and resistance dissemination in biofilms. From a wider environmental perspective antibiotic exposure can alter the

ecology of biofilms in nature, and hence disrupt ecosystems. Biofilm cells display increased resilience toward antibiotics. This resilience is often explained by mechanisms and traits such as decreased antibiotic penetration, metabolically inactive persister cells, and intrinsic resistance by members of the biofilm community. Together, these factors suggest that cells in biofilms are often exposed to subinhibitory concentrations of antimicrobial agents. Here we discuss how cells in biofilms are affected by the presence of antibiotics at subinhibitory concentrations, and the possible ramifications of such secondary effects for healthcare and the environment.

Accès au document

Tolerance Patterns in Stream Biofilms Link Complex Chemical Pollution to Ecological Impacts

Authors: Tlili A, Corcoll N, Arrhenius A, Backhaus T, Hollender J, Creusot N, Wagner B, Behra R

Source: ENVIRONMENTAL SCIENCE & TECHNOLOGY 54:10735-10743, 2020, DOI: 10.1021/acs.est.0c02975

Abstract: Preventing and remedying fresh waters from chemical pollution is a fundamental societal and scientific challenge. With other nonchemical stressors potentially co-occurring, assessing the ecological consequences of reducing chemical loads in the environment is arduous. In this case study, we comparatively assessed the community structure, functions, and tolerance of stream biofilms to micropollutant mixtures extracted from deployed passive samplers at wastewater treatment plant effluents. These biofilms were growing up- and downstream of one upgraded and two nonupgraded wastewater treatment plants before being sampled for analyses. Our results showed a substantial decrease in micropollutant concentrations by 85%, as the result of upgrading the wastewater treatment plant at one of the sampling sites with activated carbon filtration. This decrease was positively correlated with a loss of community tolerance to micropollutants and the recovery of the community structure downstream of the effluent. On the other hand, downstream biofilms at the nonupgraded sites displayed higher tolerance to the extracts than the upstream biofilms. The observed higher tolerance was positively linked to micropollutant levels both in stream water and in biofilm samples, and to shifts in the community structure. Although more investigations of upgraded sites are needed, our findings point toward the suitability of using community tolerance for the retrospective assessment of the risks posed by micropollutants, to assess community recovery, and to relate effects to causes in complex environmental conditions.

Accès au document

The effects of bisphenol A, F and their mixture on algal and cyanobacterial growth: from additivity to antagonism

Authors: Elersek T, Notersberg T, Kovacic A, Heath E, Filipic M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access, 2020, DOI: 10.1007/s11356-020-10329-7

Abstract: Bisphenol A (BPA) is, due to its widespread use including the production of plastic materials, an ubiquitous pollutant in the aquatic environment. Due to evidence of adverse BPA effects on the environment and human health, its use has been restricted and replaced by analogues such as bisphenol F (BPF). This study examined the toxicity of BPA, BPF and their mixture towards primary producers, the eukaryotic green alga *Pseudokirchneriella subcapitata* and the prokaryotic cyanobacterium *Synechococcus leopoliensis*. The results demonstrated that *S. leopoliensis* is more sensitive than *P. subcapitata*, whereas toxic potential of the two BPs is comparable and represents comparable hazard for phytoplankton. The toxicity of the binary mixture was predicted by different models (concentration addition,

independent action, combination index and the isobologram method) and compared to experimental data. Additive effect was observed in *P. subcapitata* over the whole effect concentration range (EC5-EC90), whereas in *S. leopoliensis*, no pronounced combined effect was observed. The environmental risk characterisation based on the comparison of reported concentrations of BPA and BPF in surface waters to the predicted no-effect concentration values obtained in this study showed that at certain industrial areas, BPA represents environmental risk, whereas BPF does not. However, BPF concentrations in aquatic environment are expected to increase in the future. To enable environmental risk assessment of BP analogues, more data on the toxicity to aquatic species, including combined effect, as well as data on their occurrence in the aquatic environment are needed.

Accès au document

Unravelling the effects of multiple stressors on diatom and macroinvertebrate communities in European river basins using structural and functional approaches

Authors: De Castro-Catala N, Doledec S, Kalogianni E, Skoulikidis NT, Paunovic M, Vasiljevic B, Sabater S, Tornes E, Munoz I

Source: SCIENCE OF THE TOTAL ENVIRONMENT 742:140543, 2020, DOI: 10.1016/j.scitotenv.2020.140543

Abstract: Rivers suffer from more severe decreases in species diversity compared to other aquatic and terrestrial ecosystems due to a variety of pressures related to human activities. Species provide different roles in the functioning of the ecosystem, and their loss may reduce the capacity of the ecosystems to respond to multiple stressors. The effects on diversity will differ based on the type, combination and severity of stressors, as well as on the characteristics of the community composition and tolerance. Multiple trait-based approaches (MTBAs) can help to unravel the effects of multiple stressors on communities, providing a mechanistic interpretation, and, thus, complementing traditional biodiversity assessments using community structure. We studied the relationships between diversity indexes and trait composition of macroinvertebrate and diatom communities, as well as environmental variables… and toxic pollution (pesticides and pharmaceuticals) of three different European river basins: the Adige, the Sava, and the Evrotas. These river basins can be considered representative cases of different situations in European freshwater systems. Hydrological variables were the main drivers determining the community structure and function in the rivers, for both diatoms and macroinvertebrates. For diatom communities, pharmaceutical active compound (PhAC) toxic units were also identified as a my important driver of diversity changes, explaining up to 57% of the variance in taxonomic richness. For macroinvertebrates, river geomorphology was an important driver of structural changes, particularly affecting Plecoptera richness. In addition, PhAC and pesticide toxic units were also identified as stressors for macroinvertebrate communities. MTBA provided a detailed picture of the effects of the stressors on the communities and confirmed the importance of hydrological variables in shaping the functional attributes of the communities.

Accès au document

Micro- and Nanoplastic Exposure Effects in Microalgae: A Meta-Analysis of Standard Growth Inhibition Tests

Authors: Reichelt S, Gorokhova E

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8:131, 2020, DOI :10.3389/fenvs.2020.00131

Abstract: Ecological impacts of micro- and nanoplastics particles (MNP) are among the most discussed environmental concerns. In algae, MNP are commonly hypothesized to reduce growth, which is a standard ecotoxicological endpoint. However, the reported test outcomes vary, with both growth inhibition and stimulation being observed. Due to this conflict of information, a data synthesis for MNP potential to cause growth inhibition in toxicity testing is needed. We performed a meta-analysis study to assess the effect of MNP exposure on algal growth. Twenty studies published between 2010 and 2020 and representing 16 algal species and five polymer materials administered as particles in size range 0.04-3,000 µm were included in this meta-analysis. A random-effect model was used to estimate the effect size in three datasets: (1)Low concentrationrange (< 100 mg/L), (2)High concentrationrange ≥ 100 mg/L), and (3)Full range model(0.004-1,100 mg/L), which encompassed all studies using the combination of experimental settings (test species, MNP concentration, polymer material, and particle size) yielding the highest effect size within a study. The exposure to MNP was not significantly associated with growth inhibition in any of the models tested. However, a high heterogeneity between the studies was found in all three models. Neither MNP concentration nor polymer material contributed significantly to the heterogeneity, whereas polymer density had a significant moderating effect, with a higher risk of growth inhibition at lower densities. We also identified a publication bias, with small studies that reported significant inhibition being overrepresented in our dataset. The meta-analysis found limited evidence for MNP effect on microalgal growth in the standard algal growth inhibition test. The heterogeneity and varying methodological quality of studies limited the interpretation and the confidence in the findings. For hazard assessment, standardization and controlled exposure are needed as well as more sensitive endpoints that can inform us about the effect mechanisms. Finally, using particle-free controls in such tests cannot account for the presence of inert particulates in the test system, and, hence, does not allow to attribute observed effects to the test polymers.

Accès au document

Pollution shapes the microbial communities in river water and sediments from the Olifants River catchment, South Africa

Authors: Valverde A, Cason ED, Gomez-Arias A, Bozkale D, Govender D, Riddell E, Cowan D

Source: ARCHIVES OF MICROBIOLOGY, Early Access, 2020, DOI: 10.1007/s00203-020-02035-2

Abstract: Human activities such as agriculture and mining are leading causes of water pollution worldwide. Individual contaminants are known to negatively affect microbial communities. However, the effect of multifaceted pollution on these communities is less well understood. We investigated, using next-generation sequencing of the 16S rRNA genes, the effects of multisource (i.e., fertilizer industry and mining) chronic pollution on bacterial and archaeal communities in water and sediments from the Olifants River catchment, South Africa. Water samples showed less microbial species diversity than sediments and both habitats displayed different microbial communities. Within each of these habitats, pollution had no effect on alpha diversity but shaped the microbial composition and taxonomy-based predicted functions. Certain prokaryotic taxa and functional groups were indicative of different degrees of pollution. Heterotrophic taxa (e.g., *Flavobacterium* sp.) and sulphur-oxidizing bacteria (i.e., *Thiobacillus* sp.) were indicators of pollution in water and sediments, respectively. Ultimately, this information could be used to develop microbial indicators of water quality degradation.

Accès au document

Size-dependent cellular internalization and effects of

https://doi.org/10.15454/6MQT-0H51

polystyrene microplastics in microalgae *P. helgolandica* var. tsingtaoensis and *S. quadricauda*

Authors: Chen YX, Ling Y, Li XY, Hu JN, Cao CJ, He DF

Source: JOURNAL OF HAZARDOUS MATERIALS 399:123092, 2020, DOI: 10.1016/j.jhazmat.2020.123092

Abstract: Microplastics (MPs) are persistent contaminants in aquatic environments. Microalgae, as the main phytoplankton and primary producers, usually co-exist with MPs. Despite previous studies that have proved the interaction of MPs and microalgae, it is largely unknown whether MPs can be uptake into cells of microalgae. In this study, both marine *P. helgolandica* var. tsingtaoensis and freshwater microalgae S. quadricauda were respectively exposed to 10 mg/L polystyrene microbeads with five diameter sizes: 1.0, 2.0, 3.0, 4.0, and 5.0 mu m. Confocal laser scanning and 3D image analysis showed that mean 24.0 % or 11.3 % cells of *P. helgolandica* var. tsingtaoensis contained 1.0 μm or 2.0 μm MPs after 72 h exposure. While mean 43.3 % or 15.3 % of *S. quadricauda* individuals engulfed 1.0 mu m or 2.0 μm MPs within cells. But, none of 3.0-5.0 μm MPs were observed within algal cells. These results demonstrate the size-dependent cellular internalization of MPs in microalgae. Exposure to 1.0-2.0 μm PS MPs caused a significant reduction in the density of microalgae and influenced photosynthesis, which suggests cellular internalization of MPs can influence algal fertility and growth. This discovery first confirms cellular internalization of MPs in phytoplankton, of significance for the fate and eco-toxicity of MPs in the aquatic ecosystem.

Accès au document

Toxic effects of Fe2WO6 nanoparticles towards microalga *Dunaliella salina*: Sonochemical synthesis nanoparticles and investigate its impact on the growth

Authors: Hassanpour M, Tafreshi SAH, Amiri O, Hamadanian M, Salavati-Niasari M

Source: CHEMOSPHERE 258:127348, 2020, DOI: 10.1016/j.chemosphere.2020.127348

Abstract: In this work, Fe2WO6 nanoparticles were synthesized by the ultrasound-assisted precipitation method. Various conditions were applied, including the change of the pH factor and reaction time for the synthesis of nanoparticles. After confirming the synthesis of the nanoparticles by various analyzes and evaluating their size and morphology, one of the conditions for the synthesis of the nanoparticles were selected as the optimum condition. The samples were added to the growth medium of a well-known microalga, *Dunaliella salina* at three concentrations of 20, 40 and 80 ppm to evaluate the effect of nanoparticles on biological systems. After 10 days different biological parameters were measured and compared with those of the control sample. According to the results, at concentration of 20 ppm the number of cells, the amount of chlorophyll a, and b, and biomass increased compared to the control samples. The Carotenoid level was higher in the treatment with 40 ppm of nanoparticles than that in the control samples. Compared to the control sample, the level of lipid peroxidation and the ratio of carbohydrate to amide II showed to be higher under 80 ppm treatment of particles. According to HCA analysis, both the evaluated parameters and concentrations of nanoparticles were divided into two general categories. Overall results showed that the effect of Fe2WO6 nanoparticles on microalgae could be a dose-dependent phenomenon, so that the addition of 20 ppm nanoparticles in the culture media helped the growth and the physiological status of algae. On the other hand, the application of a higher concentration of nanoparticles negatively affects algal biology. The results showed that the algae could be successfully used to precise

screen of various nanoparticles in terms of safety especially in aquatic en vironments and also biotechnological applications.

Accès au document

The interactions between microplastic polyvinyl chloride and marine diatoms: Physiological, morphological, and growth effects

Authors: Wang S, Wang Y, Liang Y, Cao W, Sun CJ, Ju P, Zheng L

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 203:111000, 2020, DOI: 10.1016/j.ecoenv.2020.111000

Abstract: Microplastics are identified as a great threat to marine environments. However, knowledge of their impacts on phytoplankton, especially for the diatoms is scarce. Herein, the effects of different polyvinyl chloride (PVC) microplastic concentrations and contact times (24, 48, 72 and 96 h) on the F-v/F-m and cell density of *Phaeodactylum tricornutum* (B255), *Chaetoceros gracilis* (B13) and *Thalassiosira* sp. (B280) were investigated to evaluate the toxic effects of micmplastics on marine diatoms. The effects of PVC microplastics on the morphology of the diatoms was observed by SEM. The order of sensitivity to 1 μm PVC microplastics among three marine diatoms was B13 B280 B255, showing that the toxic effects varied with different microalgae species. Furthermore, the presence of a siliceous cell wall played a minimal role in protecting cells from the physical attack of PVC microplastics, with no significant difference from the common cell wall. PVC microplastics caused dosedependent adverse effects on three marine diatoms. High PVC concentrations (200 mg/L) reduced the chlorophyll content, inhibited F-v/F-m, and affected the photosynthesis of three marine diatoms. The PVC micmplastics adsorbed and caused physical damage on the structure of algal cells. Interactions between PVC microplastics and diatoms may be the probable reason for the negative effects of PVC on diatoms.

Accès au document

Effect of Azamethiphos on enzymatic activity and metabolic fingerprints of marine microbial communities from the water column

Authors: Garces DV, Fuentes ME, Quinones RA

Source: AQUACULTURE 529:735650, 2020, DOI: 10.1016/j.aquaculture.2020.735650

Abstract: Salmon production in Chile has increased significantly since the 1990s. However, there have been significant economic losses owing to outbreaks of *Caligus rogercresseyi*. Pesticides, among them Azamethiphos, are used to mitigate the impact of this sea louse. Azamethiphos can affect non-target species living near salmon farms such as microbial plankton, although there is little information about this. The general objective of this study was to determine the effect of different concentrations of the pesticide Azamethiphos on the metabolism of microbial plankton communities (< 100 μm) in two contrasting zones, one without salmon farming and the other with a high level of aquaculture activity. Several methodological approaches were used, including the enzymatic activity of j3-glucosidase and malate dehydrogenase (MDH), fingerprinting techniques (EcoPlates for bacteria and FF microplate for marine fungi) and the estimation of microbial aerobic respiration. We found greater de gradation of the pesticide Azamethiphos in the salmon culture zone (-72.4%) than in an area not previously used in salmon production (-26.1%). The response of microbial beta-glucosidase activity to Azamethiphos is highly variable, but there is a tendency toward more activity in the smaller size fractions (5-25 mu m and 0.22-3 μm) when exposed to high Azamethiphos concentrations.

We also detected a highly variable response in microbial MDH activity. The most widely used carbon substrates by bacterioplankton and marine fungi are those related to carbohydrate metabolism. We also found increased use of carboxylic acids and amino acids in the treatments with higher concentrations of Azamethiphos. Enzyme activity, together with metabolic fingerprints, could be used as an indicator of perturbations in marine microbial communities.

Accès au document

Bacterial community colonization on tire microplastics in typical urban water environments and associated impacting factors

Authors: Wang LY, Luo ZX, Zhen Z, Yan Y, Yan CZ, Ma XF, Sun L, Wang M, Zhou XY, Hu AY

Source: ENVIRONMENTAL POLLUTION 265:114922, 2020, DOI: 10.1016/j.envpol.2020.114922

Abstract: Only limited information is available on bacterial communities' dynamics on tire microplastics in urban water environments. This study exploited 16S rDNA high-throughput sequencing to characterize bacterial communities on tire microplastics, using three different tire brands and tire sizes, in two typical urban water environments, including an influent pond of constructed wetland (CW) and its subsequent effluent into a landscape river (LR) during three different periods, namely, 1 month, 3 and 6 months. Results showed that the abundance of bacterial colonization on tire microplastics will increase over time. Proteobacteria, Bacteroidetes were the dominant bacteria at a phylum level, although they exhibited dynamic changes. At a genus level, the identifiable bacteria found in tire microplastics was generally the common bacteria in wastewater discharge, such as Aquabacterium and Denitratisoma. Additionally, alpha diversity showed no significant differences in bacterial communities at the same locations. While beta diversity showed that the bacterial communities on the tire microplastics in the two locations was different. BugBase revealed that tire microplastics could support pathogenic bacteria in urban water environments. PICRUSt (Phylogenetic Investigation of Communities by Reconstruction of Unobserved States) indicated that the abundance of microorganisms associated with metabolism and degradation increased with time. Moreover, the ambient environmental factors were the main influencing factors of bacterial communities on tire microplastics. Herein, the contribution rate of nutrient salts (NO2-N, NO3-N, NH4-N, CODcr) was approximately 63%, and that of environmental physical factors of T and pH was 50%. While physicochemical factors, including particle size, contact angle, element content only had a slight impact. Accordingly, tire microplastics, as an emerging environmental pollutant, can act as carries for bacterial colonization and propagation, particularly harmful microorganisms. Therefore, the obtained findings can provide new insight into potential risks of harmful microorganisms that colonize tire microplastics in urban water environments.

Accès au document

Differences in metal tolerance among strains, populations, and species of marine diatoms - Importance of exponential growth for quantification

Authors: Andersson B, Godhe A, Filipsson HL, Rengefors K, Berglund O

Source: AQUATIC TOXICOLOGY 226:105551, 2020, DOI: 10.1016/j.aquatox.2020.105551

Abstract: Strains of microalgae vary in traits between species and populations due to adaptation or stochastic processes. Traits of individual strains may also vary depending on the acclimatization state and external forces, such as abiotic stress. In this study we tested how metal tolerance differs among marine diatoms at three organizational levels: species, populations, and strains. At the species level we compared two pelagic Baltic Sea diatoms (*Skeletonema marinoi* and *Thalassiosira baltica*). We found that the between-species differences in tolerance (EC50) to the biologically active metals (Cu, Co, Ni, and Zn) was similar to that within-species. In contrast, the two species differed significantly in tolerance towards the non-essential metals, Ag (three-fold higher in *T. baltica*), Pb and Cd (two and three-fold higher in S. marinoi). At the population level, we found evidence that increased tolerance against Cu and Co (17 and 41 % higher EC50 on average, respectively) had evolved in a S. marinoi population subjected to historical mining activity. On a strain level we demonstrate how the growth phase of cultures (i.e., cellular densities above exponential growth) modulated dose-response relationships to Ag, Cd, Co, Cu, and Zn. Specifically, the EC50's were reduced by 10-60 % in non-exponentially growing S. marinoi (strain RO5AC), depending on metal. For the essential metals these differences were often larger than the average differences between the two species and populations. Consequently, without careful experimental design, interactions between nutrient limitation and metal stress may interfere with detection of small, but evolutionary and ecologically important, differences in tolerance between microalgae. To avoid such artifacts, we outline a semi-continuous cultivation approach that maintains, and empirically tests, that exponential growth is achieved. We argue that such an approach is essential to enable comparison of population or strain differences in tolerance using dose-response tests on cultures of microalgae.

Accès au document

The Fungicide Tebuconazole Confounds Concentrations of Molecular Biomarkers Estimating Fungal Biomass

Authors: Baudy P, Konschak M, Sakpal H, Baschien C, Schulz R, Bundschuh M, Zubrod JP

Source: BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY Early Access, 2020, DOI: 10.1007/s00128-020-02977-9

Abstract: Due to their ecological importance, fungi are suitable indicator organisms for anthropogenic stress. To estimate fungal biomass, the fungal membrane molecule ergosterol is often quantified as a proxy. Estimates based on ergosterol may, however, be distorted by exposure to demethylase inhibiting (DMI) fungicides, interfering with sterol synthesis. To test this hypothesis, we exposed ten fungal species to the DMI fungicide tebuconazole and measured concentrations of ergosterol and DNA per unit dry mass of the fungal hyphae. The latter served as alternative biomass proxy that is not specifically targeted by tebuconazole. Effects of tebuconazole on ergosterol concentrations were species-specific, while concentrations were on average reduced by 13%. In contrast, DNA concentrations were on average increased by 13%. We demonstrate that DMI fungicides - at close to field relevant levels - can distort fungal biomass estimation, complicating the use of this endpoint for environmental management.

Accès au document

Distinct Temporal Succession of Bacterial Communities in Early Marine Biofilms in a Portuguese Atlantic Port

Authors: Antunes JT, Sousa AGG, Azevedo J, Rego A, Leao PN, Vasconcelos V

Source: FRONTIERS IN MICROBIOLOGY 11:1938, 2020, DOI: 10.3389/fmicb.2020.01938

Abstract: Marine biofilms are known to influence the corrosion of metal surfaces in the marine environment. Despite some recent research, the succession of bacterial communities colonizing artificial surfaces remains uncharacterized in some temporal settings. More specifically, it is not fully known if bacterial colonizers of artificial surfaces are similar or distinct in the different seasons of the year. In particular the study of early biofilms, in which the bacterial cells communities first adhere to artificial surfaces, are crucial for the development of the subsequent biofilm communities. In this work, we used amplicon-based NGS (next-generation sequencing) and universal 16S rRNA bacterial primers to characterize the early biofilm bacterial communities growing on 316 L stainless steel surfaces in a Northern Portugal port. Sampling spanned 30-day periods in two distinct seasons (spring and winter). Biofilm communities growing in steel surfaces covered with an anti-corrosion paint and planktonic communities from the same location were also characterized. Our results demonstrated that distinct temporal patterns were observed in the sampled seasons. Specifically, a significantly higher abundance of Gammaproteobacteria and Mollicutes was found on the first days of biofilm growth in spring (day 1 to day 4) and a higher abundance of Alphaproteobacteria during the same days of biofilm growth in winter. In the last sampled day (day 30), the spring biofilms significantly shifted toward a dominance of photoautotrophic groups (mostly diatoms) and were also colonized by some macrofouling communities, something not observed during the winter sampling. Our results revealed that bacterial composition in the biofilms was particularly affected by the sampled day of the specific season, more so than the overall effect of the season or overall sampling day of both seasons. Additionally, the application of a non-fouling-release anti-corrosion paint in the steel plates resulted in a significantly lower diversity compared with plates without paint, but this was only observed during spring. We suggest that temporal succession of marine biofilm communities should be taken in consideration for future antifouling/anti-biofilm applications.

Accès au document

The role of metal contamination in shaping microbial communities in heavily polluted marine sediments

Authors: Di Cesare A, Pjevac P, Eckert E, Curkov N, Sparica MM, Corno G, Orlic S

Source: ENVIRONMENTAL POLLUTION 265:114823, 2020, DOI: 10.1016/j.envpol.2020.114823

Abstract: Microorganisms in coastal sediments are fundamental for ecosystem functioning, and regulate processes relevant in global biogeochemical cycles. Still, our understanding of the effects anthropogenic perturbation and pollution can have on microbial communities in marine sediments is limited. We surveyed the microbial diversity, and the occurrence and abundance of metal and antibiotic resistance genes is sediments collected from the Pula Bay (Croatia), one of the most significantly polluted sites along the Croatian coast. With a collection of 14 samples from the bay area, we were able to generate a detailed status quo picture of a site that only recently started a cleaning and remediation process (closing of sewage pipes and reduction of industrial activity). The concentrations of heavy metals in Pula Bay sediments are significantly higher than in pristine sediments from the Adriatic Sea, and in some cases, manifold exceed international sediment quality guidelines. While the sedimentary concentrations of heavy metals did significantly influence the abundance of the tested metal resistance genes, no strong effect of heavy metal pollution on the overall microbial community composition was observed. Like in many other marine sediments, Gammaproteobacteria, Bacteroidota and Desulfobacterota dominated the microbial community composition in most

samples, and community assembly was primarily driven by water column depth and nutrient (carbon and nitrogen) availability, regardless of the degree of heavy metal pollution.

Accès au document

Interactive effects of warming and copper toxicity on a tropical freshwater green microalga *Chloromonas augustae* (Chlorophyceae)

Authors: Yong WK, Sim KS, Poong SW, Wei D, Phang SM, Lim PE

Source: JOURNAL OF APPLIED PHYCOLOGY Early Access, 2020, DOI: 10.1007/s10811-020-02087-3

Abstract: Microalgae, the primary producers in aquatic ecosystems, are highly susceptible to heavy metal contamination. In this study, the interactive effects of warming and copper (Cu) toxicity on the physiology (cell density, photosynthetic efficiency, reactive oxygen species (ROS) production, and metal uptake in the biomass) and biochemistry (metabolite) of a freshwater green microalga, *Chloromonas augustae* (UMACC246), were elucidated. The microalgae were exposed to culture media supplemented with copper (II) sulfate pentahydrate (CuSO4·5H(2)O) at different concentrations (50, 150, 250 μM) at two temperatures, 25 degrees C (control) and 30 degrees C (sub-optimal), for 24 h. The results indicated that *C. augustae* exhibited a concentration- and temperature-dependent decrease in the cell density. Copper greatly affected the photosynthetic efficiency of C.augustae by reducing the maximum rate of relative electron transport (rETR(m)), light harvesting efficiency (alpha), and saturation irradiance (E-k). Warming increased ROS production remarkably in the microalga. Untargeted metabolomics indicated that temperature contributed to the most significant variations in the cultures ($p < 0.05$) in comparison with Cu toxicity or both factors combined. Compounds such as amino acids and amines were significantly dysregulated in response to warming and Cu toxicity. Pathway analyses showed that the glutathione metabolism, sulfur metabolism, and mechanisms in the amino acid metabolism were regulated, suggesting that the microalga underwent primary metabolism restructuring for survival and adaptation. Overall, the data showed that warming enhanced Cu toxicity in the cultures. This implied that increasing water temperature and metal toxicity due to global warming and anthropogenic activities will probably exacerbate existing threats to the primary producers.

Accès au document

Characterization of the nano-bio interaction between metallic oxide nanomaterials and freshwater microalgae using flow cytometry

Authors: Arze AR, Manier N, Chatel A, Mouneyrac C

Source: NANOTOXICOLOGY Early Access, 2020, DOI: 10.1080/17435390.2020.1808106

Abstract: Since nanomaterials (NMs) are particulate contaminants, their first contact with organisms is a physical encounter ruled by physic-chemical processes that can determinate the potential NMs accumulation, toxicity, and trophic transfer. Freshwater ecosystems often become a final depository for NMs, so they can get in contact with the biota, especially primary organisms as algae. There are almost none comparative studies of this interaction using various NMs in the same conditions. This work identifies, analyzes, and compares the algae-NMs interaction by flow cytometry after a short-term contact test in which three freshwater algae (*Raphidocelis subcapitata*, *Desmodesmus subspicatus*, and *Chlorella vulgaris*) interact individually with a set of twelve metallic oxide NMs. Dose-response profiles and differences in the algae-NMs interaction were found according

to each algae species (*C. vulgaris* had the most affinity, starting the interaction from 0.5 mg/L and D. subspicatus had the less affinity starting at 5 mg/L). Flow cytometry results were confirmed by optical microscopy. Some NMs characteristics were identified as key-factors that govern the algae-NMs interaction: NMs composition (no interaction for SiO2NMs), surface electric charge (higher interaction for the positively charged NMs and lower interaction for the negatively charged ones) and crystalline form (for TiO2NMs). The presented method can be useful for a rapid determination of the interaction between free cells organisms as microalgae and (nano)particulate substances.

Accès au document

Effect of humic acids on the toxicity of pollutants to *Chlamydomonas reinhardtii:* Investigation by a microscale algal growth inhibition test

Authors: Nanayama Y, Sazawa K, Yustiawati Y, Syawal MS, Fukushima M, Kuramitz H

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access, 2020, DOI: 10.1007/s11356-020-10425-8

Abstract: Dissolved humic substances (DHSs) are the major components of organic matter in the aquatic environment. DHSs are well known to considerably affect the speciation, solubility, and toxicity of a wide variety of pollutants in the aquatic environment. In this study, the effects of the toxicity of heavy metals and hydrophobic organic pollutants (HOPs) on Chlamydomonas reinhardtii in the presence of humic acid (HA) were examined by a microscale algal growth inhibition (mu-AGI) test based on spectrophotometric detection. To clarify the relationship between the chemical properties of HAs and the toxicity change of pollutants, eight HAs from different sources were prepared and used. HAs were responsible for mitigating the toxicity of Hg, Cu, pesticides (gamma-HCH, 2,4-D, and DDT), and polycyclic aromatic hydrocarbons (PAHs) such as naphthalene (Nap), anthracene (Ant), and benzo[a]pyrene (BaP). In particular, an approximately 100-fold decrease in the toxicity of BaP was observed in the presence of 10 ppm HAs extracted from tropical peat. The results indicated that the carboxylic group content and the HA molecular weight are correlated to the changes in the heavy metal toxicity. For HOPs, the aromaticity and polarity of HAs are crucial for mitigating their toxicity. Furthermore, it was clearly shown that the lake water including a high concentration of DHSs collected from Central Kalimantan, Indonesia, reduced the toxicity of Hg and gamma-HCH on Chlamydomonas reinhardtii.

Accès au document

Increased inheritance of structure and function of bacterial communities and pathogen propagation in plastisphere along a river with increasing antibiotics pollution gradient

Authors: Xue NN, Wang LY, Li WF, Wang SS, Pan XL, Zhang DY

Source: ENVIRONMENTAL POLLUTION 265:114641, 2020, DOI: 10.1016/j.envpol.2020.114641

https://doi.org/10.15454/6MQT-0H51

Abstract: Plastic debris provides a stable substrate and novel ecological niche for microorganisms in the aquatic environment, which was referred to as "Plastisphere". Little is known about distribution patterns and responses of ecological function and structure of microbial communities in the plastisphere along rivers which usually have antibiotics pollution gradient. In this study, the differences in the community structure between the plastisphere and the planktonic bacteria, and their spatial variation of the community structure and function along a river with increased antibiotics pollution gradient was investigated at the watershed scale. The diversity of bacteria colonized on most plastic debris was higher than in surrounding water. Plastic debris could accumulate a higher abundance of some potential pathogens than surrounding water even at high antibiotics concentrations. The source tracking results showed that downstream plastisphere inherited much higher proportions of bacterial taxa from upstream than planktonic bacteria. About 92.3-99.7% of bacteria communities in downstream water were not from upstream but from the input of downstream human activities. On the contrary, high proportions of bacterial taxa in downstream plastisphere were closely connected to upstream. The plastisphere possesses higher ecological functional diversity than the planktonic bacteria. Seventy nine functional groups across plastisphere were predicted using functional annotation of prokaryotic taxa and only 65 functional groups were found in the planktonic bacteria. Plastisphere also acts as hotspot for biogeochemical cycling of nutrients such as N and S. Intensive human activities of urban and downstream agriculture and aquaculture had great effects on microbial community structure and functional groups of the Urumqi River. Pastisphere communities are much more resistant to human disturbance than planktonic bacteria. Compared to surrounding water, plastisphere increased inheritance from upstream microbial structure and function and also increased survival and propagation of pathogens in the downstream water with high concentrations of antibiotics.

Accès au document

Advances in characterizing microbial community change and resistance upon exposure to lead contamination: Implications for ecological risk assessment

Authors: George SE, Wan YS

Source: CRITICAL REVIEWS IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY 50:2223-2270, 2020, DOI: 10.1080/10643389.2019.1698260

Abstract: Recent advancement in molecular techniques has spurred numerous studies on responses of microorganisms to lead exposure, leveraging detailed phylogenetic analyses and functional gene identification to discern the effects of lead toxicity on microbial communities. A comprehensive review of recent research is provided on (1) lead resistance mechanisms of microorganisms; (2) microbial community changes in contaminated aquatic sediments and terrestrial soils; and (3) lead resistance genes applied to lead biosensor development. Ample evidence in the literature, including both in vitro and in situ studies, indicates that exposure to lead inhibits microbial activities (such as respiration and metabolism), reduces biomass and alters microbial community structure. Even at sites where microbial communities do not vary compositionally with contaminant levels, functional differences between microbial communities are evident. The main mechanisms of lead resistance involve extracellular and intracellular biosorption, precipitation, complexation, and/or efflux pumps. The suites of genes associated with lead resistance mechanisms can serve, when considered with phylogenetic information, as indicators of lead contamination. This holds potential for development of next generation lead biosensors. To promote applications of advanced knowledge, molecular techniques, and lead biosensor technology, perspectives on using

microbial indicators for site ecological assessment are presented.

Accès au document

Polystyrene nanoplastics cause growth inhibition, morphological damage and physiological disturbance in the marine microalga *Platymonas helgolandica*

Authors: Wang SY, Liu MH, Wang JM, Huang JS, Wang J

Source: MARINE POLLUTION BULLETIN 158:111403, 2020, DOI: 10.1016/j.marpolbul.2020.111403

Abstract: Effects of nanoplastics at low level on the marine primary producer are largely unclear. To assess the potential risk of nanoplastic pollution, this study exposed marine green microalgae *Platymonas helgolandica* to 20, 200, and 2000 μg/L 70-nm polystyrene nanoplastics for 6 days. Nanoplastics significantly inhibited the growth of *P. helgolandica* during the first 4 days of exposure, and elevated heterocyst frequency was observed in 200 and 2000 μg/L exposure groups in the early exposure stage. Exposure to 200 and 2000 μg/L nanoplastics for 4 days increased the membrane permeability and mitochondrial membrane potential, and decreased light energy used in photochemical processes of microalgae. Moreover, clear morphological changes, including surface folds, fragmentation, aggregation cluster, and rupture, in the microalgae exposed to nanoplastics were observed under scanning electron microscope and transmission electron microscope. These results demonstrate that nanoplastics could reduce the microalgal vitality by the damage on cell morphology and organelle function.

Accès au document

Effects of humic acids on biotoxicity of tetracycline to microalgae *Coelastrella* sp.

Authors: Tong MY, Li X, Luo Q, Yang CP, Lou W, Liu HY, Du C, Nie LJ, Zhong YY

Source: ALGAL RESEARCH-BIOMASS BIOFUELS AND BIOPRODUCTS 50:101962, 2020, DOI: 10.1016/j.algal.2020.101962

Abstract: The release of antibiotics into aquatic environments would induce adverse effects on organisms, so the environmental impact and fate of antibiotics must be paid close attention. In this paper, the effects of tetracycline on the growth of microalgae *Coelastrella* sp. in the presence of humic acids were investigated at various tetracycline concentrations ranging from 0.5 to 10 mg/L in Blue-Green medium, and the underlying mechanisms were also discussed. Results revealed that the microalgae growth showed a hormesis dose-response phenomenon under tetracycline stress with stimulation at low levels ≤ 2 mg/L) while inhibition at higher levels (2 mg/L). More importantly, tetracycline biotoxicity to Coelastrella sp. decreased significantly due to the increase in humic acids concentration, as evidenced by the increased biomass, chlorophyll-a and total proteins contents, as well as the reduced oxidative stress response in *Coelastrella* sp. cells. The strong complexation between tetracycline and humic acids was responsible for the reduced tetracycline biotoxicity. These findings are helpful for better understanding the environmental risk of antibiotics in eutrophic waters.

Accès au document

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https://doi.org/10.15454/6MQT-0H51

MICROBIOLOGIE ET CONTAMINANTS

Effects of co-contamination of heavy metals and total petroleum hydrocarbons on soil bacterial community and function network reconstitution

Authors: Li Q, You Pi, Hu Q, Leng BF, and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 204, 2020, DOI: 10.1016/j.ecoenv.2020.111083

Abstract: Due to the accumulation of heavy metals in soil ecosystems, the response of soil microorganisms to the disturbance of heavy metals were widely studied. However, little was known about the interactions among microorganisms in heavy metals and total petroleum hydrocarbons (TPH) co-contaminated soils. In the present study, the microbiota shifts of 2 different contamination types of heavy metal-TPH polluted soils were investigated. NGS sequencing approach was adopted to illustrate the microbial community structure and to predict community function. Networks were established to reveal the interactions between microbes and environmental pollutants. Results showed that the alpha diversity and OTUs number of soil microbiota were reduced under heavy metals and TPH pollutants. TPH was the major pollutant in HT1 group, in which Proteobacteria phylum increased significantly, including Arenimonas genus, Sphingomonadaceae family and Burkholderiaceae family. Moreover, the function structures based on the KEGG database of HT1 group was enriched in the benzene matter metabolism and bacterial motoricity in microbiota. In contrast, severe Cr-Pb-TPH co-pollutants in HT2 increased the abundance of Firmicutes. In details, the relative abundance of Streptococcus genus and Bacilli class raised sharply. The DNA replication functions in microbiota were enriched under severely contaminated soil as a result of high concentrations of heavy metals and TPH pollutants' damage to bacteria. Furthermore, according to the correlation analysis between microbes and the pollutants, Streptococcus, Neisseria, Aeromonas, Porphyromonas and Acinetobacter were suggested as the bioremediation bacteria for Cr and Pb polluted soils, while Syntrophaceae spp. and Immundisolibacter were suggested as the bioremediation bacteria for TPH polluted soil. The study took a survey on the microbiota shifts of the heavy metals and TPH polluted soils, and the microbe's biomarkers provided new insights for the candidate strains of biodegradation, while further researches are required to verify the biodegradation mechanism of these biomarkers.

Accès au document

Molecular identification and phylogenetic analysis of chromium-resistant bacteria isolated from chromite mine area soil, Sukinda, India using 16S rRNA sequencing

Authors: Pradhan SK, Singh NR, Das S, Thatoi H

Source: SOIL & SEDIMENT CONTAMINATION 29, 8: 805-822, 2020, DOI: 10.1080/15320383.2020.1771272

https://doi.org/10.15454/6MQT-0H51

Abstract: The present study was undertaken to characterize the Cr(VI)-resistant bacteria isolated from the chromite mine area of Sukinda, Odisha through 16S rRNA sequencing technique followed by homology search, secondary structure analysis. The 16S rRNA sequencing resulted in varied bacterial sequence lengths. Characterization of these isolated sequences showed the dominance of the members of the genera Bacillus, Lysinibacillus, and Staphylococcus followed by the members of other distinct genera such asEnterobacter, Curtobacterium, Kocuria, and Stenotrophomonas. Cr(VI)-tolerant study of these bacterial isolates exhibited comparatively higher resistance toward Cr(VI) at 500 mg L(-1)concentration. Secondary-structural diversity among isolated sequences obtained from mfold prediction server varied with sequence-based diversity with some conserved pattern observed among the few Bacillus groups and Staphylococcus groups, but in other genera, the structural similarity is not observed. Multiple sequence alignment of all 16S rRNA sequences showed monomorphic and polymorphic sites in most of the sequences, whereas parsimony-informative sites were identified in a few bacterial isolates. Further, phylogenetic analysis of the isolated chromium-resistant 16S rRNA bacterial sequences along with the sequences retrieved from NCBI's ENTREZ database was performed to study their divergence. Phylogenetic analysis revealed that chromate-resistant sequences were clustered into two distinct clades in maximum parsimony-based phylogenetic tree construction.

Accès au document

Effects of dibutyl phthalate contamination on physiology, phytohormone homeostasis, rhizospheric and endophytic bacterial communities of Brassica rapa var. chinensis

Authors: Ge J, Cheng JJ, Li Y, and more ...

Source: ENVIRONMENTAL RESEARCH 189, 2020, DOI: 10.1016/j.envres.2020.109953

Abstract: Phthalates are plasticizers and are ubiquitously detected in the environment, frequently at mg/kg levels. The present study aimed to evaluate the effects of dibutyl phthalate (DBP) on germination, growth, enzyme activity, phytohormone homeostasis and bacterial communities of two cultivars of Brassica rapa var. chinensis. The germination rate was decreased up to 20% compared to the control, and the growth of the vegetables was severely inhibited at the early stage when exposed to DBP at 20 mg/kg. Antioxidant defense enzyme activities and malondialdehyde (MDA) content increased upon exposure to DBP. A dose-response of auxin (IAA) was observed after a 2 d exposure. Gibberellin (GA3) and abscisic acid (ABA) responded at day 10 under DBP stress. GA3 did not show a clear dose-response effect and ABA increased about 3 times as the DBP concentration increased from 2 to 20 mg/L. Microbial population shifts were observed, especially in rhizosphere soil and roots. No obvious change occurred for the a diversity of rhizospheric bacteria among different treatments. Chaol, Shannon and Simpson indices of the root endophytic bacteria showed a decreasing trend with increasing DBP supplementation, while all the indices increased in shoot endophytic bacteria in comparison to the control. The results indicated that exposure to DBP may compromise the fitness of the leafy vagetables and alter the endophytic and rhizospheric bacteria, which might further affect the nutrients of the vegetables and alter ecosystem functions.

Accès au document

Bioavailable metal(loid)s and physicochemical features co-mediating microbial communities at combined metal(loid) pollution sites

Authors: Wang JW, Liu T, Sun WL, Chen Q

Source: CHEMOSPHERE 260, 2020, DOI: 10.1016/j.chemosphere.2020.127619

Abstract: Heavy metal contamination poses considerable threats to various ecosystems, yet little is known about the assembly and adaptation of microbial communities at sites with combined heavy metal(loid) pollution. Here, we examined metal(loid) pollutants and bacterial communities in three zones (Zones I, II, and III) of an abandoned sewage reservoir with different usage years. The contamination level of multiple metal(loid)s was higher in Zone I than in the other zones, and arsenic (As), zinc (Zn), selenium (Se), copper (Cu), tin (Sn), molybdenum (Mo), antimony (Sb), cadmium (Cd), lead (Pb), thallium (Tl), and nickel (Ni) were the major contaminants (pollution load index > 1). Bioavailable forms of titanium (Ti), chromium (Cr), Sn, and cobalt (Co) played essential roles in shaping the microbial structure, and physicochemical properties, especially organic matter (OM) and pH, also mediated the microbial diversity and composition in the metal(loid) contaminated zones. Metal-microbe interactions and heatmap analysis revealed that the bioavailability of metal(loid)s promoted the niche partitioning of microbial species. Metal-resistant species were abundant in Zone I that had the highest metal-contaminated level, whereas metal-sensitive species prevailed in Zone III that had the lowest pollution level. The bioavailable metal(loid)s rather than physicochemical and spatial variables explained a larger portion of the variance in the microbial community, and the homogeneous selection was the dominant ecological process driving the assembly of the microbial community. Overall, our study highlighted the importance of metal(loid) bioavailability in shaping microbial structure, future bioremediation, and environmental management of metal(loid) contaminated sites.

Accès au document

Temporal dynamics of heavy metal distribution and associated microbial community in ambient aerosols from vanadium smelter

Authors: Wang YN, Zhang BG, Wang S and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 735, 2020, DOI: 10.1016/j.scitotenv.2020.139360

Abstract: Heavy metals (HMs) such as vanadium (V), zinc (Zn), arsenic (As), chromium (Cr), copper (Cu) and nickel (Ni) are released into atmosphere during V smelting activities, resulting in their co-existence with airborne microbes. However, little is known about HMs distributions and associated microbes in aerosols from such industrial districts. This study reveals seasonal dynamics of HMs and microbes in ambient aerosols from V smelter in Panzhihua, China. Multiple HMs were detected, while V concentration was the highest, maximizing at 228.0 +/- 10.3 ng/m(3) in Spring. Health risks displayed similar trends to HMs distributions, and children were posed much higher risks than adults due to their more sensitivity to HMs. V and As contributed dramatically to total health risks among all examined HMs. High-throughput 16S rRNA gene sequencing analysis revealed microbes tolerant to V, Zn, As, Cr, Cu and Ni. Acinetobacter widely existed with function of detoxifying V(V) and more species as Bacillus, Gobacter and Thauera tolerating V, Zn, As, Cr, Cu and Ni appeared in Summer. These findings shed light on understandings of HMs dynamics and associated microbial community in aerosols from smelting regions.

Accès au document

Microbial Distribution and Diversity of Soil Around a Manganese Mine Area

Authors: Xiang YW, Dong YiQ, Zhao SY, and more ...

Source: WATER AIR AND SOIL POLLUTION 231, 10, 2020, DOI: 10.1007/s11270-020-04878-3

Abstract: From 12 mining areas surrounding a manganese mining area in Guangxi, soil samples were collected at different distances from the center of the mining area and different sampling points at the same distance. 16S rRNA gene sequencing was used in extracting and amplifying DNA in the soil samples, and double-terminal gene sequence library comparison was performed. Through OUT clustering, species community, species diversity, and inter-group difference analyses, the composition of microbial community and biological diversity in the mining soil was evaluated. Results showed that the soil around the mining area was affected by heavy metals, and species complexity was positively correlated with distance. Proteobacteria, Firmicutes, Bacteroidetes, and Acidobacteria were the dominant species with high abundance in some soil samples because of their pollution tolerance. The samples closer to the center were more disturbed by mining activities, and species diversity sequencing based on observed species index and Shannon index was consistent with that of cluster analysis. Differences among the sample groups at 2 km from the center were the smallest, and species diversity had the highest similarity. Differences among the sample groups at 1 km from the center were the largest, and species composition significantly varied. Microorganism distribution is an important indicator of soil ecological characteristics, and the analysis of species and diversity of soil microorganisms is important to the assessment of the impact of mining activities and the extent of soil contamination.

Accès au document

Unraveling consequences of soil micro- and nano-plastic pollution on soil-plant system: Implications for nitrogen (N) cycling and soil microbial activity

Authors: Iqbal S, Xu JC, Allen SD and more ...

Source: CHEMOSPHERE 260, 2020, DOI: 10.1016/j.chemosphere.2020.127578

Abstract: Micro- and nano-plastics have widely been recognized as major global environmental problem due to its widespread use and inadequate waste management. The emergence of these plastic pollutants in agroecosystem is a legitimate ecotoxicological concerns for food web exchanges. In agriculture, micro/ nano plastics are originated from a variety of different agricultural management practices, such as the use of compost, sewage sludge and mulching. A range of soil properties and plant traits are affected by their presence. With the increase of plastic debris, these pollutant materials have now begun to demonstrate serious implications for key soil ecosystem functions, such as soil microbial activity and nutrient cycling. Nitrogen (N) cycle is key predictor of ecological stability and management in terrestrial ecosystem. In this review, we evaluate ecological risks associated with micro-nano plastic for soil-plant system. We also discuss the consequence of plastic pollutants, either positive or negative, on soil microbial activities. In addition, we systematically summarize both direct and hypothesized implications for N cycling in agroecosystem. We conclude that soil N transformation had showed varied effects resulting from different types and sizes of plastic polymers present in soil. While mixed effects of microplastic pollution on plant growth and yield have been observed, biodegradable plastics have appeared to pose greater risk for plant growth compared to chemical plastic polymers.

Accès au document

Smectite clay minerals reduce the acute toxicity of quaternary alkylammonium compounds towards potentially pathogenic

bacterial taxa present in manure and soil

Authors: Heyde BJ, Glaeser SP, Bisping L and more ...

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-71720-5

Abstract: Quaternary alkylammonium compounds (QAACs) are a group of cationic surfactants which are disinfectants with numerous industrial and agricultural applications and frequently released into the environment. One recent hypothesis is that bacteria present in soil will be protected from acute toxic effects of QAACs in the presence of expandable layer silicates due to interlayer sorption. We therefore studied bacterial growth kinetics with high temporal resolution and determined minimal inhibitory concentrations (MICs) of two QAACs, benzyldimethyldodecylammonium chloride (BAC-C12) and didecyldimethylammonium chlorid (DADMAC-C10), for eight strains of different bacterial taxa (*Escherichia coli*, *Acinetobacter*, *Enterococcus faecium*, *Enterococcus faecalis*, and *Pseudomonas fluorescens*) in relation to QAAC sorption to smectite and kaolinite. The MICs of BAC-C12 and DADMAC-C10 were in the absence of smectite and kaolinite in the order of 10 to 30 µg mL(-1) and 1.0 to 3.5 µg mL(-1) for all strains except the more sensitive Acinetobacter strain. For all tested strains and both tested QAACs, the presence of smectite increased apparent MIC values while kaolinite had no effect on MICs. Sorption curves without bacteria showed that smectite sorbed larger amounts of QAACs than kaolinite. Correcting nominal QAAC concentrations employed in toxicity tests for QAAC sorption using the sorption curves explained well the observed shifts in apparent MICs. Transmission electron microscopy (TEM) demonstrated that the interlayer space of smectite expanded from 13.7 +/- 1 angstrom to 19.9 +/- 1.5 angstrom after addition of BAC-C12. This study provides first evidence that low charge 2:1 expandable layer silicates can play an important role for buffering QAAC toxicity in soils.

Accès au document

Graphene oxide influences bacterial community and soil environments of Cd-polluted Haplic Cambisols in Northeast China

Authors: Ru JX, Chen GY, Liu Y, Sang Y, Song JF

Source: JOURNAL OF FORESTRY RESEARC, 2020, DOI: 10.1007/s11676-020-01217-4

Abstract: Graphene oxide (GO), a carbon nanomaterial that is widely used in the environment and other industries, may pose potential risks to ecosystems, especially the soil ecosystem. Some soils in Northeast China are frequently polluted with cadmium (Cd) metal. However, there is no study on the influence of GO on the Cd-contaminated soil microbial community and soil chemical properties. In this study, Cd (100 mg kg(-1))-polluted soils were treated with different concentrations of GO (0, 25, 50, 150, 250, and 500 mg L-1, expressed as T1, T2, T3, T4, T5, and T6, respectively) for 40 days. The treatment without Cd pollution and GO served as the control (CK). Then, we investigated the influence of the GO concentrations on the bacterial community and chemical properties of Cd-polluted Haplic Cambisols, the zonal soil in Northeast China. After GO addition, the richness and diversity indexes of the bacterial community in Cd-contaminated Haplic Cambisols initially increased by 0.05-33.92% at 25 mg L-1, then decreased by 0.07-2.37% at 50 mg L-1, and then increased by 0.01-24.37% within 500 mg L(-1)again. The species and abundance of bacteria varied with GO concentration, and GO significantly increased bacterial growth at 25 and 250 mg L-1. GO treatments influenced the bacterial community structure, and the order of similarity of the bacterial community structure was as follows: T4 = T5 > T1 = T6 > T2 > T3 > CK. Proteobacteria and Acidobacteria were the dominant bacteria, accounting for 36.0% and 26.2%, respectively, of soil bacteria. Different GO treatments also significantly affected the metabolic function of bacteria and further

influenced the diversity of the bacterial community structure by affecting several key soil chemical properties: soil pH, organic matter and available potassium, phosphorus, and cadmium. Our results provide a theoretical basis for scientific and comprehensive evaluation of the environmental impacts of GO on the zonal forest soils of Northeast China.

Accès au document

Spatial and Temporal Variation in Microbial Diversity and Community Structure in a Contaminated Mangrove Wetland

Authors: Ma J, Zhou T, Xu C, and more ...

Source: APPLIED SCIENCES-BASEL 10, 17, 2020, DOI: 10.3390/app10175850

Abstract: Field and laboratory investigations were conducted to characterize bacterial diversity and community structure in a badly contaminated mangrove wetland adjacent to the metropolitan area of a megacity in subtropical China. Next-generation sequencing technique was used for sequencing the V4-V5 region of the 16s rRNA gene on the Illumina system. Collectively, Proteobacteria, Chloroflexi, Planctomycetes, Actinobacteria and Bacteroidetes were the predominant phyla identified in the investigated soils. A significant spatial variation in bacterial diversity and community structure was observed for the investigated mangrove soils. Heavy metal pollution played a key role in reducing the bacterial diversity. The spatial variation in soil-borne heavy metals shaped the spatial variation in bacterial diversity and community structure in the study area. Other environmental factors such as total carbon and total nitrogen in the soils that are affected by seasonal change in temperature could also influence the bacterial abundance, diversity and community structure though the temporal variation was relatively weaker, as compared to spatial variation. The bacterial diversity index was lower in the investigated site than in the comparable reference site with less contaminated status. The community structure in mangrove soils at the current study site was, to a remarkable extent, different from those in the tropical mangrove wetlands around the world.

Accès au document

Fungal heavy metal adaptation through single nucleotide polymorphisms and copy-number variation

Authors: Bazzicalupo AL, Ruytinx J, Ke YH, and more ...

Source: MOLECULAR ECOLOGY, 2020, DOI: 10.1111/mec.15618

Abstract: Human-altered environments can shape the evolution of organisms. Fungi are no exception, although little is known about how they withstand anthropogenic pollution. Here, we document adaptation in the mycorrhizal fungusSuillus luteusdriven by soil heavy metal contamination. Genome scans across individuals from recently polluted and nearby unpolluted soils in Belgium revealed low divergence across isolates and no evidence of population structure based on soil type. However, we detected single nucleotide polymorphism divergence and gene copy-number variation, with different genetic combinations potentially conferring the ability to persist in contaminated soils. Variants were shared across the population but found to be under selection in isolates exposed to pollution and located across the genome, including in genes involved in metal exclusion, storage, immobilization and reactive oxygen species detoxification. Together, our results point toS. luteusundergoing the initial steps of adaptive divergence and contribute to understanding the processes underlying local adaptation under strong environmental selection.

Accès au document

https://doi.org/10.15454/6MQT-0H51

Selective pressures of heavy metals on microbial community determine microbial functional roles during composting: Sensitive, resistant and actor

Authors: Chen XM, Zhao Y, Zhao XY and more ...

Source: JOURNAL OF HAZARDOUS MATERIALS 398, 2020, DOI: 10.1016/j.jhazmat.2020.122858

Abstract: Heavy metals (HM) pollution exerts an effect on microbial community composition and structure during composting, the way how microbial community responses to HM pressure is remain poorly understood though. The aim of this study was to explore functional roles of microorganisms based on selective pressures of HM (Cu, Zn and Cd). The results of microbial resistance showed that the toxicity of metals to microorganisms were Cu > Zn > Cd during composting. Cu and Zn were more toxic for microorganisms during composting when compared with Cd. However, microorganisms had a longer lag period to grow under Zn stress through microbial tolerance determination. In addition, the microbial catalase activity generally decreased and protease activity generally increased, thus microorganisms became more adaptable to HM stress during composting. The experimental results confirmed the existence of sensitive, resistant and actor microorganisms during beef cattle and chicken manures composting. Ultimately, the resistant, sensitive and actor microorganisms at genus level were distinguished under HM pressure based on the network analysis and structural equation models, including 85 resistant microorganisms, 5 sensitive microorganisms and 6 actor microorganisms. This would be helpful to understand the microbial succession process under HM stress and identify functional strains of HM remediation.

Accès au document

Comparative study on the pollution status of organochlorine pesticides (OCPs) and bacterial community diversity and structure between plastic shed and open-field soils from northern China

Authors: Sun Y, Chang XP, Zhao LX, and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 741, 2020, DOI: 10.1016/j.scitotenv.2020.139620

Abstract: The pollution status of organochlorine pesticides (OCPs) and microbial community in plastic shed and open-field soils may be different due to the significant variations in environmental factors between the two cultivation modes. However, the differences remain unclear. We conducted a regional-scale survey to investigate the pollution level, distribution, and sources of 20 OCPs, and to evaluate the soil physicochemical properties and bacterial community in soils from plastic shed and open-field locating the north areas of China. We found that levels of total OCPs in the plastic shed soils were significantly higher than those in the nearby open-field soils. Most of these OCPs were attributed to historical application, except for dichlorodiphenyltrichloroethanes (DDTs) due to the fresh input along with dicofol application. Soil pH (for both cultivation modes) and total organic carbon (TOC) content (only for plastic sheds) were significantly correlated with the total OCP concentrations. Additionally, microbial diversity and richness were generally lower in plastic shed soils than in nearby open-field soils for each region. The bacterial community variation among different regions might be principally determined by the soil type. Soil pH had the greatest impact on the microbial community across all plastic shed and open-field samples. These results provide a better understanding of the environmental impact and ecological risk of OCPs in soils with different cultivation modes.

Accès au document

Physicochemical properties, heavy metals, and metal-tolerant bacteria profiles of abandoned gold mine tailings in Krugersdorp, South Africa

Authors: Fashola MO, Ngole-Jeme VM, Babalola OO

Source: CANADIAN JOURNAL OF SOIL SCIENCE 100 3: 217-233, 2020, DOI: 10.1139/cjss-2018-0161

Abstract: Mine tailings are a potential source of heavy metals (HM) that can be toxic to microbes, plants, and animals in aquatic and terrestrial ecosystems. Bacteria have evolved several mechanisms to tolerate the uptake of HM ions. This study aimed to assess the physicochemical properties, concentrations of selected HM and metalloids [arsenic (As), nickel (Ni), lead (Pb), zinc (Zn), cadmium (Cd), and cobalt (Co)], and isolate potential metal-tolerant bacteria present at three abandoned gold mining sites with a view of understanding how tailings characteristics vary and the implications on microbial activities in tailings dumps. Heavy-metal-tolerant bacteria were isolated from the samples using minimum inhibitory and maximum tolerable concentrations of the Ni, Pb, Zn, Cd, and Co. The substrates of the studied sites were acidic and deficient in nutrients. High metals and metalloid concentrations in the order Zn > Ni > Co > As > Pb > Cd were recorded in some of the studied sites and its adjacent soil which exceeded South African recommended values for soil and sediments. Heavy-metal-tolerant bacteria that showed multiple tolerances to Ni, Pb, and Zn were isolated and putatively identified using biochemical tests as belonging to the phyla Proteobacteria, Actinobacteria, and Firmicutes. Gold mine tailings enriched the soil with HM and also affect soil physicochemical properties. Proper management of mine wastes must be ensured to prevent their adverse effects on the diversity, composition, and activity of soil microorganisms that help in maintenance of the ecosystem.

Accès au document

Physicochemical and microbial properties of urban park soils of the cities of Marrakech, Morocco and Torun, Poland: Human health risk assessment of fecal coliforms and trace elements

Authors: Beroigui M, Naylo A, Walczak M. and more ...

Source: CATENA 194, 2020, DOI: 10.1016/j.catena.2020.104673

Abstract: The public green space (PGS) in urban areas presents an image of nature and its animal and plant biodiversity in the city. Due to intense urbanization in the world, pollutants such as trace elements (FE) or pathogenic microorganisms are continually emitted into the environment and pose a threat to ecosystems. The aim of this work was to assess the soil quality of PGS in the cities of Marrakech (Morocco) and Torun (Poland) through physicochemical and microbiological approaches and to assess related health risks. Eighteen soils from the most visited historic parks in Marrakech and Torun were sampled and analyzed. The results showed that content of Total Organic Carbon (TOC) in Torun urban soils is about three times higher than that measured in Marrakech urban park soils. These differences are related to the naturally higher content of organic matter in the soils of temperate climate regions than in Mediterranean soils. The concentrations of trace element (FE) showed a similar trend in both cities, except for Pb in one Marrakech site, which exhibited a high concentration (400 mg Pb Kg(-1) in Bab Rab Park). Soil enzymes present a high sensitivity to anthropogenic disturbances and can be used as tool to evaluate early disturbance of urban soils. The alkaline

phosphatase (APHa) and urease (URa) activities are less affected by anthropogenic pressure than dehydrogenase (DHa). Slight sensitivity to TE was observed in the microbial community in the order fungi < actinomycetes < bacteria. Total and fecal coliforms (TC, FC) were present in all soil samples, with higher concentrations in Marrakech sites. Based on estimated FC risk, the highest percentage did not exceed 11% of the guideline limit set by International Commission on Microbiological Specifications for Foods. Hazard index showed no health risk for adults caused by studied TE concentrations in the park soils of Marrakech and Torun, but potential adverse non-cancer health effects for children. Their safety depends on their own behavior and the ways by adults supervise them.

Accès au document

Effect of heavy metals on soil microbial biomass, and nematode trophic groups of a paddy soil affected by long-runningpolymetallic mining activities in Guangdong, Southern China

Authors: Zeng QP, Zhu LA, Wang JZ and more ...

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH 18(4):4915-4927, 2020, DOI: 10.15666/aeer/1804_49154927

Abstract: While the effects of heavy metals on soil organisms are relatively well-documented, the effects of heavy metals caused by long-term sewage irrigation are poorly understood. Therefore, we collected two kinds of soil samples from a paddy field which was irrigated with sewage for more than 20 years (SIA) and the adjacent non-sewage irrigated land as control (NSIA) in Shaoguan, southern China, to assess the long-term effects of multiple metal mining activities on soil microbial biomass, nematode assemblages. The available Cu and Zn, and the total Cu, Zn, Pb and As contents in SIA were higher than those in NSIA area by 13.60, 7.69, 8.56, 2.35, 2.96 and 3.11 times on average. Heavy metals stimulated microbial biomass and nematode biomass consumption, which caused a shift in nematode groups, and the mean content of soil microbial biomass carbon (C) and nitrogen (N) in SIA drops by 25.76%, 11.10% compared to the NSIA. Organics showed a positive effect on soil microbial biomass C and N, with the same response for all types of nematodes, Available Cu and Zn, and the total Cu, Zn, Pb and As content in soils exhibited a negative effect on soil microbial biomass C and N, and each group of nematodes, which reveal that the microbial/nematode activities had been disrupted by the heavy metals.

Accès au document

Soil Microbial Community Changes in a Field Treatment with Chlorotoluron, Flufenacet and Diflufenican and Two Organic Amendments

Authors: Carpio MJ, Garcia-Delgado C, Marin-Benito JM, and more ...

Source: AGRONOMY-BASEL 10, 8, 2020, DOI: 10.3390/agronomy10081166

Abstract: The soil microbial activity, biomass and structure were evaluated in an unamended (S) and organically amended soil treated with two commercial formulations of the herbicides chlorotoluron (Erturon(R)) and flufenacet plus diflufenican (Herold(R)) under field conditions. Soils were amended with spent mushroom substrate (SMS) or green compost (GC). Soil microbial dehydrogenase activity (DHA), biomass and structure determined by the phospholipid fatty acid (PLFA) profiles were recorded at 0, 45, 145, 229 and 339 days after herbicide treatment.

The soil DHA values steadily decreased over time in the unamended soil treated with the herbicides, while microbial activity was constant in the amended soils. The amended soils recorded higher values of concentrations of PLFAs. Total soil microbial biomass decreased over time regardless of the organic amendment or the herbicide. Herbicide application sharply decreased the microbial population, with a significant modification of the microbial structure in the unamended soil. In contrast, no significant differences in microbial biomass and structure were detected in S + SMS and S + GC, untreated or treated with herbicides. The application of SMS and GC led to a significant shift in the soil microbial community regardless of the herbicides. The use of SMS and GC as organic amendments had a certain buffer effect on soil DHA and microbial biomass and structure after herbicide application due to the higher adsorption capacity of herbicides by the amended soils.

Accès au document

Microbial responses to selected pharmaceuticals in agricultural soils: Microcosm study on the roles of soil, treatment and time

Authors: Frkova Z, Vystavna Y, Koubova A

Source: SOIL BIOLOGY & BIOCHEMISTRY 149, 2020, DOI: 10.1016/j.soilbio.2020.107924

Abstract: Evaluating microbial responses to pharmaceuticals in agricultural soils is essential to improve our fundamental understanding of the fate of micropollutants and their potential implications for the environment and human health. In this study, we focused on the immediate (1 d), short- (13 d) and long-term effects (61 d) of pharmaceutical amendment on microbial communities in seven soils differing in physical chemical properties. Basal respiration was used to indicate microbial activity, while phospholipid fatty acids were used to determine microbial biomass and community structure. We identified four microbial responses to pharmaceutical amendment: stimulation, inhibition, stress and dormancy, which were highly significant in the short-term. The largest stimulatory effect accompanied by shifts in the microbial community structure towards fungi and G- bacteria was detected for sulfamethoxazole. The inhibitory effect was mainly observed for citalopram, irbesartan and pharmaceutical mixture in Cambisol Dystric with minor alterations in microbial community structure compare to a non-amended control. The stress effect was detected for all pharmaceuticals in Arenosol and Cambisol Haplic. While the dormancy effect was mainly observed in Chernozem Siltic for most of the pharmaceuticals. Microbial responses were highly dependent on the soil type, pharmaceutical compound and time, highlighting the importance to consider these parameters including a resilience of soil microbial communities to micropollutants within a long-term agricultural soil management.

Accès au document

Impact assessment of heavy metals pollution in the air on bacterial microflora of elm trees

Authors: Sabourmoghaddam N, Shakery M

Source: CARPATHIAN JOURNAL OF EARTH AND ENVIRONMENTAL SCIENCES 15(1):87-92, 2020, DOI: 10.26471/cjees/2020/015/111

Abstract: Heavy metals are one of the most important environmental pollutants in all over the world. Heavy metals not only are seen in the soil and water but also can be found in the air. In recent years, the concentration of these metals has been increased in the atmosphere of many cities due to human activities. Examining the qualitative and quantitative changes of the endophyte microorganisms is one of the best markers to investigate the long-term impacts of these pollutants. This research was conducted in

order to identify the effect of cadmium, lead and mercury on the population of the endophyte bacteria inside the elm trees in Tabriz. The plant samples including leaf and stem were collected during two years (2015-2016) in two different regions of the city randomly and their endophyte bacteria were isolated. One of the selected sampling site was the central region of the city with the highest pollution and the other one was marginal with less pollution in Tabriz. The experiments showed that there was a significant difference between the bacterial micro flora in these two regions. While, in the elm trees of the marginal region with less pollution the dominated bacteria were Gram negative bacteria, mostly from Pseudomonas genus, though in the polluted area, Gram positive bacteria, particularly Actinomyces and Bacillus were dominated.

Accès au document

Metal-induced bacterial interactions promote diversity in river-sediment microbiomes

Authors: Cyriaque V, Geron A, Billon G and more ...

Source: FEMS MICROBIOLOGY ECOLOGY 96, 6, 2020, DOI: 10.1093/femsec/fiaa076

Abstract: Anthropogenic metal contamination results in long-term environmental selective pressure with unclear impacts on bacterial communities, which comprise key players in ecosystem functioning. Since metal contamination poses serious toxicity and bioaccumulation issues, assessing their impact on environmental microbiomes is important to respond to current environmental and health issues. Despite elevated metal concentrations, the river sedimentary microbiome near the MetalEurop foundry (France) shows unexpected higher diversity compared with the upstream control site. In this work, a follow-up of the microbial community assembly during a metal contamination event was performed in microcosms with periodic renewal of the supernatant river water. Sediments of the control site were gradually exposed to a mixture of metals (Cd, Cu, Pb and Zn) in order to reach similar concentrations to MetalEurop sediments. Illumina sequencing of 16S rRNA gene amplicons was performed. Metal-resistant genes, czcA and pbrA, as well as IncP plasmid content, were assessed by quantitative PCR. The outcomes of this study support previous in situ observations showing that metals act as community assembly managers, increasing diversity. This work revealed progressive adaptation of the sediment microbiome through the selection of different metal-resistant mechanisms and cross-species interactions involving public good-providing bacteria co-occurring with the rest of the community.

Accès au document

Responses of soil and earthworm gut bacterial communities to heavy metal contamination

Authors: Liu P, Yang Y, Li M.

Source: ENVIRONMENTAL POLLUTION 265, B, 2020, DOI: 10.1016/j.envpol.2020.114921

Abstract: The large accumulation of heavy metals in the soil surrounding steel factories has become a severe environmental problem. However, few studies have focused on how the earthworm gut microbiota responds to heavy metals in the soil. This study used research sites at a steel factory in Nanjing, China, to investigate how the soil bacterial community and earthworm gut microbiota respond differently to heavy metal contamination using Illumina high-throughput sequencing targeting 16S rRNA genes. The bacterial community of earthworm guts showed a distinct structure compared with that of the soil, featuring a higher relative abundance of Proteobacteria (45.7%) and Bacteroidetes (18.8%). The bacterial community in the earthworm gut appeared more susceptible to heavy metal contamination compared with the soil community. For example, we identified 38

OTUs (Operational taxonomic units) significantly influenced by contamination among 186 abundant OTUs in the soil, whereas 63 out of the 127 abundant OTUs in the earthworm gut were altered significantly under contamination. This susceptibility may be partly explained by the lower alpha diversity and distinct microbial interactions in the gut. In addition, the accumulation of heavy metals also stimulated the growth of potential plant growth promoting bacteria (PGPB) in the earthworm gut, especially those related to indole-3-acetic acid (IAA) and 1-aminocyclopropane-1-carboxylic acid deaminase (ACCD) production, which may potentially benefit the phyto-remediation of heavy metals. These results contribute to our understanding of the soil biota and its interactions under heavy metal contamination and may provide further insights into the phytoremediation of metal-contaminated soil.

Accès au document

Ecological Effects of Heavy Metal Pollution on Soil Microbial Community Structure and Diversity on Both Sides of a River around a Mining Area

Authors: Zhao XQ, Huang J, Zhu XY and more ...

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH 17, 16, 2020, DOI: 10.3390/ijerph17165680

Abstract: The objectives of this study were to understand the characteristics of heavy metal pollution caused by mining activities on the two sides of the Shun'an river and the response of soil microorganisms to the habitats by different contamination levels and vegetation. This paper selected soil samples from the banks of the Shun'an River near the Shizishan mining area, which is at the left of the river, in Tongling, Anhui Province, China. Using Illumina MiSeq 2500 technology, we analyzed the relationship between environmental factors and microbial communities. As the distance from the mining area increased, the heavy metal comprehensive pollution and potential risk value decreased. Additionally, the pollution severity and risk value of the left bank, where the mining area lies, were generally higher than those of the right bank. Because the symmetric sampling points on both banks of the river had similar planting types, their environmental factors and microbial community structure were similar and clustered. However, under different vegetation, the paddy soils tended to have a higher nutrient content and community richness and diversity than the vegetable fields or the abandoned land. It was found that soil microbial communities in this area were mostly affected by pH and Nemerow pollution index (P-N). The pH significantly affected the abundance and structure of most microorganisms. In addition, Proteobacteria, Acidobacteria, and Bacteroidetes had significant tolerance to Zn, Pb, and Cd. By exploring the potential use of these tolerant microorganisms, we seek to provide strains and the theoretical basis for the bioremediation of areas contaminated by heavy metal.

Accès au document

The interaction of dissolved organic nitrogen removal and microbial abundance in iron-filings based green environmental media for stormwater treatment

Authors: Valencia A, Ordonez D, Wen D and more ...

Source: ENVIRONMENTAL RESEARCH 188, DOI: 10.1016/j.envres.2020.109815

Abstract: Nonpoint sources pollution from agricultural crop fields and urbanized regions oftentimes have elevated concentrations of dissolved organic nitrogen (DON) in stormwater runoff, which are difficult for microbial communities to decompose. The impact of elevated DON can be circumvented through the

use of green sorption media, such as Biosorption Activated Media (BAM) and Iron-Filing Green Environmental Media (IFGEM), which, as integral parts of microbial ecology, can contribute to the decomposition of DON. To compare the fate, transport, and transformation of DON in green sorption media relative to natural soil (control), a series of fixed-bed columns, which contain natural soil, BAM, and two types of IFGEM, respectively, were constructed to compare nutrient removal efficiency under three distinct stormwater influent conditions containing nitrogen and phosphorus. The interactions among six microbial species, including ammonia-oxidizing bacteria, nitrite-oxidizing bacteria, complete ammonia oxidation (comammox) bacteria, anaerobic ammonium oxidation (anammox) bacteria, dissimilatory nitrate reduction to ammonium bacteria, and iron-reducing bacteria, were further analyzed from microbial ecology perspectives to determine the DON impact on nutrient removal in BAM and IFGEM. Natural soil was only able to achieve adequate DON transformation at the influent condition of lower nutrient concentration. However, the two types of IFGEM showed satisfactory nutrient removals and achieved greater transformation of DON relative to BAM when treating stormwater in all three influent conditions.

Accès au document

The response of soil and phyllosphere microbial communities to repeated application of the fungicide iprodione: accelerated biodegradation or toxicity?

Authors: Katsoula A, Vasileiadis S, Sapountzi M, Karpouzas DG

Source: FEMS MICROBIOLOGY ECOLOGY 96, 6, 2020, DOI: 10.1093/femsec/fiaa056

Abstract: Pesticides interact with microorganisms in various ways with the outcome being negative or positive for the soil microbiota. Pesticides' effects on soil microorganisms have been studied extensively in soil but not in other pesticides-exposed microbial habitats like the phyllosphere. We tested the hypothesis that soil and phyllosphere support distinct microbial communities, but exhibit a similar response (accelerated biodegradation or toxicity) to repeated exposure to the fungicide iprodione. Pepper plants received four repeated foliage or soil applications of iprodione, which accelerated its degradation in soil (DT50_1st = 1.23 and DT50_4th = 0.48 days) and on plant leaves (DT50_1st > 365 and DT50_4th = 5.95 days). The composition of the epiphytic and soil bacterial and fungal communities, determined by amplicon sequencing, was significantly altered by iprodione. The archaeal epiphytic and soil communities responded differently; the former showed no response to iprodione. Three iprodione-degrading Paenarthrobacter strains were isolated from soil and phyllosphere. They hydrolyzed iprodione to 3,5-dichloraniline via the formation of 3,5-dichlorophenyl-carboxiamide and 3,5-dichlorophenylurea-acetate, a pathway shared by other soil-derived arthrobacters implying a phylogenetic specialization in iprodione biotransformation. Our results suggest that iprodione-repeated application could affect soil and epiphytic microbial communities with implications for the homeostasis of the plant-soil system and agricultural production.

Accès au document

Effect of dibutyl phthalate on microbial function diversity and enzyme activity in wheat rhizosphere and non-rhizosphere soils

Authors: Gao ML, Dong YM, Zhang Z, Song ZG

Source: ENVIRONMENTAL POLLUTION 265, B, 2020, DOI: 10.1016/j.envpol.2020.114800

Abstract: The pollution of farm soils by the plasticizer dibutyl phthalate (DBP) should be

researched owing to the extensive use of plastic film. We investigated the influence of DBP on microbial communities and enzyme activities in rhizosphere and non-rhizosphere soil during the different growth stages of wheat and determined the response through simulations. The results indicated that protease, polyphenol oxidase, and beta-glucosidase activity in soil decreased with increasing DBP dosage, while dehydrogenase, urease, and acid phosphatase activities increased. Moreover, the effects of DBP on soil enzyme activity gradually weakened with DBP degradation. Dibutyl phthalate has a certain inhibitory effect on the activity, diversity, and heterogeneity of microorganisms in soil. In addition, DBP can increase the utilization of amines and carboxylic acids and decrease the utilization of carbohydrates and amino acids by soil microorganisms. According to the Gaussian and molecular docking analysis, we considered that monobutyl phthalate and DBP could affect the utilization of amino acids by Proteobacteria. The enzyme activity, microbial activity, and heterogeneity of rhizosphere soil were higher than those of non-rhizosphere soil. Microbial carbon source utilization in rhizosphere and non-rhizosphere soils depends on wheat growth, soil type, and DBP dosage. Owing to the widespread presence of DBP in agriculture, negative effects of phthalic acid esters should be considered in relation to soil quality and food safety in future.

Accès au document

Levels of heavy metal concentrations and their effect on net nitrification rates and nitrifying archaea/bacteria in paddy soils of Bangladesh

Authors: Nahar K, Ali MM, Khanom A and more ...

Source: APPLIED SOIL ECOLOGY 156, 2020, DOI: 10.1016/j.apsoil.2020.103697

Abstract: Heavy metal concentrations (HMCs) may alter nitrification activity in soil. However, the levels of HMCs in paddy soil and the relations among HMCs, net nitrification rates, and nitrifying archaea/bacteria in paddy soils of Bangladesh remain unknown. The goal of this study was to determine the effect of HMCs on net nitrification rates and ammonia-oxidizing archaea (AOA) and bacteria (AOB), and nitrite-oxidizing bacteria (NOB) in paddy soils. HMCs and net nitrification rates were assayed through an atomic absorption spectrophotometer (AAS) and mass spectrophotometer (MS), respectively, and the abundance of AOA, AOB, and NOB was quantified by q-PCR. According to the contamination factor (C-f), concentrations of Cd were found to be a very severe pollutant in all soils. On the other hand, concentrations of Fe and Cu were found to be moderately contaminated and slightly polluted in paddy soils as compared to control soils. The net nitrification rates (8.67 to 12.75 mg kg(-1)h(-1)) and the abundance of AOA, AOB, and NOB were significantly higher (p < 0.05) in the paddy soils than in the control soils. AOB, AOA, and NOB were correlated positively with net nitrification rates. The relations between net nitrification rates and HMCs (Fe, Pb, and Zn) were correlated significantly and positively (p < 0.05), but the concentration of Cu was correlated negatively with net nitrification rates. To the best of our knowledge, this is the first report that has investigated the effects of HMCs on nitrifying bacteria in paddy soils, which will change the scenario of nitrification in Bangladesh greatly.

Accès au document

Soil bacterial community response to long-term land use conversion in Yellow River Delta

Authors: He H, Miao YJ, Gan YD and more ...

Source: APPLIED SOIL ECOLOGY 156, 2020, DOI: 10.1016/j.apsoil.2020.103709

https://doi.org/10.15454/6MQT-0H51

Abstract: Yellow River Delta undergoes intensive conversion from natural wetland to agricultural fields and artificial woodland. In this study, we analysed how the conversion affects bacterial community diversity and composition by Illumina Miseq sequencing combined with functional prediction. Compared to natural wetland, arable land and woodland were featured with higher soil organic matter, total nitrogen and bacterial diversity, but lower electrical conductivity. The bacteria Gemmatimonadetes related to soil organic matter and total nitrogen, was enriched in arable land, while salt-resistant bacteria (e.g. phylum Chloroflexi and its class Ardenticatenia) were abundant in natural wetland. Moreover, the relative abundances of the nitrifying bacteria Nitrospira and Nitrosospira were significantly higher in arable land and woodland than in natural wetland, suggesting that land use changes significantly affect the bacterial processes involved in nitrogen cycling. Redundancy analysis (RDA) showed that the differences in bacterial community were attributed to soil nutrient-related properties (i.e., total nitrogen and soil organic matter), soil salinity (i.e., electrical conductivity), and heavy metals (i.e. Cu and Cr). PICRUSt results revealed that land use conversion from natural wetland to arable land increased soil functions, e.g., biosynthesis process and oxidative phosphorylation. The data help us elucidate how land use changes affect terrestrial ecosystem function, and advise local farmers to apply the suitable land-use strategies and keep agricultural sustainable development.

Accès au document

Elevated CO2 Affects the Soil Organic Carbon Fractions and Their Relation to Soil Microbial Properties in the Rhizosphere of *Robinia pseudoacacia* L. Seedlings in Cd-Contaminated Soils

Auithors: Huang SP, Huang XS, Fang B

Source: JOURNAL OF SOIL SCIENCE AND PLANT NUTRITION, 2020, DOI: 10.1007/s42729-020-00205-1

Abstract: As the global climates change, elevated CO2and soil contamination by heavy metal co-occur in natural ecosystems, which are anticipated to affect soil organic carbon fractions (SOC) and their relation to soil microbial activities, but this issue has not been extensively examined. We investigated the response of SOC and their relation with soil microorganisms and enzyme activities in rhizosphere soils ofRobinia pseudoacaciaL. seedlings to elevated CO2 plus cadmium (Cd) contamination. We found that elevated CO2 significantly ($p < 0.05$) stimulated total organic carbon (TOC) (8.6%), dissolved organic carbon (DOC) (32.6%), microbial biomass carbon (MBC) (13.5%), bacteria (11.6%), fungi (20.9%), actinomycetes (15.3%), urease (20.1%), dehydrogenase (15.8%), invertase (11.1%), and beta-glucosidase (11.9%), and DOC, MBC, bacteria, actinomycetes, urease, and invertase presented smaller growth trend in the range of 500-700 μmol mol(-1)CO2 than in the range of 385-500 μmol mol(-1)CO2. Cd decreased DOC (30.1%), MBC (24.9%), bacteria (21.5%), actinomycetes (15.9%), and enzyme activities. Elevated CO2 offsets the negative effect of Cd on SOC and microbial activities (except for TOC and L-asparaginase). Procrustes rotation test was used to determine the drivers (elevated CO2, Cd, and CO2 + Cd) of the relation between SOC and microbial activities, revealing the correlations between SOC, soil microorganisms, and enzyme activities were higher under elevated CO2 than under elevated CO2 + Cd. Our results suggest elevated CO2 could stimulate soil fertility and microecological cycle in the rhizosphere microenvironment exposed to heavy metal by affecting the relationship between SOC and soil microbial properties.

Accès au document

A novel extracellular enzyme stoichiometry method to

evaluate soil heavy metal contamination: Evidence derived from microbial metabolic limitation

Authors: Wang X, Cui YX, Zhang XC and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 738, 2020, DOI: 10.1016/j.scitotenv.2020.139709

Abstract: Heavy metal contaminates have become a significant threat to soil ecosystems due to their chronicity and universality in soil. Soil microbial metabolism plays a vital role in biogeochemical cycles and soil functions. However, the response of microbial metabolism to heavy metal contamination in soil remains elusive despite potentially offering important insight into the health and ecological consequences of soil ecosystems under such contamination. This study used extracellular enzyme stoichiometry models to identify the response of microbial metabolism to various heavy metal contaminants, while also revealing potential implications of heavy metal contaminates in soil ecosystems. Results showed that microbial metabolism was restricted by soil carbon (C) and phosphorus (P) within a heavy metal polluted area in Northwest China. Heavy metal stress significantly increased microbial C limitation while decreasing microbial P limitation. However, microbial C and P limitations both responded consistently to different heavy metals (i.e., Cd, Pb, Zn, and Cu). Heavy metals had the greatest effect on microbial C limitation (i.e., 0.720 of the total effects) compared to other soil properties, and soil with the lowest heavy metal concentration exhibited the lowest microbial C limitation, and vice versa. These results indicated that microbial metabolic limitation can robustly and sensitively reflect the degree of heavy metals pollution in soil. Additionally, increased microbial C limitation caused by heavy metal contaminants could potentially escalate C release by promoting soil C decomposition as well as increasing investments in enzyme production and the maintenance of metabolic processes. Consequently, potential C loss induced by heavy metal pollution on soil eco-systems may be extensive and significant. Generally, our results suggest the usefulness of extracellular enzyme stoichiometry as a new method from which to evaluate heavy metal soil pollution, while microbial metabolic limitation could potentially be a promising indicator.

Accès au document

Spatiotemporal vanadium distribution in soils with microbial community dynamics at vanadium smelting site

Authors: Zhang H, Zhang BG, Wang S and more...

Source: ENVIRONMENTAL POLLUTION 265, PT A, A, 2020, DOI: 10.1016/j.envpol.2020.114782

Abstract: Whereas the adverse effects of vanadium released from smelting activities on soil microbial ecology have been widely recognized, little is known about spatiotemporal vanadium distribution and microbial community dynamics in typical contaminated sites. This study describes vanadium contents associated with health risk and microbial responses in both topsoil and subsoil during four consecutive seasons around an ongoing-production smelter in Panzhihua, China. Higher levels of vanadium concentration exceeding soil background value in China (82 mg/kg) were found close to the smelter. Vanadium concentrations decreased generally with the increase in distance to the smelter and depth below surface, as soil vanadium pollution is induced mainly by atmospheric deposition of vanadium bearing dust during smelting. Residual fraction was the predominated vanadium form in soils, with pronounced increase in bioavailable vanadium during rainfall period due to frequent drought-rewetting process. Topsoil close to the smelter exhibited significant contamination, inducing high probability of adverse health effects. Spatiotemporal vanadium distribution creates

filtering effects on soil microorganisms, promoting metal tolerant genera in topsoil (e.g. Microvirga) and subsoil (e.g. Bacillus, Geobacter), which is the key in maintaining the community structure by promoting cooperative relation with other taxa. Our results reveal spatiotemporal vanadium distribution in soils at site scale with potential health risk and microbial responses, which is helpful in identifying severe contamination and implementing bioremediation.

Accès au document

Analysis of Fungal Composition in Mine-Contaminated Soils in Hechi City

Authors: Ye FC, Gong DF, Pang CP and more ...

Source: CURRENT MICROBIOLOGY, 2020, DOI: 10.1007/s00284-020-02044-w

Abstract: Fungi play an important role in bioremediation of contaminated soil. However, the diversity of fungal populations in four mine-contaminated soils located in Hechi City has remained unexplored. In this study, high-throughput sequencing of ITS was performed to investigate the diversity and abundance of fungal communities in four mine-contaminated soils in Hechi city. Phylogenetic taxonomy showed that the fungal communities included five phyla.AscomycotaandBasidiomycotawere the most abundant phyla in four samples. The most abundant fungi included Agaricomycetes, Nectriaceae, Eurotiomycetes, Mortierellaceae, Incertae sedis, Trichocomaceae, Sordariomycetes, and Fusarium. Various fungi with the potential of bioremediation and industrial application were discussed. The results of fungal composition will provide a clue for isolation of new fungi with the potential of bioremediation and industrial application. Furthermore, this study will lay a good foundation for modifying the indigenous fungi by genetic engineering in the future.

Accès au document

Microbial remediation of micro-nano plastics: Current knowledge and future trends

Authors: Tiwari N., Santhiya D., Sharma J.G., 2020

Sources: Environmental Pollution 265, 2020, DOI: 10.1016/j.envpol.2020.115044

Abstract: An alarming rise of micro-nano plastics (MNPs) in environment is currently causing the biggest threat to biotic and abiotic components around the globe. These pollutants, apart from being formed through fragmentation of larger plastic pieces and are also manufactured for commercial usage. MNPs enter agro-ecosystem, wildlife, and human body through the food chain, ...

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / MICROBIOLOGIE ET CONTAMINANTS / Antibiotiques et antibiorésistances

Modeling transport of antibiotic resistant bacteria

in aquatic environment using stochastic differential equations

Authors: Gothwal R, Thatikonda S

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-72106-3

Abstract: Contaminated sites are recognized as the "hotspot" for the development and spread of antibiotic resistance in environmental bacteria. It is very challenging to understand mechanism of development of antibiotic resistance in polluted environment in the presence of different anthropogenic pollutants. Uncertainties in the environmental processes adds complexity to the development of resistance. This study attempts to develop mathematical model by using stochastic partial differential equations for the transport of fluoroquinolone and its resistant bacteria in riverine environment. Poisson's process is assumed for the diffusion approximation in the stochastic partial differential equations (SPDE). Sensitive analysis is performed to evaluate the parameters and variables for their influence over the model outcome. Based on their sensitivity, the model parameters and variables are chosen and classified into environmental, demographic, and anthropogenic categories to investigate the sources of stochasticity. Stochastic partial differential equations are formulated for the state variables in the model. This SPDE model is then applied to the 100 km stretch of river Musi (South India) and simulations are carried out to assess the impact of stochasticity in model variables on the resistant bacteria population in sediments. By employing the stochasticity in model variables and parameters we came to know that environmental and anthropogenic variations are not able to affect the resistance dynamics at all. Demographic variations are able to affect the distribution of resistant bacteria population uniformly with standard deviation between 0.087 and 0.084, however, is not significant to have any biological relevance to it. ... This study is an ongoing effort to improve the model for the transport of antibiotics and transport of antibiotic resistant bacteria in polluted river. There is a wide gap between the knowledge of stochastic resistant bacterial growth dynamics and the knowledge of transport of antibiotic resistance in polluted aquatic environment, this study is one step towards filling up that gap.

Accès au document

Detection and Profiling of Antibiotic Resistance among Culturable Bacterial Isolates in Vended Food and Soil Samples

Authors: Muriuki SW, Neondo JO, Budambula NLM

Source: INTERNATIONAL JOURNAL OF MICROBIOLOGY, 2020, DOI: 10.1155/2020/6572693

Abstract: The emergence and persistence of antibiotic resistance remain formidable health challenges. This study aimed at detecting and profiling antibiotic resistance of bacterial contaminants in vended food and the environment. Seventy antibiotic-resistant bacterial isolates were isolated from fried fish, African sausages, roasted meat, smokies, samosa, chips (potato fries), vegetable salads, and soil samples collected from Embu Town and Kangaru Market in Embu County, Kenya. The antibiotic susceptibility test, morphological and biochemical characterization, antibiosis assay, polymerase chain reaction-based detection of antibiotic resistance genes, and sequencing of the 16S rRNA gene were done. Analysis of variance on all measured data was done, and Tukey's honest test was used to compare and separate mean diameters of zones inhibition. Resistance of bacterial isolates to antibiotics was chloramphenicol (90%), cefotaxime (84.29%), nalidixic acid (81.43%), tetracycline (77.14%), amoxicillin (72.86%), gentamycin (48.57%), streptomycin (32.86%), and trimethoprim + sulphamethoxazole (30%). Isolate KMP337, Salmonella spp., exhibited highly significant

antibiosis against S. aureus recording a mean inhibition diameter and standard error (SE) of 16.33 +/- 0.88 mm, respectively, at P = 0.001. The 70 bacterial isolates belonged to Bacillus, Paraclostridium, Lysinibacillus, Virgibacillus, and Serratia genera. The study isolated Bacillus wiedmannii (KC75) which is a risk group 2 as well as Serratia marcescens (KMP95) and Bacillus anthracis (KS606) which are risk group 3 organisms. +e presence of antibiotic resistance genes Tet A, (TEM)-T-Bla, StrB, Dfr A, Amp, and FloR genes was confirmed by a polymerase chain reaction. Samples from Kangaru Market recorded a higher (88.57%) proportion of resistant isolates as compared to isolates from Embu Town (11.43%). The study confirmed the presence of antibiotic-resistant bacteria in vended fast food and the soil in Embu Town and Kangaru Market. This study calls for continuous monitoring of bacterial status and hygienic handling of vended food.

Accès au document

High levels of antibiotic resistance genes and opportunistic pathogenic bacteria indicators in urban wild bird feces

Authors: Zhao HR, Sun RN, Yu PF, Alvarez PJ

Source: ENVIRONMENTAL POLLUTION 266, 2, 2020, DOI: 10.1016/j.envpol.2020.115200

Abstract: This study analyzed fresh feces from three common bird species that live in urban environments and interact with human communities. Antibiotic resistance genes (ARGs) encoding resistance to three major classes of antibiotics (i.e., tetracyclines, (beta-lactams, and sulfonamides) and the mobile genetic element integrase gene (intI1) were abundant (up to 10(9), 10(8), 10(9), and 10(10) copies/g dry feces for tetW, bla(TEM), sul1, and intI1, respectively), with relative concentrations surprisingly comparable to that in poultry and livestock that are occasionally fed antibiotics. Biomarkers for opportunistic pathogens were also abundant (up to 10(7) copies/g dry feces) and the dominant isolates (i.e., Enterococcus spp. and Pseudomonas aeruginosa) harbored both ARGs and virulence genes. ARGs in bird feces followed first-order attenuation with half-lives ranging from 1.3 to 11.1 days in impacted soil. Although residual antibiotics were detected in the feces, no significant correlation was observed between fecal antibiotic concentrations and ARG relative abundance. Thus, other unaccounted factors likely contributed selective pressure for ARG maintenance. These findings highlight the contribution of wild urban bird feces to the maintenance and dissemination of ARGs, and the associated health risks.

Accès au document

Bacteriophages as antibiotic resistance genes carriers in agro-food systems

Authors: Jebri S, Rahmani F, Hmaied F

Source: JOURNAL OF APPLIED MICROBIOLOGY, 2020, DOI: 10.1111/jam.14851

Abstract: Antibiotic resistance genes (ARGs) are a global health concern. Antibiotic resistance occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process of antibiotic resistance emergency, which has been aggravated by exposure to molecules of antibiotics present in clinical and agricultural settings and the engagement of many countries in water reuse especially in Middle East and North Africa region. Bacteriophages have the potential to be significant actors in ARGs transmission through the transduction process. These viruses have been detected along with ARGs in non impacted habitats and in anthropogenic impacted environments like wastewater, reclaimed water and manure amended soil as well as minimally processed food and ready to eat vegetables. The ubiquity of bacteriophages and their persistence in the environment raises concern about their involvement in ARGs transmission among

different biomes and the generation of pathogenic-resistant bacteria that pose a great threat to human health. The aim of this review is to give an overview of the potential role of bacteriophages in the dissemination and the transfer of ARGs to pathogens in food production and processing and the consequent contribution to antibiotic resistance transmission through faecal oral route carrying ARGs to our dishes.

Accès au document

Isolation of antibiotic-resistant bacteria in biogas digestate and their susceptibility to antibiotics

Authors: Sun H, Bjerketorp J, Levenfors J, Schnurer A

Source: ENVIRONMENTAL POLLUTION 266, 1, 2020, DOI: 10.1016/j.envpol.2020.115265

Abstract: Antibiotics are widely used to prevent and treat diseases and promote animal growth in the livestock industry, and therefore antibiotic residues can end up in biogas digestate from processes treating animal manure (AM) and food waste (FW). These digestates represent a potential source of spread of antimicrobial resistance (AMR) when used as fertilisers. This study evaluated AMR risks associated with biogas digestates from two processes, using AM and FW as substrate, by isolation and identification of antibiotic-resistant bacteria (ARB) and testing their susceptibility to different antibiotics. ARB from the digestates were isolated by selective plating. The antibiotic susceptibility profile of isolates was determined using ampicillin, ceftazidime, meropenem, vancomycin, ciprofloxacin, rifampicin, chloramphenicol, clindamycin, erythromycin, tetracycline, gentamicin or sulfamethoxazole/trimethoprim, representing different antibiotic classes with differing mechanisms of action. In total, 30 different bacterial species belonging to seven genera were isolated and classified. Bacillus and closely related genera, including Paenibacillus, Lysinibacillus and Brevibacillus, were the dominant ARB in both digestates. Most of the ARB strains isolated were non-pathogenic and some were even known to be beneficial to plant growth. However, some were potentially pathogenic, such as an isolate identified as Bacillus cereus. Many of the isolated species showed multi resistance and the AM digestate and FW digestate both contain bacterial species resistant to all antibiotics tested here, except gentamicin. A higher level of resistance was displayed by the FW isolates, which may indicate higher antibiotic pressure in FW compared with AM digestate. Overall, the results indicate a risk of AMR spread when these digestates are used as fertiliser. However, most of the ARB identified are species commonly found in soil, where AMR in many cases is abundant already, so the contribution of digestate-based fertiliser to the spread of AMR may still be very limited.

Accès au document

Antimicrobial resistance: more than 70 years of war between humans and bacteria

Authors: Nadeem SF, Gohar UF, Tahir SF and more ...

Source: CRITICAL REVIEWS IN MICROBIOLOGY, 2020, DOI: 10.1080/1040841X.2020.1813687

Abstract: Development of antibiotic resistance in bacteria is one of the major issues in the present world and one of the greatest threats faced by mankind. Resistance is spread through both vertical gene transfer (parent to offspring) as well as by horizontal gene transfer like transformation, transduction and conjugation. The main mechanisms of resistance are limiting uptake of a drug, modification of a drug target, inactivation of a drug, and active efflux of a drug. The highest quantities of antibiotic concentrations are usually found in areas with strong anthropogenic pressures, for example medical source (e.g., hospitals) effluents, pharmaceutical industries, wastewater influents, soils treated with manure, animal husbandry and

aquaculture (where antibiotics are generally used as in-feed preparations). Hence, the strong selective pressure applied by antimicrobial use has forced microorganisms to evolve for survival. The guts of animals and humans, wastewater treatment plants, hospital and community effluents, animal husbandry and aquaculture runoffs have been designated as "hotspots for AMR genes" because the high density of bacteria, phages, and plasmids in these settings allows significant genetic exchange and recombination. Evidence from the literature suggests that the knowledge of antibiotic resistance in the population is still scarce. Tackling antimicrobial resistance requires a wide range of strategies, for example, more research in antibiotic production, the need of educating patients and the general public, as well as developing alternatives to antibiotics (briefly discussed in the conclusions of this article).

Accès au document

Seasonal variations in export of antibiotic resistance genes and bacteria in runoff from an agricultural watershed in Iowa

Authors: Neher TP, Ma LY, Moorman TB and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 738, 2020, DOI: 10.1016/j.scitotenv.2020.140224

Abstract: Seasonal variations of antimicrobial resistance (AMR) indicators in runoff water can help improve our understanding of AMR sources and transport within an agricultural watershed. This study aimed to monitor multiple areas throughout the Black Hawk Lake (BHL) watershed (5324 ha) in central Iowa during 2017 and 2018 that consists of both swine and cattle feeding operations as well as known areas with manure application. The measured indicators included plate counts for fecal indicator bacteria (FIB) *E. coli*, Enterococcus, antibiotic resistant fecal indicator bacteria (ARBs) tylosin resistant Enterococcus, tetracycline resistant Enterococcus, and antibiotic resistance genes (ARGs): ermB, ermF (macrolide), tetA, tetM, tetO, tetW (tetracycline), sul1, sul2 (sulfonamide), aadA2 (aminoglycoside), vgaA, and vgaB (pleuromutilin). Both the plate count and the ARG analyses showed seasonal trends. Plate counts were significantly greater during the growing season, while the ARGs were greater in the pre-planting and post-harvest seasons (Wilcoxon Rank-SumTest p < 0.05). The ermB gene concentration was significantly correlated (p < 0.05) with E. coli and Enterococcus concentrations in 2017, suggesting a potential use of this ARG as an indicator of environmental AMR and human health risk. Flow rate was not a significant contributor to annual variations in bacteria and AMR indicators. Based on observed seasonal patterns, we concluded that manure application was the likely contributor to elevated ARG indicators observed in the BHL watershed, while the driver of elevated ARB indictors in the growing season can only be speculated. Understanding AMR export patterns in agricultural watersheds provides public health officials knowledge of seasonal periods of higher AMR load to recreational waters.

Accès au document

Linkage of antibiotic resistance genes, associated bacteria communities and metabolites in the wheat rhizosphere from chlorpyrifos-contaminated soil

Authors: Guo AY, Pan CR, Ma JY, Bao YY

Source: SCIENCE OF THE TOTAL ENVIRONMENT 741, 2020, DOI: 10.1016/j.scitotenv.2020.140457

Abstract: Rhizosphere is a crucial site for the proliferation of antibiotic resistance genes (ARGs) in agricultural soil. Pesticide contamination is ubiquitous in soil, such as

chlorpyrifos as one of the most commonly used pesticides. However, limited knowledge is reported about ARGs profiles changes and the driving mechanism of ARGs prevalence in rhizosphere soil after adding pesticide. In this study, irrespective of chlorpyrifos presence, the abundances of ARGs (tetM, tetO, tetQ, tetW, tetX, sul1 and sul2) and intI1 in rhizosphere soil of wheat were obviously higher than those in bulk soil. 20.0 mg center dot kg(-1) chlorpyrifos significantly increased the abundance of total ARGs and intI1 in bulk soil, respectively, at day 50 and 100, but not in rhizosphere soil. Rhizosphere influence on ARGs was far greater than chlorpyrifos. ARGs and intI1 abundances were higher at day 50 than ones at day 100. C/N ratio and NO3--N content, which were affected by rhizosphere and cultivation time, significantly explained the increased ARGs. Compared to bulk soil, rhizosphere shifted host bacteria of tetracycline resistance genes (TRGs), intI1 at genus level, and host bacteria of sul1, sul2 at phylum level. Rhizosphere simplified the linkage of ARGs, host bacteria and metabolites. Bacterial communities played important roles in the variation of ARGs and intI1, and the difference in the distribution of potential hosts between bulk and rhizosphere soil was related to metabolites abundance and composition. These results provide valuable information for understanding the linkage of ARGs, associated bacteria communities and metabolites in the wheat rhizosphere soil.

Accès au document

The formation mechanism of antibiotic-resistance genes associated with bacterial communities during biological decomposition of household garbage

Authors: Liang ZS, Zhang YN, He T and more ...

Source: JOURNAL OF HAZARDOUS MATERIALS 398, 2020, DOI: 10.1016/j.jhazmat.2020.122973

Abstract: Food wastes are significant reservoir of antibiotic-resistance genes (ARGs) and antibiotic-resistant bacteria (ARB) available for exchange with clinical pathogens. However, food wastes-related changes of antibiotic resistance in long-period decomposition have been overlooked. Here, we evaluated the comprehensive ARG profile and its association with microbial communities, explained how this might vary with household garbage decomposition. Average of 128, 150 and 91 ARGs were detected in meat, vegetable and fruit wastes, respectively, with multidrug and tetracycline as the predominant ARG types. ARG abundance significantly increased at initial stage of waste fermentation and then decreased. High abundance of Eubacterium-coprostanoligenes, Sporanaerobacter, Peptoniphilus, Peptostreptococcus might be explained for the high relative abundance of ARGs in meat, while high abundance of Advenella, Prevotella, Solobacterium was attributed to the high diversity of ARGs in vegetables. Significant correlations were observed among volatile organic compounds, mobile genetic elements and ARGs, implying that they might contribute to transfer and transport of ARGs. Network analysis revealed that aph(2')-Id-01, acrA-05, tetO-1 were potential ARG indicators, while Hathewaya, Paraclostridium and Prevotellaceae were possible hosts of ARGs. Our work might unveil underlining mechanism of the effects of food wastes decomposition on development and spread of ARGs in environment and also clues to ARG mitigation.

Accès au document

Untreated swine wastes changed antibiotic resistance and microbial community in the soils and impacted abundances of antibiotic resistance genes in the vegetables

https://doi.org/10.15454/6MQT-0H51

Authors: Gao FZ, He LY, He LX, Zou HY and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 741, 2020, DOI: 10.1016/j.scitotenv.2020.140482

Abstract: Animal waste fertilization is a traditional agricultural practice, which may have adverse effects to soil ecosystem. However, the side-effects of animal waste fertilization on vegetables are less studied. Here we selected a swine farming village for investigation with a nearby village without swine farming as comparison. In the swine farming village, the farmers use untreated swine manure and wastewater as fertilizers for vegetable cultivation. In the reference village, the farmers mainly use commercial organic fertilizers. The objective of this study is to assess the impacts of untreated swine waste fertilization on both soils and vegetables in terms of antibiotics, antibiotic resistance genes (ARGs) and bacterial microbial communities. The results indicate that untreated swine waste fertilization caused both antibiotic and ARG contaminations and changed the microbial community compositions in the soils. Varieties of tetracyclines and related resistance genes were detected especially in swine wastewater treated soils. The soil quality was impacted with the relations to bacterial abundances and microbial geochemical functions. Proteobacteria and Bacteroidetes were prevalent and positively correlated to ARGs in soils, indicating they were potential antibiotic resistant bacteria. Antibiotics and ARGs were detected in vegetables of both villages. The abundances of ARGs were relatively higher in some vegetable samples of the swine farming village than the reference village. In addition, intracellular parasites Rickettsiales with positive correlation to ARGs were prevalent in some vegetables of swine farming village, indicating potential health risks through eating contaminated vegetables. The results of this study suggest that untreated swine wastes may cause adverse effects to not only agricultural soils but also associated vegetables.

Accès au document

Oxytetracycline, copper, and zinc effects on nitrification processes and microbial activity in two soil types

Authors: Tang Q, Xia LL, Ti CP and more ...

Source: FOOD AND ENERGY SECURITY, 2020, DOI: 10.1002/fes3.248

Abstract: The distribution, fate, and effects of antibiotics and heavy metal residues in agricultural soil caused by long-term application of organic fertilizers are of increasing concern. However, the ecotoxic effects of the interaction between antibiotics and heavy metals vary with the physicochemical properties of the soil, and it is still unclear how these substances interact with soil microbial functions. A short-term microcosm experiment was conducted to investigate effects of the typical antibiotic oxytetracycline (OTC) with heavy metals (zinc [Zn] and copper [Cu]) alone or in combination on nitrification process and soil microbial activity in two different types of soil (FQ: sandy loam soil and NB: clay loamy soil). Results indicated that soil types influenced the toxic effects of antibiotics and heavy metals. Zn and Cu alone and when combined with OTC inhibited and retarded nitrification processes and reduced nitrous oxide emissions, which were mainly attributed to the inhibitory effects on ammonia-oxidizing microorganisms. Moreover, Zn and Cu alone or combined with OTC increased soil respiration, but decreased the abundances of bacteria and fungi. In contrast, OTC alone had no significant effect on soil respiration but increased the abundance of fungi in both soils. Together, our results suggest that the widespread occurrence of antibiotics and heavy metals in agriculture soils may pose significant eco-environmental risks by altering nitrification process and soil microbial activity.

Accès au document

https://doi.org/10.15454/6MQT-0H51

Effects of co-loading of polyethylene microplastics and ciprofloxacin on antibiotic degradation efficiency and microbial community structure soil

Authors: Wang J, Liu XH Dai YX and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 741, 2020, DOI: 10.1016/j.scitotenv.2020.140463

Abstract: Microplastics (MPs) have become a global environmental concern while soil plastic pollution has been largely overlooked. In view of the severe antibiotic contamination in arable soils owing to land application of sewage sludge and animal manure, the invasion of MPs along with antibiotics may pose an unpredictable threat to soil microbial communities and ecological health. In this work, polyethylene MPs and ciprofloxacin (CIP) were applied to a soil microcosm to investigate the CIP degradation behavior and their combined effects on soil microbial communities. Compared with that of the individual amendment of CIP, the co-amendment of CIP and MPs reduced the CIP degradation efficiency during the 35 d cultivation period. In addition, the high-throughput sequencing results illustrated that the combined loading of MPs and CIP in soil significantly decreased the microbial diversity compared with that of individual contamination. As for the community structure, the microbial compositions at the phylum level were consistent among all treatments, and the most dominant phyla were Proteobacteria, Actinobacteria, and Chloroflexi. At the genus level, only one genus, namely Arthrobacter, was remarkably changed in the CIP-amended soil compared with that in the blank control, but four genera were significantly altered in the MPs-CIP co-amended soil. Serratia and Achromobacter were abundant in the combined polluted soil, which might have been involved in accelerated depletion of soil total nitrogen based on redundancy analysis. These findings may contribute to the understanding of bacterial responses to the combined pollution MPs and antibiotics in soil ecosystems.

Accès au document

Antibiotic resistance gene abundance and bacterial community structure in soils altered by Ammonium and Nitrate Concentrations

Authors: Sun SL, Lu C, Liu J and more ...

Source: SOIL BIOLOGY & BIOCHEMISTRY 149, 2020, DOI: 10.1016/j.soilbio.2020.107965

Abstract: Antibiotic resistance genes (ARGs) in soils pose a risk to ecological and human health, and are considered emerging pollutants. Application of nitrogen fertilizer affects the soil bacterial community structure and could be a trigger for the development of ARGs. This study explored the effects of two forms of nitrogen (NH4+-N and NO3--N) on the abundance of six ARGs (blaTEM-1, cmlA, str, stil1, tetO, and tnpA-4) and bacterial community structure in soils using quantitative polymerase chain reaction and high-throughput sequencing. Our results show that the addition of 100-200 mg kg(-1) NH4+-N or NO3--N increased the relative abundance of ARGs but decreased 16S rRNA gene abundance. Nitrogen addition at a rate of 100 mg kg(-1) NH4+-N significantly reduced the abundance and diversity of the bacterial community, and the community structure differed in soil receiving NH4+-N and NO3--N treatments. Pearson correlation and redundancy analysis supported a correlation between the soil bacterial community and ARGs with the addition of NH4+-N or NO3--N. The increase in ARGs abundance with inorganic N may be ascribed to the changes in host bacterial communities. These findings suggest that NH4+-N and NO3--N application may trigger the development of ARGs in soil bacterial communities, and could be another risk factor in addition to the well-known effects of antibiotic exposure from animal manure on ARGs abundance in soil. We recommend that future

work on this topic be attentive to experimental designs that include appropriate controls and references to improve understanding of the ARGs profiles in the soil bacterial communities.

Accès au document

Effect of Drug-Resistant Bacteria on Agriculture, Livestock, and Environment

Authors: Sagar S, Kaistha S, Das AJ, Kumar R

Source: Book chapter: ANTIBIOTIC RESISTANT BACTERIA: A CHALLENGE TO MODERN MEDICINE. 57-67, 2020, DOI: 10.1007/978-981-13-9879-7_5

Abstract: Antibiotic-resistant bacteria are the most severe cause of concern for the public health globally. Misuse and intermittent use of antibiotic are mainly responsible for the emergence of drug resistance in bacteria in developing countries. Further, the poor agricultural practices, consistent feed of antibiotics to livestock without prescription of medical practitioners, and environmental factors are also responsible for the emergence and dissemination of drug-resistant bacteria around the world. A big portion of commercially available antibiotics has been consumed by livestock every year, and the waste product of such antibiotics consumed by animals is responsible for contamination of agricultural and nonagricultural land. In the current chapter, we have tried to figure out these three major factors which are also responsible for the emergence of antibiotic resistance in bacteria.

Accès au document

Characteristics of microbial community of soil subjected to industrial production of antibiotics

Authors: Borcinova M, Pitkina A, Maresova H, and more ...

Source: FOLIA MICROBIOLOGICA, 2020, DOI: 10.1007/s12223-020-00819-z

Abstract: Ecosystems worldwide are exposed to pollutants connected to the industrial production of pharmaceuticals. The objective of this study was to study the composition and characteristics of the soil microbial communities that had been exposed to long-term selection pressure caused by the industrial production of penicillin G. Soil samples from four sites among the penicillin G production plant were analysed using 16S rRNA profiling via Illumina MiSeq platform and were compared with the control samples from four sites outside the plant. Total metagenomic DNA from the impacted soil was also used for the preparation ofE. coliT1R-based fosmid library which was consequently qualitatively tested for the presence of penicillin G acylase (PGA)-encoding genes using the method of sequence homology. Analyses of alpha diversity revealed that the long-term antibiotic presence in the soil significantly increased the microbial diversity and richness in terms of Shannon diversity index (p= 0.002) and Chao estimates (p= 0.004). Principal component analysis showed that the two types of communities (on-site and control) could be separated at the phylum, class and genus level. The on-site soil was enriched in Betaproteobacteria, Deltaproteobacteria, Gemmatimonadetes, Acidobacteria and Planctomycetia, while a significant decrease in Actinobacteria was observed. Metagenomic fosmid library revealed high hit rates in identifying PGAs (14 different genes identified) and confirmed the biotechnological potential of soils impacted by anthropogenic activity. This study offers new insights into the changes in microbial communities of soils exposed to anthropogenic activity as well as indicates that

those soils may represent a hotspot for biotechnologically interesting targets.

Accès au document

Genetic Determinants for Metal Tolerance and Antimicrobial Resistance Detected in Bacteria Isolated from Soils of Olive Tree Farms

Authors: Glibota N, Grande MJ, Galvez A, Ortega E

Source: ANTIBIOTICS-BASEL 9, 8, 2020, DOI: 10.3390/antibiotics9080476

Abstract: Copper-derived compounds are often used in olive tree farms. In a previous study, a collection of bacterial strains isolated from olive tree farms were identified and tested for phenotypic antimicrobial resistance and heavy metal tolerance. The aim of this work was to study the genetic determinants of resistance and to evaluate the co-occurrence of metal tolerance and antibiotic resistance genes. Both metal tolerance and antibiotic resistance genes … were detected in the bacterial strains from Cu-treated soils. A high percentage of the strains positive for metal tolerance genes also carried antibiotic resistance genes … to beta-lactams and tetracycline. Significant associations were detected between genes involved in copper tolerance and genes coding for beta-lactamases or tetracycline resistance mechanisms. A significant association was also detected between zntA (coding for a Zn(II)-translocating P-type ATPase) and tetCgenes. In conclusion, bacteria from soils of Cu-treated olive farms may carry both metal tolerance and antibiotic resistance genes. The positive associations detected between metal tolerance genes and antibiotic resistance genes suggests co-selection of such genetic traits by exposure to metals.

Accès au document

Antibiotic resistance genes, bacterial communities, and functions in constructed wetland-microbial fuel cells: Responses to the co-stresses of antibiotics and zinc

Authors: Li H, Xu H, Song HL and more ...

Source: ENVIRONMENTAL POLLUTION 265, B, 2020, DOI: 10.1016/j.envpol.2020.11508

Abstract: The effects of the continuous accumulation of Zinc (Zn) on the fate of antibiotic resistance genes (ARGs) in constructed wetland-microbial fuel cells (CW-MFCs) remain unclear. In this study, the impacts of Zn addition and a circuit mode on antibiotic removal, occurrence of ARGs, the bacterial community, and bacterial functions were investigated in three groups of CW-MFCs. The results showed that continuous Zn exposure enriched the target ARGs during the initial stage, while excessive Zn accumulation decreased antibiotic removal and the abundance of ARGs. A principal component analysis demonstrated that ARGs and the bacterial community distribution characteristics were significantly impacted by the mass accumulation of antibiotics and Zn, as well as the circuit mode. A redundancy analysis, partial least squares path modeling, and Procrustes analysis revealed that the accumulation of antibiotics and Zn, the composition of the bacterial community, the circuit mode, and the abundance of Intl associated with horizontal gene transfer jointly contributed to the distributions of ARGs in the electrodes and effluent. Moreover, continuous exposure to Zn decreased the bacterial diversity and changed the composition and function of the bacterial community predicted using PICRUSt tool. The co-occurrence of ARGs, their potential hosts and bacterial functions were further revealed using a network analysis. A variation partition analysis also showed that the accumulation of target pollutants and the circuit mode had a significant impact on the bacterial community composition and functions. Therefore, the interaction among

ARGs, the bacterial community, bacterial functions, and pollutant accumulations in the CW-MFC was complex. This study provides useful implications for the application of CW-MFCs for the treatment of wastewater contaminated with antibiotics and heavy metals.

Accès au document

Detection of sul1 and sul2 genes in sulfonamide-resistant bacteria (SRB) from sewage, aquaculture sources, animal wastes and hospital wastewater in South-West Nigeria

Authors: Adekanmbi, AO., Adejoba, AT., Banjo, OA., Saki, M.

Source: GENE REPORTS 20, 2020, DOI: 10.1016/j.genrep.2020.100742

Abstract: Background: The indiscriminate use of antibiotics has placed a lot of selective pressure on bacteria from several environments. This study aimed at detecting the occurrence of sulfonamide resistance genes and antibiogram of sulfonamide-resistant bacteria (SRB) isolated from sewage, aquaculture sources, animal wastes and hospital wastewater. Methods: SRB were isolated on medium incorporated with sulfadiazine (SDZ). Antibiotic susceptibility was carried out using disc diffusion method, while detection of sul1, sul2 and sul3 genes was done by polymerase chain reaction (PCR) using specific primers. Results: A total of forty-eight SRB; aquaculture (8), animal wastes (16), hospital wastewater (10) and sewage (14) belonging to sixteen genera were obtained, with Pseudomonas spp. and Bacillus spp. predominating. In the Gram-negative SRB, there was 100% resistance to ertapenem, tetracycline (77.5%), ampicillin (75%), cefpodoxime (47.5%), streptomycin (27.5%), amoxicillin-clavulanate (22.5%), ciprofloxacin (22.5%), imipenem (15%), cefotaxime (12.5%) and ceftazidime (7.5%). In the Gram-positive SRB, there was 100% resistance to ampicillin, tetracycline and ertapenem, while 50% and 12.5% respectively were resistant to cefpodoxime and imipenem. No resistance was observed to amoxicillin-clavulanate and ciprofloxacin. 85.4% of the SRB were multidrug resistant (MDR). sul1 was detected in *Pseudomonas aeruginosa* H19A (hospital wastewater), *Bacillus* sp. AQE3 (aquaculture pond) and *Leclercia* sp. S5C (sewage) while sul2 was detected in *Pseudomonas aeruginosa* PG4A (animal waste) and *Klebsiella* sp. S6C (sewage). None of the SRB harboured sul3 and no co-occurrence of the sul genes was observed. Conclusion: This study confirms the sources sampled in this study as important media for the proliferation of MDR bacteria and resistance genes.

Accès au document

The Effects of Tetracycline Residues on the Microbial Community Structure of Tobacco Soil in Pot Experiment

Authors: Zheng JY, Zhang JiX, Gao L and more ...

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-65203-w

Abstract: To evaluate the micro-ecological effects of tetracycline residues on tobacco soil, high-throughput sequencing technology was used to study the effects of the addition of different concentrations (0, 5, 50, and 500 mg.kg(-1)) of tetracycline on the abundance, diversity, and structure of bacterial and fungal communities in the rhizosphere and non-rhizosphere soil of flue-cured tobacco in China. Results showed that the presence of tetracycline had an important but varying effect on soil bacterial and fungal community richness, diversity, and structure. Changes in the diversity indices (Chao index and Shannon index) of soil bacterial and fungal communities showed a similar pattern after the

https://doi.org/10.15454/6MQT-0H51

addition of tetracycline; however, a few differences were found in the effects of tetracycline in the rhizosphere and non-rhizosphere soil, suggesting an evident rhizosphere-specific effect. The bacterial community at the phylum level in the rhizosphere closely clustered into one group, which might be the result of tobacco root secretions and rhizodeposition. Tetracycline showed a concentration-dependent effect on the soil bacterial community structure. The soil bacterial community structures observed after treatments with higher concentrations of tetracycline (50 and 500 mg.kg(-1)) were found to be closely related. Moreover, the effects of the treatments with higher concentrations of tetracycline, on the soil bacterial community at the phylum level, were different from those with lower concentrations of tetracycline (5 mg.kg(-1)), and CK treatments. This might have resulted from the induction of increasing selective pressure with increasing antibiotic concentration. Tetracycline continued to affect the soil bacterial community throughout the experiment. Tetracycline was found to have a varying impact on the community structure of soil fungi compared to that of soil bacteria, and the addition of an intermediate concentration of tetracycline (50mg.kg(-1)) significantly increased the soil fungal diversity in the non-rhizosphere soil. The biological effects of tetracycline on the soil fungal community and the fungal-bacterial interactions, therefore, require further elucidation, warranting further research.

Accès au document

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MICROBIOLOGIE ET CONTAMINANTS / BIOREMEDIATION

Bioremediation of Fluazifop-p-butyl herbicide by some soil bacteria isolated from various regions of Turkey in an artificial agricultural field

Authors: Erguven GO, Nuhoglu Y

Source: ENVIRONMENT PROTECTION ENGINEERING 46, 3: 5-15, 2020, DOI: 10.37190/epe200301

Abstract: The bioremediation rate of fluazifop-p-butyl (C19H20F3NO4) was monitored. Bacteria were isolated in agricultural soil samples. Fifteen sterilised glass jars were inoculated with 2, 5, 10, 20 cm(3) of a homogenised bacterial mixture (10(9) CFU/cm(3)), then sterile agricultural soil and 60 mu g of fluazifop-p-butyl (in liquid form) were added to each jar. Each week, filtrated water drained from bottles was analysed for fluazifop-p-butyl concentration, chemical oxygen demand (COD), biochemical oxygen demand (BOD5) and total organic carbon (TOC). Additionally, pH and dissolved oxygen concentration were monitored. The highest biodegradation rate was observed in the soil sample containing 20 cm(3) of the culture media. In this media, fluazifop-p-butyl, COD, BOD5 and TOC removals were measured as 91, 83, 96 and 86%, respectively, at the end of the 2 months. The DO level was measured between 3 and 6 mg O-2/dm(3) in the first month for all cultures. An increase of pH was recorded during the first month and after this time a pH decrease was noted.

Accès au document

https://doi.org/10.15454/6MQT-0H51

Combined use of municipal solid waste biochar and bacterial biosorbent synergistically decreases Cd(II) and Pb(II) concentration in edible tissue of forage maize irrigated with heavy metal-spiked water

Authors: Abedinzadeh M, Etesami H, Alikhani HA, Sha S

Source: HELIYON 6, 8, 2020, DOI: 10.1016/j.heliyon.2020.e04688

Abstract: A pot experiment was carried out to evaluate the effect of a municipal solid waste (MSW) biochar and a bacterial strain on the forage maize growth and the concentration of lead (Pb) and cadmium (Cd) in the edible tissue of maize irrigated with water contaminated with Cd (5 mg L-1) and Pb (100 mg L-1). Experimental treatments included (i) bacterial strain at two levels: no bacterial strain and Enterobacter cloacae R7; (ii) MSW biochar at three levels: 0, 1, and 3% (w/w); and (iii) irrigation water quality at five levels: plants irrigated with 100% freshwater (FW), plants irrigated with 75%FW + 25% contaminated water (CW), plants irrigated with 50%FW + 50% CW, plants irrigated with 25%FW + 75% CW, and plants irrigated with 100% CW. The effect of various treatments on maize growth indices and concentration of Pb(II) and Cd(II) in the plant was significant at 5% level. The concentration of these metals in the shoot of plants irrigated with 75 and 100% CW was higher than the permissible limits for Cd(II) and Pb(II) in livestock feed. However, the concentration of these metals in the shoot of the plants irrigated with 25 and 50% CW was lower than the permissible limit for this use. In this study, the combined application of 3% biochar and *E. cloacae* R7 had a significant effect on increased root dry weight (ranging from 29 to 33%), shoot dry weight (ranging from 32 to 43%) and bacterial root colonization (ranging from 33 to 53%) and on reduced concentration of Pb (ranging from 78 to 80%) and Cd (ranging from 72 to 76%) of the shoot of maize plant (edible tissues used by livestock), which was below the permissible limits for livestock feed, compared to corresponding controls. According to the results of this study, to reduce the concentration of the heavy metals in forage maize shoot (below the permissible limits for livestock feed), it is suggested using heavy metal -contaminated water either in combination with freshwater (50 or 75% FW) or in combination with biochar and bacterial biosorbent, averting human/animal health risk.

Accès au document

Arsenic mobilization affected by extracellular polymeric substances (EPS) of the dissimilatory iron reducing bacteria isolated from high arsenic groundwater

Authors: Liu H, Li P, Wang HL and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 735, 2020, DOI: 10.1016/j.scitotenv.2020.139501

Abstract: The factors that control arsenic (As) mobilization by dissimilatory iron reduction (DIR) are complicated. The association between As mobilization and extracellular polymeric substance (EPS) of dissimilatory iron reducing bacteria (DIRB) remained unclear. In this study, three DIRB were isolated from high arsenic groundwater to understand the effects of EPS on As mobilization. In the laboratory settings, strain Klebsiella oxytoca IR-ZA released As into aqueous phase from As-bearing ferrihydrite, while strain Shewanella putrefaciens IAR-S1 and S. xiamenensis IR-S2 resequestrated As by forming secondary minerals during ferrihydrite reduction. Characterization of EPS contents with Fourier Transform Infrared Spectroscopy and high-performance liquid chromatography suggested

that mannan and succinic acid were the main different EPS contents of the DIRB. The biomineralization processes were tightly regulated by EPS compositions. Mannan secreted by IAR-S1 and IR-S2 promoted while succinic acid secreted by IR-ZA suppressed the biomineralization and As immobilization. Energy-dispersive X-ray Spectroscopy mapping indicated that As in the secondary minerals was wrapped with EPS. X-ray diffraction and room temperature Mossbauer spectroscopy showed these secondary minerals were vivianite and magnetite, respectively. The amount of As mobilized into aqueous phase was strongly affected by available anions (H2PO4- and HCO3). Our results indicated that the EPS of DIRB significantly influenced As mobilization.

Accès au document

Bioremediation potential of new cadmium, chromium, and nickel-resistant bacteria isolated from tropical agricultural soil

Authors: Minari GD, Saran LM, Constancio MTL and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 204, 2020, DOI: 10.1016/j.ecoenv.2020.111038

Abstract: Soil management using fertilizers can modify soil chemical, biochemical and biological properties, including the concentration of trace-elements as cadmium (Cd), chromium (Cd) and nickel (Ni). Bacterial isolates from Cd, Cr, and Ni-contaminated soil were evaluated for some characteristics for their use in bioremediation. Isolates (592) were obtained from soil samples (19) of three areas used in three maize cultivation systems: no-tillage and conventional tillage with the application of mineral fertilizers; minimum tillage with the application of sewage sludge. Four isolates were resistant to Cr3+ (3.06 mmol dm(-3)) and Cd2+ (2.92 mmol dm(-3)). One isolate was resistant to the three metals at 0.95 mmol dm(-3). All isolates developed in a medium of Cd2+, Cr3+ and Ni2+ at 0.5 mmol dm(-3), and removed Cd2+ (17-33%) and Cr6+ (60-70%). They were identified by sequencing of the gene 16S rRNA, as bacteria of the genera Paenibacillus, Burkholderia, Ensifer, and two Cupriavidus. One of the Cupriavidus isolate was able to remove 60% of Cr6+ from the culture medium and showed high indole acetic acid production capacity. We evaluated it in a microbe-plant system that could potentially be deployed in bioremediation by removing toxic metals from contaminated soil.

Accès au document

Biochar-bacteria-plant partnerships: Eco-solutions for tackling heavy metal pollution

Authors: Harindintwali JD, Zhou JL, Yang WH and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 204, 2020, DOI: 10.1016/j.ecoenv.2020.111020

Abstract: Over the past 30 years, the ever-rising demands of the modern and growing population have led to the rapid development of agricultural and industrial sectors worldwide. However, this expansion has exposed the environment to various pollutants including heavy metal (HM)s. Almost all HMs are serious toxicants and can pose serious health risks to living organisms in addition to their bioaccumulative and non-biodegradable nature. Different techniques have been developed to restore the ecological functions of the HM-contaminated soil (HMCS). However, the major downfalls of the commonly used remediation technologies are the generation of secondary wastes, high operating costs, and high energy consumption. Phytoremediation is a prominent approach that is more innocuous than the existing remediation approaches. Some microbes-plant interactions enhance the bioremediation process, with heavy metal resistant-plant growth promoting bacteria

(HMRPGPB) being widely used to assist phytoremediation of HMs. However, the most common of all major microbial assisted-phytoremediation disturbances is that the HM-contaminated soil is generally deficient in nutrients and cannot sustain the rapid growth of the applied HMRPGPB. In this case, biochar has recently been approved as a potential carrier of microbial agents. The biochar-HMRPGPB-plant association could provide a promising green approach to remediate HM-polluted sites. Therefore, this review addresses the mechanisms through which biochar and HMRPGPB can enhance phytoremediation. This knowledge of biochar-HMRPGPB-plant interactions is significant with respect to sustainable management of the HM-polluted environment in terms of both ecology and economy, and it offers the possibility of further development of new green technologies.

Accès au document

4-Nitrophenol biodegradation by an isolated and characterized microbial consortium and statistical optimization of physicochemical parameters by Taguchi Methodology

Authors: Sarkar P, Dey A

Source: JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING 8, 5, 2020, DOI: 10.1016/j.jece.2020.104347

Abstract: A metabolically versatile and highly efficient 4-Nitrophenol degrading bacterial consortium was isolated from a pesticide-contaminated agricultural soil by successive enrichment on a mineral salt medium. Based on the phylogenetic analysis, the members of the consortium were found to be *Brevibacterium* sp. PNP1 (MH169212), *Pseudomonas* sp. PNP2 (MH169213), *Agromyces mediolanus* PNP3 (MH169214) and *Microbacterium oxydans* PNP4 (MH169215). Taguchi Design of experiments approach (DOE) was applied using Qualitek-4 software for the optimization of parameters to enhance the biomass growth and 4-Nitrophenol biodegradation efficiency. Nine physicochemical parameters such as magnesium sulphate, phosphate ion, yeast extract, calcium chloride, temperature, pH, inoculum dose, incubation time, and agitation speed were chosen for optimization due to their crucial impact on biomass growth and 4-Nitrophenol degradation. 27 trials of biodegradation experiments were performed under the L-27 Orthogonal Array (OA) designed by the Taguchi approach. The experimental data were analyzed using the Signal-to-noise (S/N) ratio with the 'bigger is better' characteristics to identify the influential parameters and to establish the optimum conditions for maximizing 4-Nitrophenol biodegradation. Validation of the predicted data with the confirmatory experiments revealed that 1.19 g/L of biomass and 99.12% of 4-Nitrophenol degradation could be attained resulting in 121.48% and 249.88% enhancement in the biomass growth and 4-Nitrophenol degradation respectively, at the optimized condition of yeast extract 2.0 g/L, pH 9.5, temperature 32 degrees C, incubation time 78 h, agitation 160 rpm, and inoculum dose 0.5 absorbance units (AU) of OD600.

Accès au document

The "Plastisphere" of Biodegradable Plastics Is Characterized by Specific Microbial Taxa of Alpine and Arctic Soils

Authors: Ruthi J, Bolsterli D, Pardi-Comensoli L and more ...

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8, 2020, DOI: 10.3389/fenvs.2020.562263

Abstract: Plastic pollution poses a threat to terrestrial ecosystems, even impacting soils from remote alpine and arctic areas. Biodegradable

plastics are a promising solution to prevent long-term accumulation of plastic litter. However, little is known about the decomposition of biodegradable plastics in soils from alpine and polar ecosystems or the microorganisms involved in the process. Plastics in aquatic environments have previously been shown to form a microbial community on the surface of the plastic distinct from that in the surrounding water, constituting the so-called "plastisphere." Comparable studies in terrestrial environments are scarce. Here, we aimed to characterize the plastisphere microbiome of three types of plastics differing in their biodegradability in soil using DNA metabarcoding. Polylactic acid (PLA), polybutylene adipate terephthalate (PBAT), and polyethylene (PE) were buried in two different soils, from the Swiss Alps and from Northern Greenland, at 15 degrees C for 8 weeks. While physico-chemical characteristics of the polymers only showed minor (PLA, PBAT) or no (PE) changes after incubation, a considerably lower alpha-diversity was observed on the plastic surfaces and prominent shifts occurred in the bacterial and fungal community structures between the plastisphere and the adjacent bulk soil not affected by the plastic. Effects on the plastisphere microbiome increased with greater biodegradability of the plastics, from PE to PLA. Copiotrophic taxa within the phyla Proteobacteria and Actinobacteria benefitted the most from plastic input. Especially taxa with a known potential to degrade xenobiotics, including Burkholderiales, Caulobacterales, Pseudomonas, Rhodococcus, andStreptomyces, thrived in the plastisphere of the Alpine and Arctic soils. In addition, Saccharimonadales (superphylum Patescibacteria) was identified as a key taxon associated with PLA. The association of Saccharibacteria with plastic has not been reported before, and pursuing this finding further may shed light on the lifestyle of this obscure candidate phylum. Plastic addition affected fungal taxa to a lesser extent since only few fungal genera such as Phlebia and Alternaria were increased on the plastisphere. Our findings suggest that the soil microbiome can be strongly influenced by plastic pollution in terrestrial cryoenvironments. Further research is required to fully understand microbial colonization on plastic surfaces and the biodegradation of plastic in soils.

Accès au document

Novel metabolites of triazophos formed during degradation by bacterial strains *Pseudomonas kilonensis* MB490, *Pseudomonas kilonensis* MB498 and *Pseudomonas* sp. MB504 isolated from cotton fields

Authors: Ambreen S, Yasmin A

Source: JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH PART B-PESTICIDES FOOD CONTAMINANTS AND AGRICULTURAL WASTES, 2020, DOI: 10.1080/03601234.2020.1823171

Abstract: In the current scenario of overuse of pesticides (resulting in soil and water pollution and ultimately leading to biomagnification), a research project was carried out to study biodegradation of Triazophos. For this purpose, three bacterial strains (*Pseudomonas kilonensis* MB490, *Pseudomonas kilonensis* MB498 and *Pseudomonas* sp. MB504), isolated from cotton fields of Mianwali, Pakistan were investigated for Triazophos degradation and metabolite formation in M-9 broth, soil slurry and soil microcosm after incubation for 9 days. There was 88.4-95.8% Triazophos degradation in M-9 broth, 99.90% degradation in soil slurry and 92.74 to 96% Triazophos degradation in soil microcosm by these bacteria after 9 days. While there was negligible Triazophos degradation (upto 7%) in the controls without bacteria. According to GCMS analysis, 7 unique and novel metabolites (1, 2, 4-Triazole-4-amine, N-(2-Thienylmethyl), Benzene sulfonic acid hydrazide, Benzene sulfonic acid methyl ester, 4H-1,2,4-Triazole-4-benzenesulfonamide, 4, 5 dihydro-N-(O-toyl)-3-furamide, Ethyl 4-phenyldiazenylbenzoate and

Dibutyl methanephosphonate) of Triazophos were revealed. Current results strongly suggest the potential of these bacterial strains for the remediation of Triazophos contaminated agricultural soils.

Accès au document

Inoculation of *Brassica napus* L. genotypes with endophytic bacteria promote growth and alleviate cadmium toxicity

Authors: Shah AU, Rajab H, Jalal A, Ajmal M and more ...

Source: JOURNAL OF ANIMAL AND PLANT SCIENCES-JAPS 30(5):1187-1193, 2020, DOI: 10.36899/JAPS.2020.5.0136

Abstract: Cadmium is a non-essential heavy metal that is highly toxic for most of the plants, even at low concentrations. Cadmium tolerant endophytic bacteria isolated from different sources have been effectively used for mitigating cadmium toxicity and plant growth promotion. In the present study, the potential of an endophytic bacterial strain known as *Serratia* sp. IU01, previously isolated from *Solanum nigrum*, was evaluated in terms of alleviating cadmium toxicity and promoting host plant growth. A significant increase in the biomass of two genotypes of *Brassica napus* L. exposed to different concentrations of cadmium was observed after three weeks inoculation with *Serratia* sp. IU01 compared to sole cadmium treated plants. High performance liquid chromatography (HPLC) analysis revealed the steady-levels of one of the key antioxidants, i.e., glutathione, were significantly higher in the sole cadmium treated plants compared to control plants. However, inoculation of the cadmium treated plants with the bacterial endophyte resulted in a significant reduction in glutathione contents compared to sole cadmium treated plants, which suggest the antioxidants released by the endophyte in the host environment have assisted the host plant in minimizing the magnitude of the resultant oxidative damage. The precursor of glutathione, i.e., cysteine, showed a similar pattern in the sole cadmium treated and inoculated plants. Our data suggested that inoculation of Brassica napus with the bacterial isolate Serratia sp. IU01, under cadmium stress provide a physiological advantage to the plants in terms of growth promotion and alleviating cadmium toxicity.

Accès au document

Biodegradation of diesel oil by cold-adapted bacterial strains of *Arthrobacter* spp. from Antarctica

Authors: Abdulrasheed M, Zakaria NN, Ahmad Roslee AF and more ...

Source: ANTARCTIC SCIENCE 32(5):341-353, 2020, DOI: 10.1017/S0954102020000206

Abstract: Bioremediation has been proposed as a means of dealing with oil spills on the continent. However, the introduction of non-native organisms, including microbes, even for this purpose would appear to breach the terms of the Environmental Protocol to the Antarctic Treaty. This study therefore aimed to optimize the growth conditions and diesel degradation activity of the Antarctic native bacteriaArthrobacterspp. strains AQ5-05 and AQ5-06 through the application of a one-factor-at-a-time (OFAT) approach. Both strains were psychrotolerant, with the optimum temperature supporting diesel degradation being 10-15 degrees C. Both strains were also screened for biosurfactant production and biofilm formation. Their diesel degradation potential was assessed using Bushnell-Haas medium supplemented with 0.5% (v/v) diesel as the sole carbon source and determined using both gravimetric and gas chromatography and mass spectrophotometry analysis. Strain AQ5-06 achieved 37.5% diesel degradation, while strain AQ5-05 achieved 34.5% diesel degradation. Both strains produced biosurfactants and showed high biofilm adherence. Strains AQ5-05 and AQ5-06 showed high cellular hydrophobicity rates of 73.0% and 81.5%, respectively, in hexadecane,

with somewhat lower values of 60.5% and 70.5%, respectively, in tetrahexadecane. Optimized conditions identified via OFAT increased diesel degradation to 41.0% and 47.5% for strains AQ5-05 and AQ5-06, respectively. Both strains also demonstrated the ability to degrade diesel in the presence of heavy metal co-pollutants. This study therefore confirms the potential use of these cold-tolerant bacterial strains in the biodegradation of diesel-polluted Antarctic soils at low environmental temperatures.

Accès au document

Xenobiotic thiencarbazone-methyl biotransformation investigation by bacteria *Streptococcus pneumoniae*, *Escherichia coli* and *Streptococcus pyogenes*

Authors: Ahmad KS, Hafeez N, Gul MM and more ...

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 2020, DOI: 10.1007/s13762-020-02948-x

Abstract: Xenobiotic thiencarbazone-methyl is a herbicide applied on various grasses and weeds. This triazolinone pesticide may be present in soil and water after application posing deleterious effects on environment and human health. The degradation of thiencarbazone-methyl was scrutinized by the pure bacterial strains including *Streptococcus pneumonia* (SP), *Escherichia coli* (EC) and *Streptococcus pyogenes* (SPy). Individual bacterial suspension was prepared with herbicide solution and evaluated for a duration of 28 days. Time-dependent sampling was performed to investigate thiencarbazone-methyl degradation after specific days interval. Biotransformed samples were extracted and analyzed by UV-Vis spectrophotometer and GC-MS. Biodegradation percentage achieved by SP, Spy and EC, after 28 days, was 31, 40 and 65, respectively. *E. coli* (R-2= 0.91) displayed greatest potential among all the strains to degrade the herbicide. Significant residues formed included methyl 4-isocyanatosulfonyl-5-methylthiophene-3-carboxylate, 4-methanesulfonyl-benzenesulfonic acid amide and methyl 3-sulfamoylthiophene-2carboxylate. Current research elucidated the effectiveness of using bacterial strains for the bioremediation of pesticides in environment.

Accès au document

Influence of Microbial Inoculation on Heavy Metals Absorption of Three Reforestation Species

Authors: Morong LJM, Aggangan NS

Source: PHILIPPINE JOURNAL OF CROP SCIENCE 44:18-27 - Special Issue: SI, 2019

Abstract: Pterocarpus indicus, Acacia mangium and Eucalyptus urophylla are fast growing tree species that thrive in diverse environments and have the potential to rehabilitate heavy metals (HM) contaminated areas i.e. mined-out areas. To determine the effect of microbial inoculation on the absorption and translocation of HMs, three treatments consisting of no microbial inoculants, mycorrhiza and mycorrhiza+NFB were applied to three reforestation species following a 2-factor experiment in RCBD. The bioconcentration factor (BCF) values indicate that *P. indicus*, *A. mangium* and *E. urophylla* accumulated higher HMs in their roots with respect to their corresponding rhizosphere soil, therefore reducing the availability of HMs in the environment. Among the tree species *P. indicus* inoculated with mycorrhiza+NFB seems to be the best bioremediation species and most effective in reducing HM in soil having had the highest BCF for Cd, Pb and Cu. Moreover, even with just mycorrhizal treatment, *P. indicus* was still able to effectively exclude Cu having shown the highest translocation factor (TF) for Cu. All the three reforestation species, however, when inoculated with microbial fertilizers have the potential to remediate Cu, Pb and Cd laden soils

and are recommended to be utilized in bioremediation of HM contaminated sites. It is also recommended that inoculants be tested on plants used as food in HM contaminated areas to determine their effects on their HM absorption to address the possibility of HM entry in the food chain.

Accès au document

Optimization of microbial assisted phytoremediation of soils contaminated with pesticides

Authors: Nurzhanova A, Mukasheva T, Berzhanova R and more ...

Source: INTERNATIONAL JOURNAL OF PHYTOREMEDIATION 2020, DOI: 10.1080/15226514.2020.1825330

Abstract: 580 microbial strains were isolated from the rhizosphere of the plants *Cucurbita pepo* L. and *Xanthium strumarium* grown on soil contaminated with dichlorodiphenyltrichloroethane (DDT) and its metabolites. During the cultivation, two bacterial strains were selected because of their ability to grow on media containing 0.5-5.0 mg L (-1) of dichlorodiphenyldichloroethylene (DDE) as the sole carbon source. They were identified as *Bacillus vallismortis* and *Bacillus aryabhattai*. Both of these species were shown to have a high capacity for the utilization of DDE - more than 90% of which was consumed after 21 days of cultivation. Laboratory experiments were carried out then to assess the possibility of using these strains for the decontamination of organochlorine pesticides (OCPs) contaminated soils. Inoculation of *C. pepo* and *X. Strumarium* with our isolates *B. Vallismortis* and *B. Aryabhattai* resulted in a reduction of the pollutant stress to the plants as shown by an increase both in aboveground and in root biomass. The microorganisms enhanced the uptake and phytostabilization potential of *C. pepo* and *X. strumarium* and can be applied for the treatment of DDE contaminated soils.

Accès au document

Trifolium repens-Associated Bacteria as a Potential Tool to Facilitate Phytostabilization of Zinc and Lead Polluted Waste Heaps

Authors: Olenska E, Imperato V, Malek W and more ...

Source: PLANTS-BASEL 9, 8, 2020, DOI: 10.3390/plants9081002

Abstract: Heavy metals in soil, as selective agents, can change the structure of plant-associated bacterial communities and their metabolic properties, leading to the selection of the most-adapted strains, which might be useful in phytoremediation.*Trifolium repens*, a heavy metal excluder, naturally occurs on metal mine waste heaps in southern Poland characterized by high total metal concentrations. The purpose of the present study was to assess the effects of toxic metals on the diversity and metabolic properties of the microbial communities in rhizospheric soil and vegetative tissues of *T. repens* growing on three 70-100-years old Zn-Pb mine waste heaps in comparison toTrifolium-associated bacteria from a non-polluted reference site. In total, 113 cultivable strains were isolated and used for 16S rRNA gene Sanger sequencing in order to determine their genetic affiliation and for in vitro testing of their plant growth promotion traits. Taxa richness and phenotypic diversity in communities of metalliferous origin were significantly lower (< 0.0001) compared to those from the reference site. Two strains, Bacillus megateriumBolR EW3_A03 andStenotrophomonas maltophiliaBolN EW3_B03, isolated from a Zn-Pb mine waste heap which tested positive for all examined plant growth promoting traits and which showed co-tolerance to Zn, Cu, Cd, and Pb can be considered as potential facilitators of phytostabilization.

Accès au document

https://doi.org/10.15454/6MQT-0H51

A Newly Discovered Humic-Reducing Bacterium, *Pseudomonas geniculata* PQ01, Isolated From Paddy Soil Promotes Paraquat Anaerobic Transformation

Authors: Wu CY, Wu XY, Chen SS, Wu DM

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.02003

Abstract: Due to toxicity and persistence of paraquat (a widely used herbicide), eco-friendly remediation approaches to its contamination and effective antidotes to its poisoning have been highly desired and raised increasing concerns. Paraquat degradation was lesser in aerobic soil in comparison with anaerobic soil, and humic-reducing microorganisms (HRMs) play a key role in paraquat anaerobic transformation process. However, the degradation pathways and related mechanisms remain poorly understood. In this study, we investigated the specific interaction mechanisms of the paraquat transformation processes mediated by a humic-reducing strain under anaerobic conditions. A strain of pure culture, designated as PQ01, was successfully isolated from paddy soil using anaerobic enrichment procedure, and identified as *Pseudomonas geniculata* using phenotypic and phylogenetic analysis. Sucrose, glucose, pyruvate, formic acid, and acetic acid were shown to be favorable electron donors for the reduction of anthrahydroquinone-2,6-disulfonate (AQDS) reduction by PQ01. The strain also had the ability of reducing Fe(III) (hydr)oxides in the presence of sucrose with efficiencies in the order of ferrihydrite > alpha-FeOOH/gamma-FeOOH > gamma-Fe2O3 > alpha-Fe2O3. In the "PQ01 + paraquat + AQDS + sucrose" system, AQDS reduction and paraquat biotransformation by strain PQ01 occurred simultaneously, and the presence of sucrose significantly enhanced the biotransformation. Specific mechanisms of the electron transfer processes are promoted by both PQ01 and AQDS, and proceed in two aspects: (1) paraquat served as electron donor in the anaerobic reduction of AQDS by strain PQ01; (2) AQDS was reduced by PQ01 anaerobic metabolism to produce AH(2)QDS, which can directly react with paraquat under anaerobic conditions to generate a single crystal compound (molecular formula of the unit structure is C26H20N2O8S2), causing the paraquat to decline dramatically. In conclusion, this main mechanism included the microbial reduction of AQDS to AH (2)QDS, followed by the abiotic reaction between AH(2)QDS and paraquat. This study reported the new characteristics of P. geniculata capable of reducing humics analogs, Fe(III) (hydr)oxides, and paraquat, and proposed a novel electron transformation mechanism of the HRMs' mediated degradation of organic contaminants.

Accès au document

Biodegradation of organophosphorus pesticide chlorpyrifos by *Sphingobacterium* sp. C1B, a psychrotolerant bacterium isolated from apple orchard in Himachal Pradesh of India

Authors: Verma S, Singh D, Chatterjee S

Source: EXTREMOPHILES, 2020, DOI: 10.1007/s00792-020-01203-y

Abstract: A psychrotolerant *Sphingobacterium* sp. was isolated from the apple orchard situated in the Kufri region of Shimla, Himachal Pradesh, India using an enrichment culture technique having chlorpyrifos (CP) as the sole source of carbon and energy. Based on biochemical characterization and 16S rRNA analysis, the strain was identified asSphingobacteriumsp. C1B. The bacterium C1B was able to degrade chlorpyrifos ≥ 42 ppm and ≥ 36 ppm within 14 days at 20 degrees C and 15 degrees C, respectively. The strain was also able to degrade chlorpyrifos ≤ 35 ppm at 28 degrees C within 14

days. The enzyme organophosphorus hydrolase might be responsible for the initial degradation of CP by the strain C1B. Based on the HPLC and GCMS analysis, a probable degradation pathway has been proposed, which followed the path from chlorpyrifos to 3,5,6-trichloro-2-pyridinol to benzene, 1,3-bis (1,1-dimethylethyl) and then entered into the TCA cycle. Our current study revealed that the bacterium C1B was found to be a useful strain for the degradation of pesticide chlorpyrifos in the cold climatic environment.

Accès au document

Lead (Pb)-resistant bacteria inhibit Pb accumulation in dill (*Anethum graveolens* L.) by improving biochemical, physiological, and antioxidant enzyme response of plants

Authors: Rahbari A, Fatemi H, Pour BE and more ...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-10851-8

Abstract: The accumulation of heavy metal in the soil is a serious concern for sustainable food production due to their toxic effects on plants and other living things. The strategies are required on urgent bases for the management of metal-contaminated soils. Thus, the microbes from the genusPseudomonaswere characterized for different traits and lead (Pb)-resistant ability and their effects were assessed on growth, photosynthesis, antioxidant capacity, and Pb uptake by dill (*Anethum graveolens* L.). Furthermore, soil basal respiration and induced respiration in soil were also assessed under microbes and Pb stress. Among the tested three strains, PseudomonasP159 and P150 were more tolerant to Pb stress than *Pseudomonas* P10, whereas P159 showed the highest values for phosphorus (P), siderophore, auxin, and hydrogen cyanide production. The bacterial inoculation increased the plant shoot dry weights, carbohydrates, proline, and chlorophyll contents under Pb stress. The catalase (CAT) and peroxidase (POD) activities of the plants were higher in bacterial-treated plants than control. The bacterial inoculation decreased Pb concentration in plants, and the response varied with the type of microbes. The bacterial strains enhanced the soil basal and induced respiration than respective Pb treatments alone. Overall, PseudomonasP159 is potentially suitable for the remediation of Pb-contaminated soils.

Accès au document

Efficient biodegradation of DEHP by CM9 consortium and shifts in the bacterial community structure during bioremediation of contaminated soil

Authors: Bai, NL., Li, SX., Zhang, JQ., and more ...

Source: ENVIRONMENTAL POLLUTION 266, 2, 2020, DOI: 10.1016/j.envpol.2020.115112

Abstract: Di(2-ethylhexyl) phthalate (DEHP), the most extensively used plasticizer in plastic formulations, is categorized as a priority environmental contaminant with carcinogenic, teratogenic, and mutagenic toxicities. Many isolated microorganisms exhibit outstanding performance as pure cultures in the laboratory but are unable to cope with harsh environmental conditions in the field. In the present study, a microbial consortium (CM9) with efficient functionality was isolated from contaminated farmland soil. CM9 could consistently degrade 94.85% and 100.00% of DEHP (1000 mg/L) within 24 h and 72 h, respectively, a higher efficiency than those of other reported pure and mixed microorganism cultures. The degradation efficiencies of DEHP and di-n-butyl phthalate were significantly higher than those of dimethyl

phthalate and diethyl phthalate (p &#60 ; 0.05). The primary members of the CM9 consortium were identified as Rhodococcus, Niabella, Sphingopyxis, Achromobacter, Tahibacter, and Xenophilus. The degradation pathway was hypothesized to include both de-esterification and beta-oxidation. In contaminated soil, bioaugmentation with CM9 and biochar markedly enhanced the DEHP removal rate to 87.53% within 42 d, compared to that observed by the indigenous microbes (49.31%) (p &#60 ; 0.05). During simulated bioaugmentation, the dominant genera in the CM9 consortium changed significantly over time, indicating their high adaptability to soil conditions and contribution to DEHP degradation. Rhodococcus, Pigmentiphaga and Sphingopyxis sharply decreased, whereas Tahibacter, Terrimonas, Niabella, Unclassifiedj Caulobacteraceae, and Allorhizobium-Neorhizobium-Pararhizobium-Rhizobium showed considerable increases. These results provide a theoretical framework for the development of in situ bioremediation of phthalate (PAE)-contaminated soil by composite microbial inocula.

Accès au document

Characterization of the Belowground Microbial Community in a Poplar-Phytoremediation Strategy of a Multi-Contaminated Soil

Authors: Barra Caracciolo A, Grenni P, Garbini GL and more ...

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.02073

Abstract: Due to their widespread use in industrial applications in recent decades, Polychlorobiphenyls (PCBs) and heavy metals (HMs) are the most common soil contaminants worldwide, posing a risk for both ecosystems and human health. In this study, a poplar-assisted bioremediation strategy has been applied for more than 4 years to a historically contaminated area (PCBs and HMs) in Southern Italy using the Monviso poplar clone. This clone was effective in promoting a decrease in all contaminants and an increase in soil quality in terms of organic carbon and microbial abundance. Moreover, a significant shift in the structure and predicted function of the belowground microbial community was also observed when analyzing both DNA and cDNA sequencing data. In fact, an increase in bacterial genera belonging toProteobacteriaable to degrade PCBs and resist HMs was observed. Moreover, the functional profiling of the microbial community predicted by PICRUSt2 made it possible to identify several genes associated with PCB transformation (e.g.,bphAa, bphAb,bphB,bphC), response to HM oxidative stress (e.g., catalase, superoxide reductase, peroxidase) and HM uptake and expulsion (e.g., ABC transporters). This work demonstrated the effectiveness of the poplar clone Monviso in stimulating the natural belowground microbial community to remove contaminants and improve the overall soil quality. It is a practical example of a nature based solution involving synergic interactions between plants and the belowground microbial community.

Accès au document

Potential Plant Growth-Promoting Bacteria with Heavy Metal Resistance

Author: Efe D

Source: CURRENT MICROBIOLOGY, 2020, DOI: 10.1007/s00284-020-02208-8

Abstract: Plant growth-promoting (PGP) bacteria commonly have many strategies to cope with heavy metal toxicity. Heavy metal-resistant PGP bacteria can be used to improve the growth of plants in heavy metal contaminated soils. In this study, the soil samples were collected from the lead-zinc mineral deposits in Gumushane Province, Turkey. Nine bacterial isolates were obtained on the nutrient agar medium

supplemented with 100 mg/mL zinc and lead. All of the isolates were screened in terms of plant growth-promoting characteristics including production of indole-3-acetic acid and siderophore, nitrogen fixation and phosphate solubilisation. Nine bacteria were identified as *Bacillus cereus*, *Bacillus atrophaeus*, *Bacillus pumilus*, *Bacillus amyloliquefaciens*, *Bacillus tropicus*, *Bacillus subtilis*, *Bacillus halotolerans*, *Bacillus vallismortis*, and *Enterococcus mundtii* by classical and 16S rDNA-PCR assays. In addition, these isolates were evaluated for their response to three heavy metals (lead, zinc, copper) dominant in the soil samples and minimal inhibitory concentration (MIC) of the heavy metals was determined with plate dilution method. Consequently, the bacterial isolates in this study possess plant growth-promoting traits and can ameliorate heavy metal contaminated soil. *E.mundtii* was reported to be found in heavy metal contaminated soil for the first time. This study is the first report about PGP characteristics (IAA production and phosphate solubilisation) of *B.vallismortis*.

Accès au document

Biodegradation of Pesticides at the Limit: Kinetics and Microbial Substrate Use at Low Concentrations

Authors: Wirsching J, Pagel H, Ditterich F and more ...

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.02107

Abstract: The objective of our study was to test whether limited microbial degradation at low pesticide concentrations could explain the discrepancy between overall degradability demonstrated in laboratory tests and their actual persistence in the environment. Studies on pesticide degradation are often performed using unrealistically high application rates seldom found in natural environments. Nevertheless, biodegradation rates determined for higher pesticide doses cannot necessarily be extrapolated to lower concentrations. In this context, we wanted to (i) compare the kinetics of pesticide degradation at different concentrations in arable land and (ii) clarify whether there is a concentration threshold below which the expression of the functional genes involved in the degradation pathway is inhibited without further pesticide degradation taking place. We set up an incubation experiment for four weeks using 14C-ring labeled 2-methyl-4-chlorophenoxyacetic acid (MCPA) as a model compound in concentrations from 30 to 20,000 mu g kg (-1) soil. To quantify the abundance of putative microorganisms involved in MCPA degradation and their degradation activity, tfdA gene copy numbers (DNA) and transcripts (mRNA) were determined by quantitative real-time PCR. Mineralization dynamics of MCPA derived-C were analyzed by monitoring 14CO(2) production and 14C assimilation by soil microorganisms. We identified two different concentration thresholds for growth and activity with respect to MCPA degradation using tfdA gene and mRNA transcript abundance as growth and activity indices, respectively. The tfdA gene expression started to increase between 1,000 and 5,000 mu g MCPA kg (-1) dry soil, but an actual increase in tfdA sequences could only be determined at a concentration of 20,000 µg. Accordingly, we observed a clear shift from catabolic to anabolic utilization of MCPA-derived C in the concentration range of 1,000 to 5,000 µg kg (-1). Concentrations ≥ 1,000 µg kg(-1)were mainly associated with delayed mineralization, while concentrations ≤ 1,000 µg kg(-1)showed rapid absolute dissipation. The persistence of pesticides at low concentrations cannot, therefore, be explained by the absence of functional gene expression. Nevertheless, significant differences in the degradation kinetics of MCPA between low and high pesticide concentrations illustrate the need for studies investigating pesticide degradation at environmentally relevant concentrations.

Accès au document

Performance of microbial induced carbonate precipitation for immobilizing Cd in water and soil

Authors: Peng DH, Qiao SY, Luo Y and more ...

Source: JOURNAL OF HAZARDOUS MATERIALS 400, 2020, DOI: 10.1016/j.jhazmat.2020.123116

Abstract: Microbial induced carbonate precipitation (MICP) is known as a significant process for remediating heavy metals contaminated environment. In this study, a novel Cd-resistant ureolytic bacteria was isolated and identified as Enterobacter sp. Its performances for immobilizing Cd in solution and soil were systematically discussed at different treatment conditions. Results showed that initial pH and Cd concentration were important parameters to influence Cd removal rate. The maximal Cd removal rate in solution reached 99.50 % within 7 days by MICP. The precipitation produced in Cd removal process were characterized by X-ray diffraction, scanning electron microscopy and energy dispersive spectrometer to understand the removal mechanism. Analyses showed that Cd removal mechanism of CJW-1 was predominately via biominerals including calcites and vaterites to absorb Cd2+. Cd immobilization tests demonstrated that the highest Cd-immobilization rate in soil could reach 56.10 %. Although all treatments contribute to soil pH, fertility, and enzyme activities improvement, oyster shell wastes (OS) had a better effect on soil cation exchange capacity. All treatments had negative effects on soil respiration and bacterial community, but OS can alleviate such adverse influence. Our results emphasized that Cd-resistant ureolytic bacteria strain CJW-1 combined with OS had excellent ability and reuse value to remediate Cd-contaminated environment.

Accès au document

Fungal bioremediation of soil co-contaminated with petroleum hydrocarbons and toxic metals

Authors: Li QW, Liu JC, Gadd GM

Source: APPLIED MICROBIOLOGY AND BIOTECHNOLOG, 2020, DOI: 10.1007/s00253-020-10854-y

Abstract: Much research has been carried out on the bacterial bioremediation of soil contaminated with petroleum hydrocarbons and toxic metals but much less is known about the potential of fungi in sites that are co-contaminated with both classes of pollutants. This article documents the roles of fungi in soil polluted with both petroleum hydrocarbons and toxic metals as well as the mechanisms involved in the biotransformation of such substances. Soil characteristics (e.g., structural components, pH, and temperature) and intracellular or excreted extracellular enzymes and metabolites are crucial factors which affect the efficiency of combined pollutant transformations. At present, bioremediation of soil co-contaminated with petroleum hydrocarbons and toxic metals is mostly focused on the removal, detoxification, or degradation efficiency of single or composite pollutants of each type. Little research has been carried out on the metabolism of fungi in response to complex pollutant stress. To overcome current bottlenecks in understanding fungal bioremediation, the potential of new approaches, e.g., gradient diffusion film technology (DGT) and metabolomics, is also discussed.

Accès au document

The Fate of Lead (Pb) in Multitrophic Interactions Among Bacteria, Fungi, and Bacterivorous Soil Nematodes

Authors : Iqbal N, Ahmed S, Pervez A and more ...

Source: CLEAN-SOIL AIR WATER, 2020, DOI: 10.1002/clen.202000307

Abstract: Contamination of potentially toxic metals poses threats to living organisms due to prolonged existence in an ecosystem. The effects of toxic metals on soil microbes have broadly been reported but the study on interactions among soil micro- and macro-organisms under metal stress needs to be elaborated. In current study, the immobilization of lead (Pb) is investigated by using five resistant microbial strains; (2) *Bacillus cereus*, (1) *Bacillus subtilis*, (1) *Brevundimonas naejangsanensis*, and (1) fungal strain *Fusarium equiseti* isolated from contaminated soil of Hattar, Pakistan. Bacterial and fungal strains and their consortia are tested in the presence/absence of nematodes for Pb immobilization in a medium containing 250 mg L-1Pb. Single bacterial strains immobilize Pb up to 72%, while in the presence of nematodes, bacterial immobilization potential decreases. An increased Pb immobilization up to 185 mg L (-1) is found when bacterial and fungal consortia are inoculated with nematodes. The maximum 80% Pb immobilization is found in bacterial-bacterial combinations with nematodes. This study, reveals that inoculation of bacterial-bacterial consortia in the presence of nematodes enhanced bacterial growth via feeding resulting in higher Pb immobilization. These resistant microbial strains can thus be used to treat contaminated sites for better ecosystem functioning.

Accès au document

Accelerated Biodegradation of the Agrochemical Ametoctradin by Soil-Derived Microbial Consortia

Authors: Whittington HD, Singh M, Ta C, Azcarate-Peril MA, Bruno-Barcena JM

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.01898

Abstract: Pesticide-resistant plant pathogens are an increasing threat to the global food supply and have generated a need for novel, efficacious agrochemicals. The current regulatory process for approving new agrochemicals is a tedious but necessary process. One way to accelerate the safety evaluation process is to utilize in vitro systems to demonstrate pesticide degradation by soil microbes prior to ex vivo soil evaluations. This approach may have the capability to generate metabolic profiles free of inhibitory substances, such as humic acids, commonly present in ex vivo soil systems. In this study, we used a packed-bed microbial bioreactor to assess the role of the natural soil microbial community during biodegradation of the triazolopyrimidine fungicide, ametoctradin. Metabolite profiles produced during in vitro ametoctradin degradation were similar to the metabolite profiles obtained during environmental fate studies and demonstrated the degradation of 81% of the parent compound in 72 h compared to a half-life of 2 weeks when ametoctradin was left in the soil. The microbial communities of four different soil locations and the bioreactor microbiome were compared using high throughput sequencing. It was found that biodegradation of ametoctradin in both ex vivo soils and in vitro in the bioreactor correlated with an increase in the relative abundance of Burkholderiales, well characterized microbial degraders of xenobiotic compounds.

Accès au document

Microbial Consortium of PGPR, Rhizobia and Arbuscular Mycorrhizal Fungus Makes Pea Mutant SGECd(t) Comparable with Indian Mustard in Cadmium Tolerance and Accumulation

Authors: Belimov AA, Shaposhnikov AI, Azarova TS and more ...

Source: PLANTS-BASEL 9, 8, 2020, DOI: 10.3390/plants9080975

Abstract: Cadmium (Cd) is one of the most widespread and toxic soil pollutants that inhibits plant growth and microbial activity. Polluted soils can be remediated using plants that either accumulate metals (phytoextraction) or convert them to biologically inaccessible forms (phytostabilization). The phytoremediation potential of a symbiotic system comprising the Cd-tolerant pea (*Pisum sativum* L.) mutant SGECd(t) and selected Cd-tolerant microorganisms, such as plant growth-promoting rhizobacterium *Variovorax paradoxus* 5C-2, nodule bacterium *Rhizobium leguminosarum* bv.viciae RCAM1066, and arbuscular mycorrhizal fungusGlomussp. 1Fo, was evaluated in comparison with wild-type pea SGE and the Cd-accumulating plant Indian mustard (*Brassica juncea* L. Czern.) VIR263. Plants were grown in pots in sterilized uncontaminated or Cd-supplemented (15 mg Cd kg (-1)) soil and inoculated or not with the microbial consortium. Cadmium significantly inhibited growth of uninoculated and particularly inoculated SGE plants, but had no effect on SGECd(t) and decreased shoot biomass of *B. juncea*. Inoculation with the microbial consortium more than doubled pea biomass (both genotypes) irrespective of Cd contamination, but had little effect on *B. Juncea* biomass. Cadmium decreased nodule number and acetylene reduction activity of SGE by 5.6 and 10.8 times, whereas this decrease in SGECd(t) was 2.1 and 2.8 times only, and the frequency of mycorrhizal structures decreased only in SGE roots. Inoculation decreased shoot Cd concentration and increased seed Cd concentration of both pea genotypes, but had little effect on Cd concentration of *B. juncea*. Inoculation also significantly increased concentration and/or accumulation of nutrients (Ca, Fe, K, Mg, Mn, N, P, S, and Zn) by Cd-treated pea plants, particularly by the SGECd(t) mutant. Shoot Cd concentration of SGECd(t) was twice that of SGE, and the inoculated SGECd(t) had approximately similar Cd accumulation capacity as compared with *B. juncea*. Thus, plant-microbe systems based on Cd-tolerant micro-symbionts and plant genotypes offer considerable opportunities to increase plant HM tolerance and accumulation.

Accès au document

Bioremediation of toxic metals in mining site of Zamfara metropolis using resident bacteria (*Pantoea agglomerans*): A optimization approach

Authors: Audu KE, Adeniji SE, Obidah J

Source: HELIYON 6, 8, 2020, DOI: 10.1016/j.heliyon.2020.e04704

Abstract: Background: Various clean-up techniques for heavy metals have been suggested and practiced for its biosorption from the contaminated or pollutant soil by using chemical and physical methods. But most of the methods are hazardous to the environment and expensive. This study was on how to determine the potential of resident bacteria in the removal of heavy metals from contaminated soils in Abare situated in Anka Local Government of Zamfara State, Nigeria. Thus, this study employed bioremediation technique for removal of heavy metals. Results: The preparation of Culture media and Isolation of bacteria of the different contaminated soils were achieved by spread plate method. Whereas, concentrations of the heavy metals (Lead (Pb), Copper (Cu) and Iron (Fe)) were determined by Atomic absorption spectrophotometer (AAS. *Pantoea agglomerans* was used for biosorption experiment. The concentrations of Pb ranged between 1.328 +/- 0.493 to 2.326 +/- 2.093 mg/L, Cu 0.234 +/- 0.117 to 1.054 +/- 1.486 mg/L and Fe 18.498 +/- 11.462 to 27.754 +/- 57.510 mg/L. The optimum temperature for biosorption condition was found to be 35 degrees C. More so, the optimum pH of (7) was observed for maximum biosorption of Pb and Cu ions by Pantoea agglomerans which may

be attributed to homeostatic phenomenon and the availability of metal binding sites on the biosorbents. Metal uptake biosorption percentage revealed that Pantoea agglomerans absorbed 99.6% of Pb, 60% of Cu and 96% of Fe. Conclusion: This study revealed that Pantoea agglomerans potential for bioremediation of the three metals.

Accès au document

Remediation potential of immobilized bacterial strain with biochar as carrier in petroleum hydrocarbon and Ni co-contaminated soil

Authors: Li X, Wang YX, Luo T and more ...

Source: ENVIRONMENTAL TECHNOLOGY 2020, DOI: 10.1080/09593330.2020.1815858

Abstract: The remediation of organic pollutant-heavy metal co-contaminated soil is a great challenge. Immobilized microorganism technology (IMT) is a potential approach to remediate co-contaminated soil. In this study, we evaluated the feasibility of IMT for the remediation of petroleum hydrocarbon-heavy metal nickel (Ni) co-contaminated soil. The Ni resistant and hydrocarbon-degrading bacteria strain *Citrobacter* sp. was added to co-contaminated soil by immobilizing on corncob biochar. The potential performance in biodegradation of petroleum hydrocarbon and changing the mobility and speciation of nickel (Ni) in soil were determined, with consideration of the influences of the soil properties and dehydrogenase activity. The results demonstrated that the degradation rate of petroleum hydrocarbons by immobilized microorganisms group (IM) was 45.52%, significantly higher than that of the free bacteria (30.15%), biochar (25.92%) and blank group (18.47%) (P&#60 ;0.05). At the same time, IM was more effective in immobilizing Ni in the soil by transforming available Ni to a stable fraction with a maximum residual concentration increasing by 101.50 mg center dot kg (-1), and the carcinogenic nickel sulfide was not detected after remediation in IM. IM exhibited a higher level of soil dehydrogenase activity (0.3956 mu g center dot mL (-1) center dot h(-1) center dot g(-1)) than that of free bacteria (0.2878 mu g center dot mL(-1)center dot h(-1)center dot g(-1)). A linear correlation was found between the petroleum pollutants degradation rate and dehydrogenase activity ($P < 0.05$). This study indicates the effectiveness and potential of IMT application in degrading petroleum hydrocarbon and immobilizing heavy metals in co-contaminated soil.

Accès au document

Effects of root endophytic fungus, *Microdochium bolleyi* on cadmium uptake, translocation and tolerance by *Hordeum vulgare* L.

Authors: Shadmani L, Jamali S, Fatemi A

Source: BIOLOGIA 2020, DOI: 10.2478/s11756-020-00598-5

Abstract: Endophytic fungi can have a positive impact on phytoremediation of heavy metals, but the effects of endophytic fungus Microdochium bolleyi on extraction of Cd by barley, have not been previously examined. Therefore, the objective of the present study was to assess the effects of *M. bolleyi* (strain B26) on cadmium (Cd) tolerance, accumulation and translocation by barley (*Hordeum vulgare* L.) (Sararood cultivar) under Cd stress. Barley plants were inoculated with B26 in Cd-added sands (0,

10, 30, 60 mg Cd kg (-1) sand), and the various attributes of growth along with the amount of Cd in barley were investigated after two months. The results indicated that fungal inoculation significantly improved ($p < 0.05$) plant growth in the presence of Cd by enhancing factors of plant growth ; shoot length increased by 8.93%, 11.61% and 5.59%, root length by 26.47%, 12.39% and 13.95%, dry root biomass by 6.35%, 8.57% and 28.57%, dry shoot biomass by 11.39%, 8.25% and 4.81% in soil containing 10, 30 and 60 mg Cd kg (-1), respectively. The increases in chlorophyll content were 16.74% and 9.97% under 10 and 30 mg Cd kg (-1) treatments, in turn. In terms of Cd accumulation, fungal inoculation increased the amount of Cd in the barley roots, by 44%, 27.95% and 25.18% in soil containing 10, 30 and 60 mg Cd kg (-1), respectively, but it remained the same in plant leaves whether the plants were inoculated or not. The results suggested B26 can be exploited to improve the potential of barley for the remediation of Cd contaminated sites.

Accès au document

Poly-gamma-glutamic acid-producing bacteria reduced Cd uptake and effected the rhizosphere microbial communities of lettuce

Authors: Wang XH, Dong GY, Liu XW and more ...

Source: JOURNAL OF HAZARDOUS MATERIALS 398, 2020, DOI: 10.1016/j.jhazmat.2020.123146

Abstract: Poly-gamma-glutamic acid (gamma-PGA) could efficiently stabilize heavy metals in the environment. This study characterized the effects of two plant growth-promoting and gamma-PGA-producing bacteria *Bacillus subtilis* W7 and *Bacillus amyloliquefaciens* W25 on Cd immobilization and gamma-PGA production in soil filtrate and on the biomass and Cd uptake by lettuce in Cd-contaminated soil, the impact of these strains on the rhizosphere soil bacterial community was also evaluated. The strains reduced Cd concentration (16-75 %) in soil filtrate and strain W25 had a higher ability of producing gamma-PGA and immobilizing Cd than strain W7. Compared with the control, the strains significantly increased the biomass (41-85 %) and reduced Cd uptake (19-41 %) by lettuce, reduced available Cd content (25-37 %) and increased the relative abundance of gamma-PGA-producing bacteria (24-30 %) in Cd-contaminated soil, among which the effects of strain W25 were better than that of strain W7. Besides, these isolates also increased soil pH value, urease activity and the relative abundance of plant growth-promoting and metal-immobilizing bacteria such as Sphingomonas and Bacillus. In summary, the two strains reduced soil available Cd and lettuce Cd uptake by increasing the pH value, urease activity and the abundance of gamma-PGA-producing bacteria, and regulating bacterial community structure in rhizosphere soil.

Accès au document

Impact of a synthetic fungicide (fosetyl-Al and propamocarb-hydrochloride) and a biopesticide (*Clonostachys rosea*) on soil bacterial, fungal, and protist communities

Authors: Fournier B, Santos SP, Gustavsen JA and more ...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 738, 2020, DOI: 10.1016/j.scitotenv.2020.139635

Abstract: The use of synthetic pesticides in agriculture is increasingly debated. However, few studies have compared the impact of synthetic pesticides and alternative biopesticides on non-target soil microorganisms playing a central role in soil functioning.

We conducted a mesocosm experiment and used high-throughput amplicon sequencing to test the

impact of a fungal biopesticide and a synthetic fungicide on the diversity, the taxonomic and functional compositions, and co-occurrence patterns of soil bacterial, fungal and protist communities.

Neither the synthetic pesticide nor the biopesticide had a significant effect on microbial a-diversity. However, both types of pesticides decreased the complexity of the soil microbial network. The two pesticides had contrasting impacts on the composition of microbial communities and the identity of key taxa as revealed by microbial network analyses. The biopesticide impacted keystone taxa that structured the soil microbial network. The synthetic pesticide modified biotic interactions favouring taxa that are less efficient at degrading organic compounds. This suggests that the biopesticides and the synthetic pesticide have different impact on soil functioning. Altogether, our study shows that pest management products may have functionally significant impacts on the soil microbiome even if microbial alpha-diversity is unaffected. It also illustrates the potential of high-throughput sequencing analyses to improve the ecotoxicological risk assessment of pesticides on non-target soil microorganisms.

Accès au document

Responses of microbial communities and metabolic activities in the rhizosphere during phytoremediation of Cd-contaminated soil

Authors: Liu CJ, Lin H, Li B and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 202, 2020, DOI: 10.1016/j.ecoenv.2020.110958

Abstract: Phytoremediation is an effective way to repair heavy metal contaminated soil and rhizosphere microorganisms play an important role in plant regulation. Nevertheless, little information is known about the variation of microbial metabolic activities and community structure in rhizosphere during phytoremediation. In this study, the rhizosphere soil microbial metabolic activities and community structure of *Trifolium repens* L. during Cdcontaminated soil phytoremediation, were analyzed by Biolog EcoPlateTM and high-throughput sequencing. The uptake in the roots of *Trifolium repens* L. grown in 5.68 and 24.23 mg/kg Cd contaminated soil was 33.51 and 84.69 mg/kg respectively, causing the acid-soluble Cd fractions decreased 7.3% and 5.4%. Phytoremediation significantly influenced microbial community and *Trifolium repens* L. planting significantly increased the rhizosphere microbial population, diversity, the relative abundance of plant growth promoting bacteria (Kaistobacter and Flavisolibacter), and the utilization of difficultly metabolized compounds. The correlation analysis among substrate utilization and microbial communities revealed that the relative abundance increased microorganisms possessed stronger carbon utilization capacity, which was beneficial to regulate the stability of plant-microbial system. Collectively, the results of this study provide fundamental insights into the microbial metabolic activities and community structure during heavy metal contaminated soil phytoremediation, which may aid in the bioregulation of phytoremediation.

Accès au document

Zinc tolerant plant growth promoting bacteria alleviates phytotoxic effects of zinc on maize through zinc immobilization

Authors: Jain D, Kour R, Bhojiya AA, and more ...

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-70846-w

Abstract: The increasing heavy metal contamination in agricultural soils has become a

serious concern across the globe. The present study envisages developing microbial inoculant approach for agriculture in Zn contaminated soils. Potential zinc tolerant bacteria (ZTB) were isolated from zinc (Zn) contaminated soils of southern Rajasthan, India. Isolates were further screened based on their efficiency towards Zn tolerance and plant growth promoting activities. Four strains viz. ZTB15, ZTB24, ZTB28 and ZTB29 exhibited high degree of tolerance to Zn up to 62.5 mM. The Zn accumulation by these bacterial strains was also evidenced by AAS and SEM-EDS studies. Assessment of various plant growth promotion traits viz., IAA, GA (3), NH3, HCN, siderophores, ACC deaminase, phytase production and P, K, Si solubilization studies revealed that these ZTB strains may serve as an efficient plant growth promoter under in vitro conditions. Gluconic acid secreted by ZTB strains owing to mineral solubilization was therefore confirmed using high performance liquid chromatography. A pot experiment under Zn stress conditions was performed using maize (Zea mays) variety (FEM-2) as a test crop. Zn toxicity reduced various plant growth parameters ; however, inoculation of ZTB strains alleviated the Zn toxicity and enhanced the plant growth parameters. The effects of Zn stress on antioxidant enzyme activities in maize under in vitro conditions were also investigated. An increase in superoxide dismutase, peroxidase, phenylalanine ammonia lyase, catalase and polyphenol oxidase activity was observed on inoculation of ZTB strains. Further, ZIP gene expression studies revealed high expression in the ZIP metal transporter genes which were declined in the ZTB treated maize plantlets. The findings from the present study revealed that ZTB could play an important role in bioremediation in Zn contaminated soils.

Accès au document

Responses of microbial communities and metabolic activities in the rhizosphere during phytoremediation of Cd-contaminated soil

Authors: Liu CJ, Lin H, Li B and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 202, 2020, DOI: 10.1016/j.ecoenv.2020.110958

Abstract: Phytoremediation is an effective way to repair heavy metal contaminated soil and rhizosphere microorganisms play an important role in plant regulation. Nevertheless, little information is known about the variation of microbial metabolic activities and community structure in rhizosphere during phytoremediation. In this study, the rhizosphere soil microbial metabolic activities and community structure of *Trifolium repens* L. during Cd contaminated soil phytoremediation, were analyzed by Biolog EcoPlateTM and high-throughput sequencing. The uptake in the roots of *Trifolium repens* L. grown in 5.68 and 24.23 mg/kg Cd contaminated soil was 33.51 and 84.69 mg/kg respectively, causing the acid-soluble Cd fractions decreased 7.3% and 5.4%. Phytoremediation significantly influenced microbial community and Trifolium repensL. planting significantly increased the rhizosphere microbial population, diversity, the relative abundance of plant growth promoting bacteria (Kaistobacter and Flavisolibacter), and the utilization of difficultly metabolized compounds. The correlation analysis among substrate utilization and microbial communities revealed that the relative abundance increased microorganisms possessed stronger carbon utilization capacity, which was beneficial to regulate the stability of plant-microbial system. Collectively, the results of this study provide fundamental insights into the microbial metabolic activities and community structure during heavy metal contaminated soil phytoremediation, which may aid in the bioregulation of phytoremediation.

Accès au document

Evaluation of organic carbon and microbial inoculum for bioremediation of acid mine drainage

Authors: Ruehl MD, Hiibel SR

Source: MINERALS ENGINEERING 157, 2020, DOI: 10.1016/j.mineng.2020.106554

Abstract: Acid mine drainage (AMD) from abandoned mines cause environmental harm and requires cost-effective, passive remediation techniques. Mining activities expose mineral surfaces to oxidation, which accelerates the release and mobilization of acidity, sulfate, and metal ions in AMD. Sulfate-reducing bioreactors (SRBRs) are an attractive means to treat AMD by reducing sulfate, increasing pH, and precipitating metals as metal sulfides. Twelve SRBRs were constructed and operated for 12 months to evaluate AMD bioremediation performance as a function of carbon source and inoculum. Several locally-sourced waste organic materials were characterized by carbon fractionation; two mixtures with the same carbon profile but originating from different sources were used as organic substrates. Microbial communities from two different soil types were used to inoculate the bioreactors. The use of cow manure, corncob, and pinewood as the carbon source and soil from a local pond shore as the inoculum resulted in the greatest bioremediation efficiency, with a pH increase from 2.85 to 6.80 and removals of 82% for total Fe2+, &#62 ; 86% for Cu2+, &#62 ; 88% for Zn2+, and > 65% for SO42-. The source of inoculum was found to impact bioremediation startup, with sulfate reduction observed 20 days earlier in high performing inocula. The carbon source was found to impact long-term bioremediation efficiency, with 24% more SO42- and 38% more Fe2+ removed by the best performing carbon sources. Altogether, the combination of manure as a carbon source and marina soil as an inoculum resulted in the highest bioremediation efficiency. The high metal and sulfate removals combined with pH increases to near neutral, validate the use of SRBRs as an effective method for long-term AMD bioremediation.

Accès au document

Insight into plant-bacteria-fungi interactions to improve plant performance via remediation of heavy metals: an overview

Authors: Kazemalilou S, Delangiz N, Lajayer BA, Ghorbanpour M

Source: book chapter: MOLECULAR ASPECTS OF PLANT BENEFICIAL MICROBES IN AGRICULTURE, Edited by: Sharma, V; Salwan, R; AlAni, LKT: 123-132, 2020, DOI: 10.1016/B978-0-12-818469-1.00010-9

Accès au document

Endophytic bacteria stimulate mercury phytoremediation by modulating its bioaccumulation and volatilization

Authors: Mello IS, Targanski S, Pietro-Souza W, and more ...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 202, 2020, DOI: 10.1016/j.ecoenv.2020.110818

Abstract: The quantification, efficiency, and possible mechanisms of mercury phytoremediation by endophytic bacteria are poorly understood. Here we selected 8 out of 34 previously isolated endophytic bacterial strains with a broad resistance profile to metals and 11 antibiotics: *Acinetobacter baumannii* BacI43, *Bacillus* sp. BacI34, *Enterobacter* sp. BacI14, *Klebsiella pneumoniae* BacI20, *Pantoea* sp.

BacI23, *Pseudomonas* sp. BacI7, *Pseudomonas* sp. BacI38, and *Serratia marcescens* BacI56. Except for *Klebsiella pneumoniae* BacI20, the other seven bacterial strains promoted maize growth on a mercury-contaminated substrate. *Acinetobacter baumannii* BacI43 and *Bacillus* sp. BacI34 increased total dry biomass by approximately 47%. The bacteria assisted mercury remediation by decreasing the metal amount in the substrate, possibly by promoting its volatilization. The plants inoculated with *Serratia marcescens* BacI56 and *Pseudomonas* sp. BacI38 increased mercury volatilization to 47.16% and 62.42%, respectively. Except for *Bacillus* sp. BacI34 and *Pantoea* sp. BacI23, the other six bacterial strains favored mercury bioaccumulation in plant tissues. Endophytic bacteria-assisted phytoremediation contributed to reduce the substrate toxicity assessed in different model organisms. The endophytic bacterial strains selected herein are potential candidates for assisted phytoremediation that shall help reduce environmental toxicity of mercury contaminated soils.

Accès au document

Efficient fungal and bacterial facilitated remediation of thiencarbazone methyl in the environment

Authors: Ahmad KS, Gul P, Gul MM

Source: ENVIRONMENTAL RESEARCH 188, 2020, DOI: 10.1016/j.envres.2020.109811

Abstract: Triazole herbicide, Thiencarbazone-methyl (TCM) applied on different crops for weedicidal activity is associated with an inherent toxicity towards bladder and urinary functionality. TCM has been first time explored for its biodegradative behavior utilizing microbes, previously isolated from soils. Simulated bio-transformation assemblies of five fungal strains; *Aspergillus fiavus* (AF), *Penicillium chrysogenum* (PC), *Aspergillus niger* (AN), *Aspergillus terrus* (AT), *Aspergillus fumigants* (AFu) and two bacterial strains: *Xanthomonas citri* (XC), *Pseudomonas syringae* (PS), were utilized. 10 mg/L TCM concentration was set up utilizing each microbe and analysed for 42 days. TCM bio-degradation was evaluated by UV-Visible spectrophotometery and gas chromatography mass spectroscopy. *Aspergillus terrus* (R-2 = 0.86) and Penicillium chrysogenum (R-2 = 0.88) exhibited highest capability to metabolize TCM while forming intermediate metabolites including ; 2,4-dihydro-[1,2,4] triazol-3-one, semicarbazide and urea, methyl 4-isocyanatosulfony1-5-methylthiophene-3-carboxylate. TCM degradation by all strains AF, AFu, AN, PC, AT, PS and XC was found to be 74, 74, 81, 95, 98, 90 and 95%, respectively after 42 days elucidating the effectiveness of all the utilized strains in degrading TCM. Current investigations can impact vital bioremediation approaches for pesticides mitigation from the ecological compartments. Furthermore, present research can be extended to the optimization of the bio-deteriorative assays to be employed on the practical scale for the successful management of environment through sustainable and cost effective ways.

Accès au document

Phytomanagement Reduces Metal Availability and Microbial Metal Resistance in a Metal Contaminated Soil

Authors: Xue K, Van Nostrand JD, Zhou JZ and more...

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.01899

Abstract: Short rotation coppice (SRC) with metal tolerant plants may attenuate the pollution of excessive elements with potential toxicity in soils, while preserving soil resources and functionality. Here, we investigated effects of 6 years phytomanagement with willow SRC on properties including heavy metal levels, toxicity tested by BioTox, microbial biomass, enzyme activities, and functional gene abundances measured by GeoChip of soils contaminated by

As, Cd, Pb and Zn, as compared to the same soils under non-managed mixed grassland representing no intervention treatment (Unt). Though metal total concentrations did not differ by SRC and Unt, SRC soils had lower metal availability and toxicity, higher organic carbon, microbial biomass, phosphatase, urease and protease activities, as compared to Unt soils. Significantly reduced abundances of genes encoding resistances to various metals and antibiotics were observed in SRC, likely attributed to reduced metal selective pressure based on less heavy metal availability and soil toxicity. SRC also significantly reduced abundances of genes involved in nitrogen, phosphorus, and sulfur cycles, possibly due to the willow induced selection. Overall, while the SRC phytomanagement did not reduce the total heavy metal concentrations in soils, it decreased the heavy metal availability and soil toxicity, which in turn led to less metal selective pressure on microbial communities. The SRC phytomanagement also reduced the abundances of nutrient cycling genes from microbial communities, possibly due to intense plant nutrient uptake that depleted soil nitrogen and phosphorus availability, and thus site-specific practices should be considered to improve the soil nutrient supply for phytomanagement plants.

Accès au document

Application of a simazine degrading bacterium, *Arthrobacter ureafaciens* XMJ-Z01 for bioremediation of simazine pollution

Authors: Zhu JW, Zhao Y, Fu L and more ...

Source: WATER AND ENVIRONMENT JOURNAL, 2020, DOI: 10.1111/wej.12560

Abstract: A bacterium named XMJ-Z01 is screened from soil and identified asArthrobacter ureafaciens, which can efficiently degrade simazine. The strain XMJ-Z01 is highly resistant to simazine and can tolerate simazine at a level of not less than 2000 mg/L. The degradation efficiency of simazine (100 mg/L) in liquid medium by strain XMJ-Z01 can reach about 99.1% in 7 days. Adding a small amount of fresh soil during the degradation of simazine (in culture medium) by strain XMJ-Z01 can improve the degradation efficiency. The use of strain XMJ-Z01 in simazine-contaminated farmland will accelerate the degradation of simazine residues in the soil and reduce its leakage into the deep soil; in addition, it is also beneficial to reduce the adverse effects of simazine on soil enzyme. Therefore, it is considered that strain XMJ-Z01 can be used for bioremediation of simazine pollution in soil.

Accès au document

Characterization and bioremediation potential of nickel-resistant endophytic bacteria isolated from the wetland plant *Tamarix chinensis*

Authors: Chen J, Li N, Han S, Sun YK and more ...

Source: FEMS MICROBIOLOGY LETTERS 367, 12, 2020, DOI: 10.1093/femsle/fnaa098

Abstract: Wetlands have been proposed as a sink for pollutants such as heavy metals. Wetland plants play a significant role in the phytoremediation of heavy metals. Here, we isolated and characterized three novel nickel (Ni)-resistant endophytic bacteria (NiEB) from the wetland plant *Tamarix chinensis*. The NiEB were identified as *Stenotrophomonas* sp. S20, *Pseudomonas* sp. P21 and *Sphingobium* sp. S42. All isolates tolerated 50 mg L-1 Ni, with isolates S20 and P21 being more tolerant to Ni at up to 400 mg L-1. Moreover, isolate S42 removed 33.7% of nickel sulfate from the water by forming white

precipitates. The three isolates exhibited different plant growth-promoting (PGP) traits related to the production of indole acetic acid (IAA), siderophores and 1-aminocyclopropane-1-carboxylate (ACC) deaminase. Phytotoxicity studies revealed that the growth of the wetland plants in a high Ni concentration (200 mg L-1) recovered after co-incubation with isolate S42. Overall, this study presents the first report of NiEB isolation from wetland plants and provides novel insights into the diverse functions of endophytic bacteria in a plant host with the potential to improve Ni phytoremediation.

Accès au document

A hyperaccumulator plant *Sedum alfredii* recruits Cd/Zn-tolerant but not Pb-tolerant endospheric bacterial communities from its rhizospheric soil

Authors: Wu Y, Ma LY, Zhang XC and more ...

Source: PLANT AND SOIL DOI: 10.1007/s11104-020-04684-0

Abstract: Aims For a metal hyperaccumulator plant *Sedum alfredii*, the recruitment of unique rhizospheric bacterial communities from bulk soils has been well studied. However, in the root-soil interface, the knowledge on the establishment of endospheric microbiomes from rhizospheric soil is still scarce. Methods In this study, we combined culture-independent that was 16S rRNA gene amplicon sequencing, and culture-dependent methods that included bacterial isolation, heavy metal tolerance and plant growth-promoting traits. Results The Cd/Zn concentrations in endosphere were significantly higher than in soil, while Pb concentration in endosphere was significantly lower than in soil. The alpha-diversity in rhizosphere soils was higher than in root endosphere, and the compartments as a major determinant revealed 85.9% of the taxa variations. The relative abundance ofProteobacteriaincreased in endosphere compared to rhizosphere. The difference of Cd/Zn tolerance between endospheric and rhizospheric isolates was not obvious, while the Pb tolerance of endospheric isolates significantly decreased compared to rhizosphere. Conclusions : The results suggest that S. alfredii recruits Cd/Zn-tolerant but not Pb-tolerant endospheric bacterial communities from its rhizospheric soil. The difference in the microbial structure and function in the root-soil interface might be related to the selective absorption of metals in S. *alfredii*.

Accès au document

Bacterial bioaugmentation enhances hydrocarbon degradation, plant colonization and gene expression in diesel-contaminated soil

Authors: Ummara U, Noreen Si, Afzal M, Ahmad P

Source: PHYSIOLOGIA PLANTARUM 2020, DOI: 10.1111/ppl.13171

Abstract: Environmental contamination by hydrocarbons is a major problem, and hydrocarbon accumulation in soil poses hazardous threat to ecosystems. Phytoremediation, which involves plants, is an encouraging technique for the removal of hydrocarbons from polluted soil and water. The purpose of this investigation was to examine whether bacterial inoculation enhanced the phytoremediation of hydrocarbons in diesel-contaminated soil vegetated with maize (Zea maysL.). The two cultivars of maize, MMRI Yellow and Pearl White, were planted in diesel-polluted soil (0, 1.5, 2.5, and 3.5 g diesel kg(-

1)soil), and inoculated with the consortium of three alkane-degrading bacterial strains, *Arthrobacter oxydans* ITRH49, *Pseudomonas* sp. ITRI73 and *Pseudomonas* sp. MixRI75. Bacterial inoculation enhanced plant growth and hydrocarbon degradation. Between two cultivars, MMRI Yellow showed better growth and hydrocarbon degradation in the presence and absence of bacterial inoculation. Maximum hydrocarbon degradation (80%) was observed in the soil having minimum concentration of diesel (1.5 g kg(-1)soil), and vegetated with bacterial inoculated MMRI Yellow maize cultivar. Furthermore, more bacterial colonization, and abundance and expression of the alkane hydroxylase gene (alkB) were observed in the root interior than in the rhizosphere and shoot interior of the plants. The bacteria-mediated phytoremediation of soil contaminated with hydrocarbons suggested that the collective use of plants and bacteria was the most beneficial approach for the reclamation of diesel-contaminated soil in comparison with vegetation alone.

Accès au document

The modulation of sugarcane growth and nutritional profile under aluminum stress is dependent on beneficial endophytic bacteria and plantlet origin

Authors: Labanca ERG, Andrade SAL, Kuramae E. E, Silveira APD

Source: APPLIED SOIL ECOLOGY 156, 2020, DOI: 10.1016/j.apsoil.2020.103715

Abstract: Plant growth-promoting bacteria (PGPB) are claimed to not only improve plant fitness but also alleviate plant stress. In this study, we evaluated the effect of five PGPB strains on plantlet growth and nutrient and aluminum (Al) uptake under acid soil conditions characterized by low P and K nutrient availability and high metal and aluminum (Al) bioavailability, which may represent a stress condition for crop plants. The PGPB strains were inoculated in sugarcane plantlets produced by meristem tissue culture (MCPs) or one-bud stalks (O-BSPs) and cultivated in soil at 37% Al saturation and pH 4.0. Biomass accumulation and Al and nutrient content in roots and shoots were determined after 30 days of growth. Bacterial inoculation increased root and shoot biomass. However, the magnitudes of these increases were dependent on bacterial strain and plantlet origin. The inoculated plantlets exhibited increased Al content and shifts in Al allocation and calcium (Ca) and boron (B) content among different plant parts (root or shoot), and these changes also depended on plantlet origin and the inoculated strain. The higher Ca uptake of inoculated MCPs and higher B uptake of inoculated O-BSPs may have contributed to reducing the damage caused by excessive Al content. The beneficial microbes also caused changes in plant uptake of micronutrients and slightly reduced macronutrient content. Pseudomonas fluorescens (IAC/BECa 141), Kosakonia radicincitans (IAC/BECa 95), Paraburkholderia tropica (IAC/BECa 135) and Herbaspirillum frisingense (IAC/BECa 152) showed potential for alleviating Al stress in sugarcane plantlets.

Accès au document

Acclimatization of a newly isolated bacteria in monomer tere-phthalic acid (TPA) may enable it to attack the polymer poly-ethylene tere-phthalate (PET)

Authors: Kumar, V., Maitra, SS., Singh, R., Burnwal, DK.

Source: JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING 8, 4, 2020, DOI: 10.1016/j.jece.2020.103977

https://doi.org/10.15454/6MQT-0H51

Abstract: Environmental persistence of polyethylene terephthalate (PET) has become a vexing problem. PET is a very popular polymer for many desirable properties, especially as a food grade polymer. It is being produced in large quantities and the entire production is not recycled. A large quantity of PET is finding its way to the Municipal Solid Waste (MSW) dumps and even to rivers as microplastics. There are various methods for PET degradation, among which bio-degradation is most environmentally friendly and technologically suitable. Some metagenomic studies have been conducted for isolation of PET degrading bacteria/enzymes. However, all previous studies deal with bacteria directly isolated from contaminated sites. We have isolated one such bacteria Rhococcus sp. SSM1 from a PET rich MSW dump of New Delhi. However, we did not use the bacteria directly for PET degradation. We forced the bacteria to grow on the monomer terephpthalic acid (TPA), the monomer, as the only carbon source for generations. Surprisingly, the Rhococcus sp. SSM1 acclimatized to grow on TPA, was able to attack PET flims, the polymer, resulting in some degradation of the material. This was evidenced by presence of more TPA concentration than supplied at certain time of fermentation and many heavy molecules (heavier than TPA) in the fermentation media which can only come only by degradation of PET. This is a new paradigm in biodegradation research, where acclimatization in the monomer enables a bacteria to attack the polymer. However, we are not claiming that the bacteria can biodegrade bulk PET. It is perhaps surviving on TPA and attacking the surface of the polymer, which is microscopically rough. Bacteria may be recognizing some protruding fingers di, tri or n-mers of TPA from polymer surface and attacking them.

Accès au document

Structure of microbial communities in amended and unamended acid-generating mine wastes along gradients of soil amelioration and revegetation

Authors: Asemaninejad A, Munford K, Watmough S and more ....

Source: APPLIED SOIL ECOLOGY 155, 2020, DOI: 10.1016/j.apsoil.2020.103645

Abstract: Understanding the structure of microbial communities in acidic, metal contaminated tailings and waste rock in cool, continental northern temperate climates is important for identifying their potential for use in phytostabilization and bioremediation programs. In this study, microbial community compositions across two large mine waste sites in the Sudbury basin, Ontario Canada were analyzed along gradients of barren-to-vegetated tailings and waste rock. Microbial communities were less diverse, more homogenous, and mainly chemolithoautotrophic in barren sites, transitioning to more diverse communities of organoheterotrophs, nitrogen-fixing/plant-growth promoting bacteria, and ectomycorrhizal fungi in the vegetated areas. Co-occurrence analyses of microbial communities demonstrated higher levels of association among microbial groups in the barren tailings, which were related to the extreme environmental and chemical conditions and restricted anabolic nutrient availability of the substrates. We also show that vegetation and plant-derived organic matter in the tailings are associated with the shifts observed in the structure of microbial communities towards more soil-like communities. These changes in microbial communities can improve soil fertility through increased rates of heterotrophic decomposition of plant-derived organic matter, and sequentially further aid in the establishment of vegetation. These findings will help develop phytostabilization approaches in mine tailings and waste rock in cool, continental northern temperate and boreal climates.

Accès au document

Microbial approach for alleviation of potentially toxic elements in agricultural soils

Authors: Alves LD, Nunes FC, Santos ID and more ...

Source: Book chapter: CLIMATE CHANGE AND SOIL INTERACTIONS Edited by:Prasad, MNV; Pietrzykowski, M: 271-303, 2020, DOI: 10.1016/B978-0-12-818032-7.00010-2

Accès au document

Microbial insights into the biogeochemical features of thallium occurrence: A case study from polluted river sediments

Authors: Wang J, She JY, Zhou YC and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 739, 2020, DOI: 10.1016/j.scitotenv.2020.139957

Abstract: Thallium (Tl) is a trace element with extreme toxicity. Widespread Tl pollution in riverine systems, mainly due to escalating mining and smelting activities of Tl-bearing sulfide minerals, has attracted increasing attention. Insights into the function of the microbial communities with advanced characterization tools are critical for understanding the biogeochemical cycle of Tl. Herein, microbial communities and their adaptive evolution strategies in river sediments from a representative Tl-bearing pyrite mine area in southern China were profiled via 16S rRNA gene sequence analysis and shotgun metagenomic analysis. In total, 64 phyla and 778 genera of microorganisms were observed in the studied sediments. The results showed that pH, Tl, Pb, Zn and total organic carbon (TOC) had a significant influence on microbial community structure. Some important reductive microorganisms (such as Erysipelothrix, Geobacter, desulfatiferula, desulfatihabadium and fusibacter) were involved in the biogeochemical cycle of Tl. The ruv, rec, ars and other resistance genes enhanced the tolerance of microorganisms to Tl. The study suggested that relevant C, N and S cycle genes were the main metabolic paths of microorganisms surviving in the high Tl-polluted environment. The findings were critical for establishment, operation and regulation in the microbial treatment of Tl containing or related wastewater.

Accès au document

The Immobilization of Soil Cadmium by the Combined Amendment of Bacteria and Hydroxyapatite

Authors: Zeng XX, Xu H, Lu J, and more ...

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-58259-1

Abstract: The remediation of heavy metal-contaminated soils has attracted increased attention worldwide. The immobilization of metals to prevent their uptake by plants is an efficient way to remediate contaminated soils. This work aimed to seek the immobilization of cadmium in contaminated soils via a combination method. Flask experiments were performed to investigate the effects of hydroxyapatite (HAP) and the *Cupriavidus* sp. strain ZSK on soil pH and DTPA-extractable cadmium. Pot experiments were carried out to study the effects of the combined amendment on three plant species. The results showed that HAP has no obvious influence on the growth of the strain. With increasing concentrations of HAP, the soil pH increased, and the DTPA-extractable Cd decreased. Via the combined amendment of the

strain and HAP (SH), the DTPA-extractable Cd in the soil decreased by 58.2%. With the combined amendment of the SH, the cadmium accumulation in ramie, dandelion, and daisy decreased by 44.9%, 51.0%, and 38.7%, respectively. Moreover, the combined amendment somewhat benefitted the growth of the three plant species and significantly decreased the biosorption of cadmium. These results suggest that the immobilization by the SH combination is a potential method to decrease the available cadmium in the soil and the cadmium accumulation in plants.

Accès au document

Diversity of Metal-Resistant and Tensoactive-Producing Culturable Heterotrophic Bacteria Isolated from a Copper Mine in Brazilian Amazonia

Authors: Domingues VS, Monteiro AD, Lopes JDL and more ...

Source: SCIENTIFIC REPORTS 10, 1, 2020, DOI: 10.1038/s41598-020-62780-8

Abstract: Bacterial extracellular polymeric substances (EPSs) present diverse properties of biotechnological interest, such as surface modification, metal adsorption and hydrophobic substances solubilization through surface tension reduction. Thus, there is a growing demand for new producing strains and structurally variable biomolecules with different properties. One approach for scanning this biodiversity consists of exploring environments under selective pressures. The aim of this study was to evaluate the composition of culturable heterotrophic bacterial communities from five different sites from a copper mine in the Amazon biome by an enrichment technique to obtain metal resistant bacteria (lead, arsenic, cadmium, copper and zinc) capable of producing EPSs. The bacterial densities at the sites varied from 2.42 x 10(3) to 1.34 x 10(8) NMP mL (-1) and the 77 bacterial isolates obtained were classified in four divisions, beta-Proteobacteria (16.88%), gamma-Proteobacteria (7.29%), Firmicutes (61%) and Actinobacteria (12.98%). Bacillus, Alcaligenes, and Lysinibacillus were the most dominant among the 16 observed genera, but the relative frequency of each varied according to the sample and the metal used in the enrichment culture. 58% of the bacterial strains (45) could produce EPSs. From these, 33 strains showed emulsifying activity (E-24), and 9 of them reached values higher than 49%. Only *Actinomyces viscosus* E3.Pb5 and *Bacillus subtilis* group E3. As2 reduced the medium surface tension to values lower than 35 mN m(-1). It was possible to confirm the high presence of bacteria capable of producing EPSs with tensoactive properties in Amazon copper mines and the evolutionary pressure exerted by the heavy metals during enrichment. These molecules can be tested as an alternative for use in processes that involve the removal of metals, such as the bioremediation of contaminated environments.

Accès au document

Responses of soil and earthworm gut bacterial communities to heavy metal contamination

Authors: Liu Pe, Yang Y, Li M

Source: ENVIRONMENTAL POLLUTION 265, PT A, A, 2020, DOI: 10.1016/j.envpol.2020.114921

Abstract: The large accumulation of heavy metals in the soil surrounding steel factories has become a severe environmental problem. However, few studies have focused on how the earthworm gut microbiota responds to heavy metals in the soil. This study used research sites at a steel factory in Nanjing, China, to investigate how the soil bacterial community and earthworm gut microbiota respond differently to

heavy metal contamination using Illumina high-throughput sequencing targeting 16S rRNA genes. The bacterial community of earthworm guts showed a distinct structure compared with that of the soil, featuring a higher relative abundance of Proteobacteria (45.7%) and Bacteroidetes (18.8%). The bacterial community in the earthworm gut appeared more susceptible to heavy metal contamination compared with the soil community. For example, we identified 38 OTUs (Operational taxonomic units) significantly influenced by contamination among 186 abundant OTUs in the soil, whereas 63 out of the 127 abundant OTUs in the earthworm gut were altered significantly under contamination. This susceptibility may be partly explained by the lower alpha diversity and distinct microbial interactions in the gut. In addition, the accumulation of heavy metals also stimulated the growth of potential plant growth promoting bacteria (PGPB) in the earthworm gut, especially those related to indole-3-acetic acid (IAA) and 1-aminocyclopropane-1-carboxylic acid deaminase (ACCD) production, which may potentially benefit the phyto-remediation of heavy metals. These results contribute to our understanding of the soil biota and its interactions under heavy metal contamination and may provide further insights into the phytoremediation of metal-contaminated soil.

Accès au document

Effect of biochar on Cd and pyrene removal and bacteria communities variations in soils with culturing ryegrass (*Lolium perenne* L.)

Authors: Li GR, Chen FK, Jia SY and more ...

Source: ENVIRONMENTAL POLLUTION 265, PT A, A, 2020, DOI: 10.1016/j.envpol.2020.114887

Abstract: Organic contaminations and heavy metals in soils cause large harm to human and environment, which could be remedied by planting specific plants. The biochars produced by crop straws could provide substantial benefits as a soil amendment. In the present study, biochars based on wheat, corn, soybean, cotton and eggplant straws were produced. The eggplant straws based biochar (ESBC) represented higher Cd and pyrene adsorption capacity than others, which was probably owing to the higher specific surface area and total pore volume, more functional groups and excellent crystallization. And then, ESBC amendment hybrid Ryegrass (*Lolium perenne* L.) cultivation were investigated to remediate the Cd and pyrene co-contaminated soil. With the leaching amount of 100% (v/w, mL water/g soil) and Cd content of 16.8 mg/kg soil, dosing 3% ESBC (wt%, biochar/soil) could keep 96.2% of the Cd in the 10 cm depth soil layer where the ryegrass root could reach, and it positively help root adsorb contaminations. Compared with the single planting ryegrass, the Cd and pyrene removal efficiencies significantly increased to 22.8% and 76.9% by dosing 3% ESBC, which was mainly related with the increased plant germination of 80% and biomass of 1.29 g after 70 days culture. When the ESBC dosage increased to 5%, more free radicals were injected and the ryegrass germination and biomass decreased to 65% and 0.986 g. Furthermore, when the ESBC was added into the ryegrass culture soil, the proportion of Cd and pyrene degrading bacteria Pseudomonas and Enterobacter significantly increased to 4.46% and 3.85%, which promoted the co-contaminations removal. It is suggested that biochar amendment hybrid ryegrass cultivation would be an effective method to remediate the Cd and pyrene co-contaminated soil.

Accès au document

Bacillus aryabhattai FACU: A promising bacterial strain capable of manipulate the glyphosate herbicide residues

Authors: Elarabi NI, Abdelhadi AA, Ahmed RH and more ...

https://doi.org/10.15454/6MQT-0H51

Source: SAUDI JOURNAL OF BIOLOGICAL SCIENCES 27(9):2207-2214, 2020, DOI: 10.1016/j.sjbs.2020.06.050

Abstract: Glyphosate is a commonly used organophosphate herbicide that has an adverse impact on humans, mammals and soil microbial ecosystems. The redundant utilize of glyphosate to control weed growth cause the pollution of the soil environment by this chemical. The discharge of glyphosate in the agricultural drainage can also cause serious environmental damage and water pollution problems. Therefore, it is important to develop methods for enhancing glyphosate degradation in the soil through bioremediation. In this study, thirty bacterial isolates were selected from an agro-industrial zone located in Sadat City of Monufia Governorate, Egypt. The isolates were able to grow in LB medium supplemented with 7.2 mg/ml glyphosate. Ten isolates only had the ability to grow in a medium containing different concentrations of glyphosate (50, 100, 150, 200 and 250 mg/ml). The FACU3 bacterial isolate showed the highest CFU in the different concentrations of glyphosate. The FACU3 isolate was Gram-positive, spore-forming and rod-shape bacteria. Based on API 50 CHB/E medium kit, biochemical properties and 16S rRNA gene sequencing, the FACU3 isolate was identified as Bacillus aryabhattai. Different bioinformatics tools, including multiple sequence alignment (MSA), basic local alignment search tool (BLAST) and primer alignment, were used to design specific primers for goxB gene amplification and isolation. The goxB gene encodes FAD-dependent glyphosate oxidase enzyme that responsible for biodegradation process. The selected primers were successfully used to amplify the goxB gene from Bacillus aryabhattai FACU3. The results indicated that the Bacillus aryabhattai FACU3 can be utilized in glyphosate-contaminated environments for bioremediation. According to our knowledge, this is the first time to isolate of FAD-dependent glyphosate oxidase (goxB) gene from Bacillus aryabhattai. (C) 2020 Published by Elsevier B.V. on behalf of King Saud University.

Accès au document

Effects of liquid digestate on the valence state of vanadium in plant and soil and microbial community response

Authors: Aihemaiti A, Gao YC, Liu L and more ...

Source: ENVIRONMENTAL POLLUTION 265, PT A, A, 2020, DOI: 10.1016/j.envpol.2020.114916

Abstract: Liquid digestate containing high levels of nutrients and humic and fatty acids can affect vanadium species and their plant uptake. To elucidate the effects of liquid digestate on the valence state of vanadium in soil and plant tissue, as well as its effects on the microbial community and soil properties, we grew green bristlegrass (Setaria viridis), a native plant capable of growing in vanadium mining areas, in vanadium-contaminated soils sampled from a mining area and treated it with 5% and 10% liquid digestate for 90 d, respectively. Changes in the concentrations of pentavalent (V[V]) and tetravalent (V[IV]) vanadium in the soils and the shoots and roots of bristlegrass and the soil microbial abundance were measured. The results showed that vanadium existed mainly in the form of V(IV) in the soil but accumulated mainly in the form of V(V) in the bristlegrass. Liquid digestate markedly reduced V(V) concentrations in the soils (by up to 45%) and in the shoots and roots of green bristlegrass (by up to 98%). Liquid digestate enhanced the abundance of Bacteroidetes, which can reduce V(V) to lower valence state. Microbial reduction and phosphorus immobilization were responsible for downregulating V(V) concentrations in the plant and soil. The liquid digestate can be used to enhance in situ bioremediation of vanadium-contaminated soil in mining area.

Accès au document

https://doi.org/10.15454/6MQT-0H51

ERA / PUBLICATIONS SCIENTIFIQUES / PESTICIDES ET FAUNE SAUVAGE

Multiscale habitat mediates pest reduction by birds in an intensive agricultural region

Authors: Heath SK, and Long RF

Source: *Ecosphere* 10(10):e02884, 2019, DOI: 10.1002/ecs2.2884

Abstract: (...) Effectiveness of local habitat enhancement and subsequent pest reduction services can be mediated by the amount of habitat at larger scales. We tested whether the presence and increase of local and landscape scale bird habitat increased avian predator abundance and pest reduction by birds. We surveyed birds and performed a sentinel prey exclosure experiment in walnut orchards in the Sacramento Valley, California, USA—comparing predation probability between orchards with (n = 10) and without (n = 10) woody habitat in uncultivated orchard margins. (...)

Accès au document

Birds suppress pests in corn but release them in soybean crops within a mixed prairie/agriculture system

Authors: Garfinkel MB, Minor ES, Whelan CJ

Source: The Condor, 122(2):1-12, 2020, DOI: 10.1093/condor/duaa009

Abstract: Birds provide ecosystem services (pest control) in many agroecosystems (...). We studied indirect effects of insectivorous birds on corn and soybean crops in fields adjacent to a prairie in Illinois (USA). (...) We used bird-excluding cages over crops to examine the net effect of birds on corn and soybean grain yield. We also conducted DNA metabarcoding to identify arthropod prey in fecal samples from captured birds. (...) We estimated that birds in this system provided a service worth approximately US $275 ha-1 in corn yield gain, and a disservice valued at approximately $348 ha-1 in soybean yield loss. (...).

Accès au document

Yellow-legged gull eggs (*Larus michahellis*) as persistent organic pollutants and trace metal bioindicator for two nearby areas with different human impact

Authors: Viñas L, Besada V, Pérez-Fernández B, Bode A

Source: Environmental Research, 190:110026, 2020, DOI: 10.1016/j.envres.2020.110026

Abstract: The concentration of different persistent organic pollutants (POPs including chlorinated and brominated compounds) and trace metals and metalloids (As, Cd, Cu, Cr, Pb, Hg, Ni, and Zn) was examined in eggs from two colonies of yellow-legged gulls. (...) Statistically significant differences for the two colonies were observed for Hg, the sum of 7 CBs, the sum of DDTs y and the sum of 9 PBDEs, with values that could be causing some toxic effects (...) The estimated isotopic niche was also calculated, based on δ15N and δ13C, for the two colonies, pointing to a wider diet in the Cíes colony when compared to the diet in the Vigo colony. (...)

Accès au document

Glyphosate-based herbicides influence antioxidants, reproductive hormones and gut microbiome but not reproduction: A long-term experiment in an avian model

Authors: Ruuskanen S, Rainio MJ, Gómez-Gallego C, Selenius O, Salminen S, Collado MC, Saikkonen K, Saloniemi I, Helander M

Sources: ENVIRONMENTAL POLLUTION, 2020, DOI:10.1016/j.envpol.2020.115108

Abstract: Glyphosate-based herbicides (GBHs) residues may expose non-target organisms to health risks, yet the developmental and cumulative effects of GBHs on physiology and reproduction remain poorly understood. We present the first long-term study on the effects of subtoxic GBH exposure (160 mg/kg) on multiple key physiological biomarkers (...), gut microbiome, reproductive hormones, and reproduction in an avian model (...) Japanese quail females and males (Cotumix japonica) (...) Future studies are needed to characterize the effects on reproductive physiology in more detail. (...)

Accès au document

Exposure Impacts of Environmentally Relevant Concentrations of a Glufosinate Ammonium Herbicide Formulation on Larval Development and Thyroid Histology of *Xenopus laevis*

Authors: Babalola OO, Truter JC, Archer E, van Wyk JH et al

Source: ARCHIVES OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY, 2020, DOI: 10.1007/s00244-020-00758-3

Abstract: (...) These complex activities of thyroid hormones are prone to disruption by agricultural pesticides, often leading to modulation of growth and the reproductive system in particular. (...) In this study, the standardized Xenopus Metamorphosis Assay protocol was used to assess the potential thyroid-modulatory properties of the Glufosinate ammonium Basta formulation, at relevant environmental concentrations (...) The present study confirmed that this Basta formulation interacts with the thyroid axis and therefore potentially pose health hazard to amphibian (...)

Accès au document

Cypermethrin- and fipronil-based insecticides cause biochemical changes in *Physalaemus gracilistadpoles*

Authors: Rutkoski CF, Macagnan N, Folador A, Skovronski VJ et al

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI:10.1007/s11356-020-10798-w

Abstract: Insecticides used for agricultural pest control, as cypermethrin-based insecticide (CBI) and fipronil-based insecticide (FBI), are constant threats to non-target aquatic organisms. This study aimed to investigate the effect of different concentrations of cypermethrin and fipronil on neurotoxicity and oxidative stress inPhysalaemus gracilis. (...) both insecticides promoted oxidative stress and neurotoxic effects in *P. gracilis* tadpoles. (...)

Accès au document

Organochlorine pesticide residues in feathers of four bird species from western part of Turkey

Authors: Arikan K, Turan SL

Source: TURKISH JOURNAL OF ZOOLOGY 2020, DOI: 10.3906/zoo-2005-52

Abstract: (...) The purpose of the study was to investigate OCP residue levels in wild birds from Aegean, Marmara, Mediterranean, and Central Anatolia geographical regions of Turkey. Feather samples (n = 80) of four bird species in four regions (...) Feather samples were analysed using GC/MS and scanned for 23 pesticide congeners. (...) Regions and birds differed significantly as well as among themselves in terms of total residue levels (...)

Accès au document

A micronucleus assay detects genotoxic effects of herbicide exposure in a protected butterfly species

Authors: Santovito A, Audisio M, Bonelli S

Source: Ecotoxicology 2020, DOI: 10.1007/s10646-020-02276-3

Abstract: (...) We investigated, by micronucleus (MN) assay, the genotoxic effect of glyphosate, a common herbicide, on *L. dispar* larvae. (...) In a control/treatment experiment, we extracted epithelial cells from last-instar larvae fed with *Rumex* spp. plants sprayed with a solution containing 3.6 g/L of glyphosate, and from larvae fed with unsprayed plants. (...) For the first time, a MN assay was used in order to evaluate the genomic damage on a phytophagous invertebrate at the larval stage. (...)

Accès au document

Legacy and Contaminants of Emerging Concern in Tree Swallows Along an Agricultural to Industrial Gradient: Maumee River, Ohio

Authors: Custer CM, Custer TW, Dummer PM, Schultz S, Tseng CY, Karouna-Renier N, Matson CW

Source: Environ Toxicol Chem 2020, DOI: 10.1002/etc.4792

Abstract: Exposure to multiple classes of contaminants, both legacy and contaminants of emerging concern (CECs), were assessed in tree swallow (*Tachycineta bicolor*) tissue and diet samples from 6 sites along the Maumee River, Ohio, USA, to understand both exposure and possible effects of exposure to those CECs for which there are little avian data. The 6 sites represented a gradient from intensive agriculture upstream to highly urbanized and industrial landscapes downstream (...) This is one of the most comprehensive assessments to date of exposure and effects of a wide variety of CECs in birds.

Accès du document

Genotoxicity in American kestrels in an agricultural landscape in the Baja California peninsula, Mexico

Authors: Frixione MG, Rodríguez-Estrella R

Sources: Environ Sci Pollut Res 2020, DOI: 10.1007/s11356-020-10392-0

Abstract: Raptors as top predators have been used as effective sentinels of environmental stressors in agricultural areas worldwide. Pollutants in agricultural areas have negative

effects on top predator populations. Biomarkers such as erythrocyte nuclear abnormalities have been used as an effective measure of genotoxicity caused by exposure—particularly short-term exposure—to pollutants. We took blood samples from 54 wild specimens of American kestrel (Falco sparverius), (...). We found a high frequency of abnormalities in numerous individuals, similar to those found in raptors from highly polluted areas. (...).

Accès au document

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

Ecotoxicology of strobilurin fungicides

Strobilurin fungicides (SFs), a class of new fungicides, use strobilurin A as a lead compound. However, with excessive production and usage, the SF residues in soil and aquatic ecosystems may lead to environmental pollution. The mechanism of action (MOA) of SFs is respiratory inhibition of fungal mitochondria. (...)

Accès au document

Sub-Lethal Effects of Pesticides on the DNA of Soil Organisms as Early Ecotoxicological Biomarkers

This review describes the researches performed in the last years to assess the impact of pesticide sub-lethal doses on soil microorganisms and non-target organisms in agricultural soil ecosystems. (...)

Accès au document

A two years field experiment to assess the impact of two fungicides on earthworm communities and their recovery

Recent EFSA (European Food Safety Authority) reports highlighted that the ecological risk assessment of pesticides needed to go further by taking more into account the impacts of chemicals on biodiversity under field conditions. We assessed the effects of two commercial formulations of fungicides separately and in mixture, i.e., (...) copper oxychloride (...) epoxiconazole (...) dimoxystmbin (...) on earthworms at 1, 6, 12, 18 and 24 months after the application (...) in field situations.

Accès au document

A biological characteristic extrapolation of compound toxicity for different developmental stage species with toxicokinetic-toxicodynamic model

Intraspecific difference in toxicity brings uncertainty to ecological risk assessment (ERA) and water quality criteria (WQC) of chemicals. Here, we compared intraspecies sensitivity to toxicants for *Mesocyclops ieuckarti* of which toxicity data was obtained from published literatures, and zebrafish *Danio rerio* of which toxicity data was done in this study). (...)

Accès au document

https://doi.org/10.15454/6MQT-0H51

What are the effects of PFAS exposure at environmentally relevant concentrations?

(...) little data exists on the effects of exposure to PFAS at environmentally relevant concentrations and this hampers the effective management of these compounds. This paper reviews current research on the occurrence and ecotoxicology of PFAS at environmentally relevant doses to assess their potential biological impacts.

Accès au document

Transcriptome, bioaccumulation and toxicity analyses of earthworms (*Eisenia fetida*) affected by trifloxystrobin and trifloxystrobin acid

As a promising fungicide, the potential environmental risk of trifloxystrobin (TFS) and its main metabolism trifloxystrobin acid (TFSA) in soil environment should be given special attention. The present study investigated the potential risks of TFS and TFSA in soil environment to earthworms (*Eisenia fetida*) through measuring several biomarkers.

Accès au document

Novel Pesticide Risk Indicators for Aquatic Organisms and Earthworms

There are many approaches of pesticide risk assessment. Despite their variation in difficulty and information complexity, all of them are intended to predict the actual pesticide risk as accurately as possible, i.e., to predict the behavior and hazard of a pesticide in the environment with high precision. The aim of this study was to develop a risk indicator of pesticide's negative impact on soil and aquatic organisms.

Accès au document

Biochemical response, histopathological change and DNA damage in earthworm (*Eisenia fetida*) exposed to sulfentrazone herbicide

(...) we know little about the impact of sulfentrazone on ecologically important soil earthworms such as Eisenia fetida. Thus, we investigated the toxicity of sulfentrazone (0.2, 1.0 and 5.0 mg/kg in soil) on *E. fetida* at day 7, 14, 21 and 28. We investigated the effects of sulfentrazone on oxidative stress, histopathological change, and DNA damage in earthworms. (...)

Accès au document

Sub-lethal effects of the pesticide imazalil on the earthworm *Eisenia andrei*: reproduction, cytotoxicity, and oxidative stress

Although considered an emerging contaminant and detected in the environment, the systematic and penetration fungicide imazalil ((RS)-1-(beta-allyloxy-2,4-dichlorophenylethyl) imidazole) has received relatively little scientific attention with regard to its possible negative effects in the environment. Only a few toxicological studies have assessed the potential environmental effect of imazalil and its impact on organisms. In this context, the aim of the present study is to evaluate the effects of different concentrations of the pesticide imazalil on the

earthwormEisenia andreiin acute contact and chronic tests in natural soil.

Accès au document

Interactive effect of glyphosate-based herbicides and organic soil layer thickness on growth and reproduction of the tropical earthworm *Pontoscolex corethrurus* (Muller, 1857)

Glyphosate-based herbicides (GBHs) have negative effects on the fitness parameters of earthworms; however, these effects may vary from one commercial product to another and between different recommended doses. Additionally, frequent applications of GBHs may decrease the thickness of the topsoil layer due to increased soil erosion through vegetation reduction. To investigate the effects of frequent applications of GBHs, and their interactive effect on the performance of *P. corethrurus*, we performed a two-factor experiment (...)

Accès au document

More frequent droughts slow down litter decomposition across European agroecosystems and increase the importance of earthworm functional diversity

Effects of increasing rainfall variability and weather extremes on litter decomposition are still uncertain, especially in agroecosystems, where the functional structure of soil communities is already affected. We conducted a mesocosm experiment to evaluate the impacts of different rain regimes and land management on litter mass loss and earthworm ecological groups (epigeic, endogeic and anecic) across European agroecosystems.

Accès au document

DROIT ET POLITIQUE DE L'ENVIRONNEMENT

Drinking Water Directive

On 1 February 2018 the Commission proposed the recast of Council Directive 98/83/EC on the quality of water intended for human consumption (the 'Drinking Water Directive'). The proposal aimed to update parameters set over 20 years ago, correct shortcomings and introduce access to water in response to the first ever European citizens' initiative 'Right2Water'.

After intense negotiations, an agreement was found between the co-legislators in December 2019, and in February 2020 the ENVI Committee approved the outcome of the negotiations. The Council adopted its first reading on 23 October 2020. The adoption of the EP second reading is foreseen in December Plenary.

The agreed text will ensure that tap water across the EU is safe to drink. Under the new rules, the quality standards for drinking water are brought up to date, a cost-effective risk-based approach to monitoring water quality is introduced as well as hygienic requirements for materials in contact with drinking water.

The recast also addresses growing concern about the effects of endocrine disruptors, pharmaceuticals and microplastics on human health by introducing a watch list mechanism which will allow to follow up, in a dynamic and

flexible way, on new knowledge about these substances and their relevance for human health.

Accès au document

Reducing agricultural ammonia emissions: benefits and costs

Ammonia (NH3) emissions associated with the agriculture sector contribute to the production of fine particulate matter (PM2.5) pollution and may be associated with premature mortality. This study assesses the economic costs and benefits associated with reducing emissions in the agricultural sector. To do this, it uses emissions data from 2016 to assess the costs and benefits of achieving the 2020 ammonia emission reduction commitments, as set out in the National Emission reduction Commitments Directive (NECD) 2016/2284/

EU1, in relation to four abatement options. The results suggest that compliance with the directive may be associated with significant reductions in premature mortality, and that the economic benefits of avoiding premature mortality might outweigh the costs of abatement.

Environment 5th October 2020 / Issue 549

Source: Giannakis, E., Kushta, J., Bruggeman. A. and Lelieveld J. (2020). Costs and benefits of agricultural ammonia emission abatement options for compliance with European air quality regulations. Environmental Sciences Europe 31: 93. https://doi.org/10.1186/s12302-019-0275-0

Accès au document

Impact des polluants en mélange: un appel à projets de recherche est ouvert

Actu-environnement 07/10/20

Clôture : 01/12/2020

L'Ademe ouvre, jusqu'au 1er décembre 2020, un appel à projets de recherche dans le cadre du « Programme impacts 2020 ». L'objectif est de soutenir des projets de recherche et de développement portant sur l'impact des mélanges de polluants sur le vivant. Les projets devront porter sur les effets sanitaires d'une exposition aux polluants de l'air ; les micro-organismes pathogènes, les agents biologiques, les virus ; la pollution des sols ; l'économie circulaire et les filières à retenir ; la santé des sols, l'agriculture urbaine et les projets alimentaires territoriaux ou encore l'approche territoriale d'évaluation du risque lié à des expositions multiples. Ils pourront bénéficier d'une subvention allant de 45 000 à 200 000 € par projet pour une durée de trois ans maximum.

Accès au document

Qualité de l'air : l'Ademe regroupe ses programmes de recherche dans l'appel à propositions unique Aqacia

Actu-environnement 17/09/20

Le 16 septembre, l'Agence de la transition écologique (Ademe) a lancé le premier appel à propositions de recherche (APR) de son nouveau programme « amélioration de la qualité de l'air : comprendre, innover, agir » (Aqacia). Les candidatures sont ouvertes jusqu'au 27 novembre 2020. Ce programme « a pour ambition de faire émerger des projets de recherche & développement orientés vers la compréhension et l'amélioration de la qualité de l'air intérieur et extérieur », résume l'Ademe. Il prend le relais de différents programmes de recherche : Primequal,

https://doi.org/10.15454/6MQT-0H51

Cortea, Aactair-volet R&D et partiellement d'Impacts-volet Air. [...]

Accès au document

REGLEMENTATION / DROIT

Limites maximales applicables aux résidus de 1,4diaminobutane, de 1méthylcyclopropène, d'acétate d'ammonium, de bifénazate, de chlorantraniliprole, de chlorméquat, de cyprodinil, de chaux, de mandipropamide, de poivre, de pyridaben, de la substance «répulsifs: farine de sang», d'extraits d'algues et de chlorhydrate de triméthylamine, présents dans ou sur certains produits

RÈGLEMENT (UE) 2020/1565 DE LA COMMISSION du 27 octobre 2020 modifiant les annexes II, III et IV du règlement (CE) n° 396/2005 du Parlement européen et du Conseil en ce qui concerne les limites maximales applicables aux résidus de 1,4diaminobutane, de 1méthylcyclopropène, d'acétate d'ammonium, de bifénazate, de chlorantraniliprole, de chlorméquat, de cyprodinil, de chaux, de mandipropamide, de poivre, de pyridaben, de la substance «répulsifs: farine de sang», d'extraits d'algues et de chlorhydrate de triméthylamine, présents dans ou sur certains produits

Numéro officiel : UE/2020/1565

Liens juridiques : Modification Règlement CE/396/2005 23/02/2005

Accès au document

Limites maximales applicables aux résidus de bupirimate, de carfentrazone-éthyle, d'éthirimol et de pyriofénone présents dans ou sur certains produits

RÈGLEMENT (UE) 2020/1566 DE LA COMMISSION du 27 octobre 2020 modifiant les annexes II et III du règlement (CE) n° 396/2005 du Parlement européen et du Conseil en ce qui concerne les limites maximales applicables aux résidus de bupirimate, de carfentrazone-éthyle, d'éthirimol et de pyriofénone présents dans ou sur certains produits

Numéro officiel : UE/2020/1566

Liens juridiques : Modification le 17/05/2021 Règlement CE/396/2005 23/02/2005

Accès au document

Démarches ou pratiques ayant des incidences favorables sur la réduction de l'usage et des impacts de produits phytopharmaceutiques

Arrêté du 16 octobre 2020 fixant la liste des démarches ou pratiques ayant des incidences favorables sur la réduction de l'usage et des impacts de produits phytopharmaceutiques permettant l'exemption prévue au 2° du III de l'article L. 254-6-2 du code rural et de la pêche maritime

Numéro officiel : AGRG2027130A

Accès au document

Activité « application en prestation de service de produits phytopharmaceutiques » : référentiel de certification

Arrêté du 16 octobre 2020 relatif au référentiel de certification prévu à l'article R. 254-3 du code rural et de la pêche maritime pour l'activité « application en prestation de service de produits phytopharmaceutiques »

Numéro officiel : AGRG2027132A

Liens juridiques : Abrogation le 01/01/2021 Arrêté 17/07/2014 NOR AGRG1403129A

Abrogation le 01/01/2021 Arrêté 25/11/2011 NOR AGRG1132074A

Accès au document

Distribution de produits phytopharmaceutiques à des utilisateurs non professionnels : référentiel de certification

Arrêté du 16 octobre 2020 relatif au référentiel de certification prévu à l'article R. 254-3 du code rural et de la pêche maritime pour l'activité « distribution de produits phytopharmaceutiques à des utilisateurs non professionnels »

Numéro officiel : AGRG2027138A

Liens juridiques : Abrogation le 01/01/2021 Arrêté 25/11/2011 NOR AGRG1132064A

Accès au document

Distribution de produits phytopharmaceutiques à des utilisateurs professionnels : référentiel de certification

Arrêté du 16 octobre 2020 relatif au référentiel de certification prévu à l'article R. 254-3 du code rural et de la pêche maritime pour l'activité « distribution de produits phytopharmaceutiques à des utilisateurs professionnels »

Numéro officiel : AGRG2027143A

Liens juridiques : Modification le 01/01/2021 Arrêté 06/01/2016 NOR AGRG1528365A

Abrogation le 01/01/2021 Arrêté 25/11/2011 NOR AGRG1132069A

Accès au document

Référentiel de certification pour l'activité « conseils stratégique et spécifique à l'utilisation de produits phytopharmaceutiques »

Arrêté du 16 octobre 2020 relatif au référentiel de certification pour l'activité « conseils stratégique et spécifique à l'utilisation de produits phytopharmaceutiques »

Numéro officiel : AGRG2027149A

Liens juridiques : Abrogation le 01/01/2021 Arrêté 25/11/2011 NOR AGRG1132072A

https://doi.org/10.15454/6MQT-0H51

Accès au document

Prolongation de l'approbation des substances actives : amidosulfuron, bifénox, chlorotoluron, clofentézine, clomazone, cyperméthrine, daminozide, deltaméthrine, dicamba, difénoconazole, diflufénican, fenoxaprop-P, fenpropidine, fludioxonyl, flufénacet, fosthiazate, indoxacarbe, lénacile, MCPA, MCPB, nicosulfuron, huiles de paraffine, piclorame, prosulfocarbe, soufre, triflusulfuron et tritosulfuron

RÈGLEMENT D'EXÉCUTION (UE) 2020/1511 DE LA COMMISSION du 16 octobre 2020 modifiant le règlement d'exécution (UE) n° 540/2011 en ce qui concerne la prolongation de l'approbation des substances actives «amidosulfuron», «bifénox», «chlorotoluron», «clofentézine», «clomazone», «cyperméthrine», «daminozide», «deltaméthrine», «dicamba», «difénoconazole», «diflufénican», «fenoxaprop-P», «fenpropidine», «fludioxonyl», «flufénacet», «fosthiazate», «indoxacarbe», «lénacile», «MCPA», «MCPB», «nicosulfuron», «huiles de paraffine», «piclorame», «prosulfocarbe», «soufre», «triflusulfuron» et «tritosulfuron»

Numéro officiel : UE/2020/1511

Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Mise sur le marché des produits phytopharmaceutiques : approbation de la substance active thiophanate-méthyl non renouvelée

RÈGLEMENT D'EXÉCUTION (UE) 2020/1498 DE LA COMMISSION du 15 octobre 2020 relatif au non-renouvellement de l'approbation de la substance active «thiophanate-méthyl», conformément au règlement (CE) n° 1107/2009 du Parlement européen et du Conseil concernant la mise sur le marché des produits phytopharmaceutiques, et modifiant l'annexe du règlement d'exécution (UE) n° 540/2011 de la Commission

Numéro officiel : UE/2020/1498

Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Autorisation de l'Union pour la famille de produits biocides «Iodine based products - CID LINES NV»

RÈGLEMENT D'EXÉCUTION (UE) 2020/1187 DE LA COMMISSION du 7 août 2020 accordant une autorisation de l'Union pour la famille de produits biocides «Iodine based products - CID LINES NV»

Numéro officiel : UE/2020/1187

Accès au document

https://doi.org/10.15454/6MQT-0H51

Teneurs maximales en 3-monochloropropanediol (3-MCPD), en esters d'acides gras de 3-MCPD et en esters d'acides gras de glycidol dans certaines denrées alimentaires

RÈGLEMENT (UE) 2020/1322 DE LA COMMISSION du 23 septembre 2020 modifiant le règlement (CE) n° 1881/2006 en ce qui concerne les teneurs maximales en 3-monochloropropanediol (3-MCPD), en esters d'acides gras de 3-MCPD et en esters d'acides gras de glycidol dans certaines denrées alimentaires

Numéro officiel : UE/2020/1322

Liens juridiques : Modification Règlement CE/1881/2006 19/12/2006

Accès au document

Avis aux opérateurs sur les décrets biocides

Avis aux opérateurs sur les décrets biocides pris en application de l'article 76 de la loi n° 2018-938 du 30 octobre 2018 pour l'équilibre des relations commerciales dans le secteur agricole et alimentaire et une alimentation saine, durable et accessible à tous (EGAlim)

Numéro officiel : TREP2024632V

Accès au document

Teneurs maximales en 3-monochloropropanediol (3-MCPD), en esters d'acides gras de 3-MCPD et en esters d'acides gras de glycidol dans certaines denrées alimentaires

RÈGLEMENT (UE) 2020/1322 DE LA COMMISSION du 23 septembre 2020 modifiant le règlement (CE) n° 1881/2006 en ce qui concerne les teneurs maximales en 3-monochloropropanediol (3-MCPD), en esters d'acides gras de 3-MCPD et en esters d'acides gras de glycidol dans certaines denrées alimentaires

Numéro officiel : UE/2020/1322

Liens juridiques : Modification Règlement CE/1881/2006 19/12/2006

Accès au document

Mise sur le marché des produits phytopharmaceutiques : approbation de la substance active «hydrogénocarbonate de sodium»

RÈGLEMENT D'EXÉCUTION (UE) 2020/1263 DE LA COMMISSION du 10 septembre 2020 portant approbation de la substance active «hydrogénocarbonate de sodium» en tant que substance à faible risque, conformément au règlement (CE) n° 1107/2009 du Parlement européen et du Conseil concernant la mise sur le marché des produits phytopharmaceutiques, et modifiant le règlement d'exécution (UE) n° 540/2011 de la Commission

Numéro officiel : UE/2020/1263

Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Non-renouvellement de l'approbation de la substance active fenamiphos

RÈGLEMENT D'EXÉCUTION (UE) 2020/1246 DE LA COMMISSION du 2 septembre 2020 concernant le non-renouvellement de l'approbation de la substance active «fenamiphos», conformément au règlement (CE) n° 1107/2009 du Parlement européen et du Conseil concernant la mise sur le marché des produits phytopharmaceutiques, et modifiant l'annexe du règlement d'exécution (UE) n° 540/2011 de la Commission

Numéro officiel : UE/2020/1246

Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

PUBLICATIONS DU RESEAU ECOTOX

Differential side-effects of *Bacillus thuringiensis* bioinsecticide on non-target *Drosophila flies*

Authors: Babin A, Nawrot-Esposito MP, Gallet A, Gatti JL, Poirie M

Source: SCIENTIFIC REPORTS 10(1):16241, 2020, DOI: 10.1038/s41598-020-73145-6

Abstract: Bioinsecticides based on Bacillus thuringiensis (Bt) spores and toxins are increasingly popular alternative solutions to control insect pests, with potential impact of their accumulation in the environment on non-target organisms. Here, we tested the effects of chronic exposure to commercial Bt formulations (Bt var. kurstaki and israelensis) on eight non-target Drosophila species present in Bt-treated areas, including D. melanogaster (four strains). Doses up to those recommended for field application (similar to 10(6) Colony Forming Unit (CFU)/g fly medium) did not impact fly development, while no fly emerged at &#62 ; = 1000-fold this dose. Doses between 10- to 100-fold the recommended one increased developmental time and decreased adult emergence rates in a dose-dependent manner, with species-and strain-specific effect amplitudes. Focusing on D. melanogaster, development alterations were due to instar-dependent larval mortality, and the longevity and offspring number of adult flies exposed to bioinsecticide throughout their development were moderately influenced. Our data also suggest a synergy between the formulation compounds (spores, cleaved toxins, additives) might induce the bioinsecticide effects on larval development. Although recommended doses had no impact on non-target Drosophila species, misuse or local environmental accumulation of Bt bioinsecticides could have side-effects on fly populations with potential implications for their associated communities.

Accès au document

Synergetic effect of antibiotic mixtures on soil bacterial N2O-reducing communities

Authors: Roose-Amsaleg C, David V, Alliot F, Guigon E, Crouzet O, Laverman AM

Source: ENVIRONMENTAL CHEMISTRY LETTERS Early Access: OCT 2020, DOI: 10.1007/s10311-020-01117-3

Abstract: Antibiotics released in agricultural soils alter soil bacterial communities, inducing antimicrobial resistance and, in turn, canceling the efficiency of antibiotic drugs used for human and animal health. In soils, antibiotic impact on

nitrogen cycling is poorly known, notably when antibiotic mixtures are applied. We hypothesized that the impact of antibiotic mixtures would have higher effects on denitrification. We exposed soil denitrifying bacteria enrichments to tetracycline, ofloxacin, sulfamethoxazole and tylosin, either applied single or as mixture of three antibiotics, during 7 days under denitrifying conditions. We measured the minimum inhibitory concentration of the N2O-reducing capacity of the bacterial enrichment, we deduced the half maximal effective concentration (EC50) from the experimental data and from the concentration addition hypothesis, and we quantifiednosZgene abundances. Results show that single antibiotic exposure inhibited N2O-reduction only for tetracycline at 64 mg/L. Inhibition by antibiotic mixtures always exceeded the modeled inhibition calculated by concentration addition. At high-antibiotic exposure,nosZgene clade I denitrifiers remained abundant, of 10(7)-10(8)copies/ng DNA.NosZgene clade II denitrifiers increased with antibiotic concentrations. Our findings reveal for the first time the synergistic effects of antibiotic mixtures on soil nitrogen cycling.

Accès au document

Transfer and Transcriptomic Profiling in Liver and Brain of European Eels (*Anguilla anguilla*) After Diet-borne Exposure to Gold Nanoparticles

Authors: Perrier F, Bertucci A, Pierron F, Feurtet-Mazel A, Simon O, Klopp C, Candaudap F, Pokrovski O, Etcheverria B, Mornet S, Baudrimont M

Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY Early Access, 2020, DOI: 10.1002/etc.4858

Abstract: A nanometric revolution is underway, promising technical innovations in a wide range of applications and leading to a potential boost in environmental discharges. The propensity of nanoparticles (NPs) to be transferred throughout trophic chains and to generate toxicity was mainly assessed in primary consumers, whereas a lack of knowledge for higher trophic levels persists. The present study focused on a predatory fish, the European eel (Anguilla anguilla) exposed to gold NPs (AuNPs; 10 nm, polyethylene glycol-coated) for 21 d at 3 concentration levels in food: 0 (NP0), 1 (NP1), and 10 (NP10) mg Au kg(-1). Transfer was assessed by Au quantification in eel tissues, and transcriptomic responses in the liver and brain were revealed by a high-throughput RNA-sequencing approach. Eels fed at NP10 presented an erratic feeding behavior, whereas Au quantification only indicated transfer to intestine and kidney of NP1-exposed eels. Sequencing of RNA was performed in NP0 and NP1 eels. A total of 258 genes and 156 genes were significantly differentially transcribed in response to AuNP trophic exposure in the liver and brain, respectively. Enrichment analysis highlighted modifications in the immune system-related processes in the liver. In addition, results pointed out a shared response of both organs regarding 13 genes, most of them being involved in immune functions. This finding may shed light on the mode of action and toxicity of AuNPs in fish. Environ Toxicol Chem2020;00:1-12. (c) 2020 SETAC

Accès au document

A maternal effect influences sensitivity to chlorpyrifos pesticide in the pest moth *Spodoptera littoralis*

Authors: Bagni T, Siaussat D, Maria A, Couzi P, Maibeche M, Massot M

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 204:111052, 2020, DOI: 10.1016/j.ecoenv.2020.111052

Abstract: Transgenerational effects on sensitivity to pesticides are poorly studied. This study

investigated the transgenerational influences of maternal body mass in the major pest moth *Spodoptera littoralis*, with a focus on sensitivity to chlorpyrifos pesticide. In 147 clutches of a laboratory strain of *S. littoralis*, we compared larval mortality between control larvae and larvae treated with chlorpyrifos. Because of the classic positive relationships between offspring size and maternal size and between offspring size and offspring quality, sensitivity to chlorpyrifos was predicted to be lower in larvae of larger mothers. Surprisingly, we found the opposite result, with higher pesticide toxicity in larvae of larger mothers. This result is partly explained by the lack of a relationship between larval mass and larval sensitivity to chlorpyrifos. This means that another offspring characteristic linked to maternal size should have affected larval sensitivity to chlorpyrifos. More generally, knowledge of the effects of the traits and ecological environments of mothers on offspring sensitivity to pesticides remains limited. Ecotoxicologists should pay more attention to such maternal effects on sensitivity to pesticides, both in pests and non-target species.

Accès au document

Keep and promote biodiversity at polluted sites under phytomanagement

Authors: Garbisu C, Alkorta I, Kidd P, Epelde L, Mench M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access, 2020, DOI: 10.1007/s11356-020-10854-5

Abstract: The phytomanagement concept combines a sustainable reduction of pollutant linkages at risk-assessed contaminated sites with the generation of both valuable biomass for the (bio)economy and ecosystem services. One of the potential benefits of phytomanagement is the possibility to increase biodiversity in polluted sites. However, the unique biodiversity present in some polluted sites can be severely impacted by the implementation of phytomanagement practices, even resulting in the local extinction of endemic ecotypes or species of great conservation value. Here, we highlight the importance of promoting measures to minimise the potential adverse impact of phytomanagement on biodiversity at polluted sites, as well as recommend practices to increase biodiversity at phytomanaged sites without compromising its effectiveness in terms of reduction of pollutant linkages and the generation of valuable biomass and ecosystem services.

Accès au document

Behavior of metallurgical zinc contamination in coastal environments: A survey of Zn from electroplating wastes and partitioning in sediments

Authors: Tonha MS, Garnier J, Araujo DF, Cunha BCA, Machado W, Dantas E, Araujo R, Kutter VT, Bonnet MP, Seyler P

Source: SCIENCE OF THE TOTAL ENVIRONMENT 743:140610, 2020, DOI: 10.1016/j.scitotenv.2020.140610

Abstract: The contamination of coastal environments by metallurgical wastes involves multiple biogeochemical processes; accordingly, understanding metal behavior and risk evaluation of contaminated areas, such as Sepetiba Bay (Rio de Janeiro. Brazil), remains challenging. This study coupled Zn isotopic analyses with sequential extractions (BCR) to investigate the mechanisms of Zn transfer between legacy electroplating waste and the main environments in Sepetiba Bay. This metallurgical waste showed a light bulk isotopic signature (delta (66/64) Znbulk(JMC)= +0.30 +/- 0.01 parts per thousand 2 s, n = 3) that was not distinct from the lithogenic geochemical baseline, but was different from signature of mangrove sediment considered as anthropogenic end member (delta(66/64) Zn-JMC = +0.86 +/- 0.15 parts per thousand) in a previous isotopic study in this

area. Zn isotopic compositions of sediment samples (ranging from +0.20 to +0.98 parts per thousand) throughout the bay fit a mixing model involving multiple sources, consistent with previous studies. In the metallurgic zone, the exchangeable/carbonate fraction (ZnF1) exhibited high Zn concentrations (ZnF1 9840 mu g g(-1)) and a heavy isotopic composition (delta(66/64) ZnF1(JMC) = +1.10 +/- 0.01 parts per thousand). This finding showed that, in some cases, the bulk isotopic signature of waste is not the most relevant criterion for evaluating trace metal dispersion in the environment. Indeed, based on the BCR. it was observed that part of the anthropogenic metallurgical Zn was redistributed from the exchangeable/carbonate fraction in the waste to the surrounding mangrove sediment. Then, this contaminated sediment with heavy delta(66/64) Zn values was exported to other coastal environments. In Sepetiba Bay, contaminated sediments revealed a large concentration of ZnF1 fraction (up to 400 mu g g(-1)) with a heavy Zn isotopic signature. This signature also matched the Zn isotopic signature of oysters in Sepetiba Bay reported by other studies; hence, measurement of the isotopic exchangeable/carbonate fraction has important implications for tracing the transfer of anthropogenic Zn to biota. (C) 2020 Elsevier B.V. All rights reserved.

Accès au document

Reprint of: The effect of the Music Day event on community drug use

Authors: Devault DA, Peyre A, Jaupitre O, Daveluy A, Karolak S

Source: FORENSIC SCIENCE INTERNATIONAL 314:110355, 2020, DOI: 10.1016/j.forsciint.2020.110355

Abstract: Illicit drugs consumption can be back-calculated based on the analysis of drug residues in wastewater using the wastewater-based epidemiology method. The Music Day, held on June 21 in France since 1982, has grown to global proportions and is now celebrated as World Music Day. This large outdoor event takes place in many cities with people allowed to play music in the streets. As psychotropic drugs are often associated with music events, the goal of this study is to investigate the use of illicit drugs on this day in Bordeaux, the fifth largest urban area in France. Daily sampling campaigns of composite wastewater were carried out for seven days in two wastewater treatment plants in Bordeaux in 2017 (Music Day) and 2018.

World Music Day in Bordeaux has no observable effect on illicit drug consumption even if this event has massive public participation: this is the first report of the absence of an illicit drug consumption increase in a festival of such magnitude, corroborating the effect of others' views and opinions, because this event takes place publicly in the street and not among peers. Different hypothesizes are put forward to explain this fact: inappropriate type of event for drug consumption, effect of other festivals, and influence of the event's timing on a weekday. (C) 2020 Elsevier B.V. All rights reserved.

Accès au document

Multi-scale impact of chronic exposure to environmental concentrations of chlordecone in freshwater cnidarian, *Hydra circumcincta*

Authors: Colpaert R, Villard PH, de Jong L, Mambert M, Benbrahim K, Abraldes J, Cerini C, Pique V, Robin M, Moreau X

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access, 2020, DOI: 10.1007/s11356-019-06859-4

Abstract: Chlordecone (CLD) is an organochlorine pesticide widely used in the past to control pest insects in banana plantations in the French West Indies. Due to its persistence in the environment, CLD has contaminated the soils where it has

been spread, as well as the waters, and is still present in them. The objective of our study was to evaluate the effects of chronic exposure to environmentally relevant CLD concentrations in an animal model, the freshwater hydra (*Hydra circumcincta*). In a multi-marker approach, we have studied the expression of some target stress genes, the morphology, and the asexual reproduction rates. Our data showed that exposure to low concentrations of chlordecone leads to (i) a modulation of the expression of target genes involved in oxidative stress, detoxification, and neurobiological processes, and (ii) morphological damages and asexual reproduction impairment. We have observed non-monotonic dose-response curves, which agree with endocrine-disrupting chemical effects. Thus, "U-shaped" dose-response curves were observed for SOD, GRed, Hym355, and potentially GST gene expressions ; inverted "U-shaped" curves for GPx and CYP1A gene expressions and reproductive rates; and a biphasic dose-response curve for morphological damages. Therefore, in the range of environmental concentrations tested, very low concentrations of CLD can produce equally or more important deleterious effects than higher ones. Finally, to our knowledge, this study is the first one to fill the lack of knowledge concerning the effects of CLD inHydra circumcinctaand confirms that this diploblastic organism is a pertinent freshwater model in the risk assessment.

Accès au document

Phytol, (E)-nerolidol and spathulenol from Stevia rebaudiana leaf essential oil as effective and eco-friendly botanical insecticides against *Metopolophium dirhodum*

Authors: Benelli G, Pavela R, Drenaggi E, Desneux N, Maggi F

Source: INDUSTRIAL CROPS AND PRODUCTS 155:112844, 2020, DOI: 10.1016/j.indcrop.2020.112844

Abstract: Stevia rebaudiana (Asteraceae) is a medicinal plant of economic importance in the food market for the manufacture of natural sweeteners, namely steviol glycosides. The plant biomass used on an industrial level may also be the source of an essential oil (EO) of potential interest for developing novel insecticides. Here, the leaf EO chemical composition of S. rebaudiana growing in central Italy was analysed by gas chromatography-mass spectrometry (GC-MS). The EO insecticidal efficacy was evaluated against the aphid Metopolophium dirhodum (Hemiptera: Aphididae), a major pest of cereals. The EO composition was dominated by sesquiterpenes, i.e. caryophyllene oxide (20.7 %), spathulenol (14.9 %) and (E)-nerolidol (8.0 %), and diterpenes, i.e. phytol (9.2 %). The EO was effective against M. dirhodum aphids, showing an LC 50(90) of 5.1 and 10.8 mL L-1, respectively. The efficacy of the EO major constituents, namely caryophyllene oxide, spathulenol, (E)-nerolidol and phytol was also tested against M. dirhodum. Phytol was the most effective aphicide (LC50(90) = 1.4(4.2) mL L-1), followed by (E)-nerolidol (LC50(90) = 3.5(9.3) mL L-1) and spathulenol (LC50(90) = 4.3(7.5) mL L-1). The EO was minimally toxic towards non-target Eisenia fetida adults and Harmonia axyridis larvae and adults. Overall, phytol, (E)-nerolidol and spathulenol can be considered further for developing effective and eco-friendly green insecticides against aphids.

Accès au document

Contribution of chemical inputs on the trace elements concentrations of surface soils in urban allotment gardens

Authors: Joimel S, Cortet J, Consales JN, Branchu P, Haudin CS, Morel JL, Schwartz C

Source: JOURNAL OF SOILS AND SEDIMENTS Earlu Access sept, 2020, DOI: 10.1007/s11368-020-02784-z

Abstract: Purpose Urban soil contamination by heavy metals is one of the foremost challenges for urban soil quality, especially in the urban agriculture context. Urban gardening is a common practice in many industrialized and developing countries. How sources of soil contamination relate to inputs and influence the heavy metal content in soils, however, is not established yet. Materials and methods This study aims to assess the potential of pesticide applications (such as Bordeaux mixture) on soil quality. A set of 104 allotment gardens was selected in three cities in France, and topsoil was sampled and analyzed. Results and discussion The four most abundant metals in urban vegetable garden topsoils were Zn, Pb, Cu, and Cr. The past and/or present industrial and urban activities are not the only cause of the metal contamination in urban vegetable garden soils. Gardens, where pesticides such as the Bordeaux mixture are being used showed significantly higher total Cu values in soils (78 mg kg(-1)compared with 49 mg kg(-1)for untreated gardens). Conclusions Even though the risk of metal contamination through vegetable consumption is usually considered low, we clearly identified indicators of anthropogenic Cd, Cu, Pb, and Zn pollution due to pesticides inputs. This link was particularly strong between the use of Bordeaux mixture and increases Cu levels.

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Emerging polar pollutants in groundwater: Potential impact of urban stormwater infiltration practices

Authors: Pinasseau L, Wiest L, Volatier L, Mermillod-Blondin F, Vulliet E

Source: ENVIRONMENTAL POLLUTION 266(2):115387, 2020, DOI: 10.1016/j.envpol.2020.115387

Abstract: The quality of groundwater (GW) resources is decreasing partly due to chemical contaminations from a wide range of activities, such as industrial and agricultural enterprises and changes in land-use. In urban areas, one potential major pathway of GW contamination is associated with urban water management practices based on stormwater runoff infiltration systems (SIS). Data on the performance of the upper layer of soil and the unsaturated zone of infiltration basins to limit the contamination of GW by hydrophilic compounds are lacking. With this aim, the impact of infiltration practices on GW contamination was assessed for 12 pesticides and 4 pharmaceuticals selected according to their ecotoxicological relevance and their likelihood of being present in urban stormwater and GW. For this purpose, 3 campaigns were conducted at 4 SIS during storm events. For each campaign, passive samplers based on the use of EmporeTM disk were deployed in GW wells upstream and downstream of SIS, as well as in the stormwater runoff entering the infiltration basins. Upstream and downstream GW contaminations were compared to evaluate the potential effect of SIS on GW contamination and possible relationships with stormwater runoff composition were examined. Our results showed two interesting opposite trends : (i) carbendazim, diuron, fluopyram, imidacloprid and lamotrigine had concentrations significantly increasing in GW impacted by infiltration, indicating a contribution of SIS to GW contamination, (ii) atrazine, simazine and 2 transformation products exhibited concentrations significantly decreasing with infiltration due to a probable dilution of historic GW contaminants with infiltrated stormwater runoff. The other 7 contaminants showed no general trend. This study demonstrates that passive samplers deployed in GW wells enabled the capture of emerging polar pollutants present at very low concentrations and allowed the assessment of infiltration practices on GW quality. New data on GW and urban stormwater are provided for poorly studied hazardous compounds. (C) 2020 Elsevier Ltd. All rights reserved.

Accès au document

https://doi.org/10.15454/6MQT-0H51

Analysis of surface water reveals land pesticide contamination: an application for the determination of chlordecone-polluted areas in Guadeloupe, French West Indies

Authors: Rochette R, Bonnal V, Andrieux P, Cattan P

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early Access Sept, 2020, DOI: 10.1007/s11356-020-10718-y

Abstract: In Guadeloupe, the use between 1972 and 1993 of chlordecone, an organochlorine insecticide, has permanently contaminated the island's soil, thus contaminating the food chain at its very beginning. There is today a strong societal requirement for an improved mapping of the contaminated zones. Given the extent of the areas to be covered, carrying out soil tests on each plot of the territory would be a long and expensive process. In this article, we explore a method of demarcating polluted areas. The approach adopted consists in carrying out, using surface water analyses, a hydrological delimitation that makes it possible to distinguish contaminated watersheds from uncontaminated ones. The selection of sampling points was based on the spatial analysis of the actual and potential contamination data existing at the beginning of the study. The approach was validated by soil analyses, after having compared the contamination data of the watersheds with the soil contamination data of the plots within them. The study thus made it possible to highlight new contaminated areas and also those at risk of contamination and to identify the plots to be targeted as a priority during future analysis campaigns by State services.

Accès au document

Impact of a synthetic fungicide (fosetyl-Al and propamocarb-hydrochloride) and a biopesticide (*Clonostachys rosea*) on soil bacterial, fungal, and protist communities

Authors: Fournier B, Dos Santos SP, Gustavsen JA, Imfeld G, Lamy F, Mitchell EAD, Mota M, Noll D, Planchamp C, Heger TJ

Source: SCIENCE OF THE TOTAL ENVIRONMENT 738:139635, 2020, DOI: 10.1016/j.scitotenv.2020.139635

Abstract: The use of synthetic pesticides in agriculture is increasingly debated. However, few studies have compared the impact of synthetic pesticides and alternative biopesticides on non-target soil microorganisms playing a central role in soil functioning.

We conducted a mesocosm experiment and used high-throughput amplicon sequencing to test the impact of a fungal biopesticide and a synthetic fungicide on the diversity, the taxonomic and functional compositions, and co-occurrence patterns of soil bacterial, fungal and protist communities.

Neither the synthetic pesticide nor the biopesticide had a significant effect on microbial a-diversity. However, both types of pesticides decreased the complexity of the soil microbial network. The two pesticides had contrasting impacts on the composition of microbial communities and the identity of key taxa as revealed by microbial network analyses. The biopesticide impacted keystone taxa that structured the soil microbial network. The synthetic pesticide modified biotic interactions favouring taxa that are less efficient at degrading organic compounds. This suggests that the biopesticides and the synthetic pesticide have different impact on soil functioning. Altogether, our study shows that pest management products may have functionally

significant impacts on the soil microbiome even if microbial alpha-diversity is unaffected. It also illustrates the potential of high-throughput sequencing analyses to improve the ecotoxicological risk assessment of pesticides on non-target soil microorganisms.

Do rainfall characteristics affect the export of copper, zinc and synthetic pesticides in surface runoff from headwater catchments?

Authors: Imfeld G, Meite F, Wiegert C, Guyot B, Masbou J, Payraudeau S

Source: SCIENCE OF THE TOTAL ENVIRONMENT 741:140437, 2020, DOI: 10.1016/j.scitotenv.2020.140437

Abstract: Rainfall and runoff characteristics may influence off-site export of pesticides into downstream aquatic ecosystems. However, the relationship between rainfall characteristics and pesticide export from small headwater catchments remains elusive due to confounding factors including the application dose and timing and the variation of pesticide stocks in soil. Here we examined the impact of rainfall characteristics on the export of copper (Cu), zinc (Zn) and 12 legacy and currently used synthetic pesticides in surface runoff from a headwater vineyard catchment. Cluster analysis of rainfall intensity, depth and duration of 78 events revealed four distinct rainfall categories, i.e., Small, Long, Moderate and Intense ($p < 0.001$). Event mean concentrations of pesticides did not differ among rainfall categories ($p > 0.05$). In contrast, event loads of both dissolved and solid-bound Cu and Zn significantly differed among rainfall categories ($p < 0.001$). Rainfall depth and intensity significantly correlated with both Cu and Zn loads in runoff (rho(s) = 0.33 to 0.92, $p < 0.002$), and might be the main drivers of Cu and Zn export at the catchment scale. In contrast, rainfall depth, intensity or duration did not influence the loads of synthetic pesticides in runoff, even when weekly variations of pesticide stocks in the soil were accounted for. However, intense rainfall-runoff events, that can fragment soil, may control the export of persistent and hydrophobic legacy pesticides stocks in the soil, such as simazine and tetraconazole. Our results show that rainfall characteristics controlled the off-site export of Cu, Zn and legacy synthetic pesticides in a small headwater catchment, whereas the application timing drove the export of currently used synthetic pesticides in runoff. We anticipate our results to be a preliminary step to forecast the influence of regional rainfall patterns on the export of both metallic and synthetic pesticides by surface runoff from small agricultural headwater catchments.

Direct and indirect effects of multiple environmental stressors on fish health in human-altered rivers

Authors: Petitjean Q, Jean S, Cote J, Larcher T, Angelier F, Ribout C, Perrault A, Laffaille P, Jacquin L

Source: SCIENCE OF THE TOTAL ENVIRONMENT 742:140657, 2020, DOI: 10.1016/j.scitotenv.2020.140657

Abstract: Freshwater fish face multiple challenges in human-altered rivers such as trace metal contamination, temperature increase and parasitism. These multiple stressors could have unexpected interactive effects on fish health due to shared physiological pathways, but few studies investigated this question in wild fish populations. In this study, we compared 16 populations of gudgeon (Gobio occitaniae) distributed along perturbation gradients in human-altered rivers in the South of France. We tested the effects of single and combined stressors (i.e., metal contamination, temperature, parasitism) on key traits linked to fish health across different biological levels using a Structural Equation Modelling approach. Parasitism and temperature alone had limited deleterious effects on fish health. In contrast, fish living in metal-contaminated sites had higher

metal bioaccumulation and higher levels of cellular damage in the liver through the induction of an inflammatory response. In addition, temperature and contamination had interactive negative effects on growth. These results suggest that trace metal contamination has deleterious effects on fish health at environmentally realistic concentrations and that temperature can modulate the effects of trace metals on fish growth. With this study, we hope to encourage integrative approaches in realistic field conditions to better predict the effects of natural and anthropogenic stressors on aquatic organisms.

Screening of potential uranium protein targets in fish ovaries after chronic waterborne exposure: Differences and similarities between roach and zebrafish

Authors: Frelon S, Simon O, Eb-Levadoux Y, Mounicou S

Source: JOURNAL OF ENVIRONMENTAL RADIOACTIVITY 222:106365, 2020, DOI: 10.1016/j.jenvrad.2020.106365

Abstract: Concentration of uranium (U), a naturally encountered radioactive element in earth's crust, can be enhanced in freshwater ecosystems (µg.L-1 - mg.L-1) due to various anthropogenic activities. The consequent aquatic organism exposure to U leads to its accumulation in all organs, particularly in the gonad, and in subcellular fractions (mainly the cytosol); then it is known to affect fish at several biological levels, and more particularly, at a reproduction endpoint, with a decrease in the total number of eggs, spawn events and larvae survival. The understanding of U reprotoxicity requires the fine knowledge of its speciation at molecular level, i.e., its interaction with cytosolic biomolecules. In this study, we focus on the U-protein interactions in gonads. A non-denaturating extraction protocol combined with size exclusion chromatography (SEC) allowed the separation of metal-protein complexes in ovaries of U-contaminated wild roaches before their elemental detection (ICP MS). This enables unprecedented information to be obtained about U distribution in ovaries of autochthonous fish, *Rutilus rutilus*, which is different in some points from that obtained in the model species, Danio rerio under controlled laboratory conditions at a similar concentration level. Finally, the ability to transpose results from model to autochthonous fish was briefly discussed.

Microbiome-Aware Ecotoxicology of Organisms: Relevance, Pitfalls, and Challenges

Authors: Duperron S, Halary S, Gallet A, Marie B

Source: FRONTIERS IN PUBLIC HEALTH 8:407 2020, DOI: 10.3389/fpubh.2020.00407

Abstract: Over the last 15 years, the advent of high-throughput "omics" techniques has revealed the multiple roles and interactions occurring among hosts, their microbial partners and their environment. This microbiome revolution has radically changed our views of biology, evolution, and individuality. Sitting at the interface between a host and its environment, the microbiome is a relevant yet understudied compartment for ecotoxicology research. Various recent works confirm that the microbiome reacts to and interacts with contaminants, with consequences for hosts and ecosystems. In this paper, we thus advocate for the development of a "microbiome-aware ecotoxicology" of organisms. We emphasize its relevance and discuss important conceptual and technical pitfalls associated with study design and interpretation. We identify topics such as functionality, quantification, temporality, resilience, interactions, and prediction as major challenges and promising venues for microbiome research applied to ecotoxicology.

https://doi.org/10.15454/6MQT-0H51

Dose reconstruction supports the interpretation of decreased abundance of mammals in the Chernobyl Exclusion Zone

Authors: Beaugelin-Seiller K, Garnier-Laplace J, Della-Vedova C, Metivier JM, Lepage H, Mousseau TA, Moller AP

Source: SCIENTIFIC REPORTS 10(1):14083, 2020, DOI: 10.1038/s41598-020-70699-3

Abstract: We re-analyzed field data concerning potential effects of ionizing radiation on the abundance of mammals collected in the Chernobyl Exclusion Zone (CEZ) to interpret these findings from current knowledge of radiological dose-response relationships, here mammal response in terms of abundance. In line with recent work at Fukushima, and exploiting a census conducted in February 2009 in the CEZ, we reconstructed the radiological dose for 12 species of mammals observed at 161 sites. We used this new information rather than the measured ambient dose rate (from 0.0146 to 225 mu Gy h(-1)) to statistically analyze the variation in abundance for all observed species as established from tracks in the snow in previous field studies. All available knowledge related to relevant confounding factors was considered in this re-analysis. This more realistic approach led us to establish a correlation between changes in mammal abundance with both the time elapsed since the last snowfall and the dose rate to which they were exposed. This relationship was also observed when distinguishing prey from predators. The dose rates resulting from our re-analysis are in agreement with exposure levels reported in the literature as likely to induce physiological disorders in mammals that could explain the decrease in their abundance in the CEZ. Our results contribute to informing the Weight of Evidence approach to demonstrate effects on wildlife resulting from its field exposure to ionizing radiation.

High-multiplexed monitoring of protein biomarkers in the sentinel *Gammarus fossarum* by targeted scout-MRM assay, a new vision for ecotoxicoproteomics

Authors: Faugere J, Gouveia D, Ayciriex S, Chaumot A, Almunia C, Francois A, Armengaud J, Lemoine, JM, Geffard O, Degli-Esposti D, Salvador A

Source: JOURNAL OF PROTEOMICS 226:103901, 2020, DOI: 10.1016/j.jprot.2020.103901

Abstract: Ecotoxicoproteomics employs mass spectrometry-based approaches centered on proteins of sentinel organisms to assess for instance, chemical toxicity in fresh water. In this study, we combined proteogenomics experiments and a novel targeted proteomics approach free from retention time scheduling called Scout-MRM. This methodology will enable the measurement of simultaneously changes in the relative abundance of multiple proteins involved in key physiological processes and potentially impacted by contaminants in the freshwater sentinel Gammarus fossarum. The development and validation of the assay were performed to target 157 protein biomarkers of this non-model organism. We carefully chose and validated the transitions to monitor using conventional parameters (linearity, repeatability, LOD, LOQ). Finally, the potential of the methodology is illustrated by measuring 277 peptide-plex assay (831 transitions) in sentinel animals exposed in natura to different agricultural sites potentially exposed to pesticide contamination. Multivariate data analyses highlighted the modulation of several key proteins involved in feeding and molting. This multiplex-targeted proteomics assay paves the way for the discovery and the use of a large panel of novel protein biomarkers in emergent ecotoxicological models for environmental monitoring in the future.

Biological significance : The study contributed to the development of Scout-MRM for the high-

throughput quantitation of a large panel of proteins in the Gammarus fossarum freshwater sentinel. Increasing the number of markers in ecotoxicoproteomics is of most interest to assess the impact of pollutants in freshwater organisms. The development and validation of the assay enabled the monitoring of a large panel of reporter peptides of exposed gammarids. To illustrate the applicability of the methodology, animals from different agricultural sites were analysed. The application of the assay highlighted the modulation of some biomarker proteins involved in key physiological pathways, such as molting, feeding and general stress response. Increasing multiplexing capabilities and field test will provide the development of diagnostic protein biomarkers for emergent ecotoxicological models in future environmental biomonitoring programs.

Sublethal exposure to deltamethrin impairs maternal egg care in the European earwig *Forficula auricularia*

Authors: Meunier J, Dufour J, Van Meyel S, Rault M, Lecureuil C

Source: CHEMOSPHERE 258:127383, 2020, DOI: 10.1016/j.chemosphere.2020.127383

Abstract: The application of pesticides typically leads to lethal and sublethal exposure of non-target insects. Whereas our current understanding of these sublethal effects typically focuses on reproductive and physiological parameters, recent works emphasize that sublethal effects on behaviors such as maternal care could be of major importance in non-target species. However, it remained unknown whether these sublethal effects occur in insects. Here, we tested if exposure to sublethal doses of deltamethrin - a pyrethroid insecticide commonly used in crops - alters the expression of maternal egg care in females of the European earwig Forficula auricularia, a predator insect and pest control. Our results first reveal that deltamethrin exposure impaired the expression of three forms of maternal egg care : It decreased the likelihood of mothers to gather their otherwise scattered clutch of eggs, increased the time during which the female abandoned the clutch after a predator attack and reduced egg grooming duration. These sublethal effects did not reflect a lower activity of deltamethrin-exposed females, as these females increased their expression of self-grooming, and deltamethrin exposure did not affect females' exploration and mobility. Finally, we found that the negative effects of deltamethrin on egg care did not modify egg development, hatching rate and juvenile weight, possibly due to the transient effects of deltamethrin on maternal behaviors. Overall, our results reveal that sublethal exposure to a pesticide may diminish maternal egg care in a natural pest control and call for the integration of this measurement in assays on pesticides application. (C) 2020 Elsevier Ltd. All rights reserved.

A two years field experiment to assess the impact of two fungicides on earthworm communities and their recovery

Authors: Amosse J, Bart S, Brulle F, Tebby C, Beaudouin R, Nelieu S, Lamy I, Pery ARR, Pelosi C

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 203:110979, 2020, DOI: 10.1016/j.ecoenv.2020.110979

Abstract: Recent EFSA (European Food Safety Authority) reports highlighted that the ecological risk assessment of pesticides needed to go further by taking more into account the impacts of chemicals on biodiversity under field conditions. We assessed the effects of two commercial formulations of fungicides separately and in mixture, i.e., Cuprafor Micro (R) (containing 500 g kg(-1) copper oxychloride) at 4 (C1, corresponding to 3.1 mg kg(-1) dry soil of

https://doi.org/10.15454/6MQT-0H51

copper) and 40 kg ha(-1)(C10), and Swing (R) Gold (50 g L-1 epoxiconazole EPX and 133 g L-1 dimoxystmbin DMX) at one (D1, 5.81 10(-2) and 1.55 10(-1) mg kg(-1) dry soil of EPX and DMX, respectively) and ten times (D10) the recommended field rate, on earthworms at 1, 6, 12, 18 and 24 months after the application following the international ISO standard no. 11268-3 to determine the effects on earthworms in field situations. The D10 treatment significantly reduced the species diversity (Shannon diversity index, 54% of the control), anecic abundance (29% of the control), and total biomass (49% of the control) over the first 18 months of experiment. The Shannon diversity index also decreased in the mixture treatment (both fungicides at the recommended dose) at 1 and 6 months after the first application (68% of the control at both sampling dates), and in C10 (78% of the control) at 18 months compared with the control. Lumbricus terrestris, Aporrectodea caliginosa, Aporrectodea giardi, Aporrectodea Tonga, and Allolobophora chlorotica were (in decreasing order) the most sensitive species to the tested fungicides. This study not only addressed field ecotoxicological effects of fungicides at the community level and ecological recovery, but it also pinpointed some methodological weaknesses (e.g., regarding fungicide concentrations in soil and statistics) of the guideline to determine the effects on earthworms in field situations.

Quantification of spatial and temporal variations in trace element fluxes originating from urban areas at the catchment scale

Authors: Froger C, Quantin C, Bordier L, Monvoisin G, Evrard O, Ayrault S

Source: JOURNAL OF SOILS AND SEDIMENTS, Early Access, 2020, DOI: 10.1007/s11368-020-02766-1

Abstract: Background, aim, and scope The release of trace elements (TE) associated with the development of human activities has accelerated since the nineteenth century, leading to the pollution of river systems. Despite a drastic reduction in industrial inputs in northern Europe, diffuse pollution originating from urban areas still prevents achieving the good status required by the European Water Framework Directive. The objectives of the current study, which is a part of a wider project, were to determine the impact of hydrological dynamics on the total exports of TE from an urban catchment and to develop an assessment tool to evaluate the level of contamination of a catchment based on its specific particulate TE fluxes. Materials and methods Accordingly, this research investigated the behavior of TE contamination in a 950 km(2)catchment (Orge River, France) showing a strong urbanization gradient in downstream direction. Particulate and dissolved samples were collected in the river during a hydrological year at four stations reflecting the increasing urbanization gradient. Trace element concentrations were measured in the samples using inductively coupled plasma/mass spectrometry (ICP-MS). Daily and annual TE fluxes were calculated at the four stations to evaluate the contribution of urban areas to the total TE exports from the catchment. Results The quantification of TE fluxes showed that up to 70% of particulate Cu, Zn, Sb, and Pb exported by the Orge River originated from the urban areas located in the lower catchment portions, especially during average water flow periods characterized by frequent rain events. Moreover, the results show that 50% of the dissolved fluxes of Cu, Zn, and Pb are supplied by urban areas during the entire year, regardless of hydrological conditions, and that the specific contribution of floods to these fluxes (i.e., the June 2016 event) is lower than that in other catchments because of the continuous supply of dissolved metal fluxes to the river in this urbanized environment. Conclusion These results underline the need to integrate all hydrological conditions for the management of TE contamination in urban areas and not to focus on storm events only. Finally, based on a literature survey, the ratios of specific fluxes were homogeneous across different highly urbanized catchments, and they

could be used as a tool to compare the levels of anthropogenic pressure in these contrasted study sites. This observation demonstrates the similar impacts of societal development on urban river geochemistry worldwide, although they occurred during different time periods.

Dietary bioaccumulation of persistent organic pollutants in the common sole *Solea solea* in the context of global change. Part 1: Revisiting parameterisation and calibration of a DEB model to consider inter-individual variability in experimental and natural conditions

Authors: Mounier F, Pecquerie L, Lobry J, Sardi AE, Labadie P, Budzinski H, Loizeau V

Source: ECOLOGICAL MODELLING 433:109224, 2020, DOI: 10.1016/j.ecolmodel.2020.109224

Abstract: Studying adverse effects of chemical pressure on aquatic ecosystems needs a comprehensive knowledge of bioaccumulation mechanisms of pollutants in biota to predict internal concentrations, especially for Persistent Organic Pollutants (POPs). However, the large variability of responses in measured POP concentrations requires explicit consideration of both individual variability and environmental influences. Dynamic Energy Budget (DEB) theory provides a rigorous and generic conceptual framework for tackling these questions in a relevant mechanistic way. In the present study, parameterisation and calibration of previous DEB models for Solea solea were revisited in order to accurately represent the full life cycle with an original emphasis on larval stage, metamorphosis, reproduction rules and sexual differences. We first improved calibration thanks to the use of the estimation procedure developed by the DEB network coupled with a broad compilation of data from literature. Then, we validated this set of parameter estimates on independent datasets of i) individual monitoring of larval growth in controlled food conditions from a novel experiment, and ii) juvenile and adult growth, and female fecundity, from a natural population. Finally, we combined the DEB model developed in the present paper with we used a simple toxicokinetic (TK) model from literature. This TK model was also combined to a previous DEB model and was used to reproduce the mean trajectories of a growth and contamination dataset. We applied the same TK model with our DEB model considering inter-individual variability in food availability. This application highlighted the need to accurately consider inter-individual variability in ingestion to correctly estimate growth and contamination variability. The present work is the first step in the development of a mechanistic TK model that will be used in a companion paper for investigations of juvenile sole sensitivity to warming, nursery quality and prey contamination, in highly fluctuating estuarine environments.

Integration of ecosystem science into radioecology: A consensus perspective

Authors: Rhodes OE, Brechignac F, Bradshaw C, Hinton TG, Mothersill C, Arnone JA, Aubrey DP, Barnthouse LW, Beasley JC, Bonisoli-Alquati A, Boring LR, Bryan AL, Capps KA, Clement B, Coleman A, Condon C, Coutelot F, DeVol T, Dharmarajan G, Fletcher D, Flynn W, Gladfelder G, Glenn TC, Hendricks S, Ishida K, Jannik T, Kapustka L, Kautsky U, Kennamer R, Kuhne W, Lance S, Laptyev G, Love C, Manglass L, Martinez N, Mathews T, McKee A, McShea W, Mihok S, Mills G, Parrott B, Powell B, Pryakhin E, Rypstra A, Scott D, Seaman J, Seymour C, Shkvyria M, Ward A, White D, Wood MD, Zimmerman JK

Source: SCIENCE OF THE TOTAL ENVIRONMENT 740:140031, 2020, DOI: 10.1016/j.scitotenv.2020.140031

https://doi.org/10.15454/6MQT-0H51

Abstract: In the Fall of 2016 a workshop was held which brought together over 50 scientists from the ecological and radiological fields to discuss feasibility and challenges of reintegrating ecosystem science into radioecology. There is a growing desire to incorporate attributes of ecosystem science into radiological risk assessment and radioecological research more generally, fueled by recent advances in quantification of emergent ecosystem attributes and the desire to accurately reflect impacts of radiological stressors upon ecosystem function. This paper is a synthesis of the discussions and consensus of the workshop participant's responses to three primary questions, which were: 1) How can ecosystem science support radiological risk assessment? 2) What ecosystem level endpoints potentially could be used for radiological risk assessment? and 3) What inference strategies and associated methods would be most appropriate to assess the effects of radionuclides on ecosystem structure and function? The consensus of the participants was that ecosystem science can and should support radiological risk assessment through the incorporation of quantitative metrics that reflect ecosystem functions which are sensitive to radiological contaminants. The participants also agreed that many such endpoints exit or are thought to exit and while many are used in ecological risk assessment currently, additional data need to be collected that link the causal mechanisms of radiological exposure to these endpoints. Finally, the participants agreed that radiological risk assessments must be designed and informed by rigorous statistical frameworks capable of revealing the causal inference tying radiological exposure to the endpoints selected for measurement. (C) 2020 Elsevier B.V. All rights reserved.

Flubendiamide, the first phthalic acid diamide insecticide, impairs neuronal calcium signalling in the honey bee's antennae

Authors: Kadala A, Charreton M, Collet C

Source: JOURNAL OF INSECT PHYSIOLOGY 125:104086, 2020, DOI: 10.1016/j.jinsphys.2020.104086

Abstract: Calcium is an important intracellular second messenger involved in several processes such as the transduction of odour signals and neuronal excitability. Despite this critical role, relatively little information is available with respect to the impact of insecticides on the dynamics of intracellular calcium homeostasis in olfactory neurons. For the first time here, physiological stimuli (depolarizing current or pheromone) were shown to elicit calcium transients in peripheral neurons from the honey bee antenna. In addition, neurotoxic xenobiotics (the first synthetic phthalic diamide insecticide flubendiamide or botanical alkaloids ryanodine and caffeine) do interfere with normal calcium homeostasis. Our in vitro experiments show that these three xenobiotics can induce sustained abnormal calcium transients in antennal neurons. The present results provide a new insight into the toxicity of diamides, showing that flubendiamide drastically impairs calcium homeostasis in antennal neurons. We propose that a calcium imaging assay should provide an efficient tool dedicated to the modern assessment strategies of insecticides toxicity.

Water and pesticide transfers in undisturbed soil columns sampled from a Stagnic Luvisol and a Vermic Umbrisol both cultivated

under conventional and conservation agriculture

Authors: Cueff S, Alletto L, Bourdat-Deschamps M, Benoit P, Pot V

Source: GEODERMA 377:114590, 2020, DOI: 10.1016/j.geoderma.2020.114590

Abstract: The main goals of conservation agriculture are to enhance soil fertility and to reduce soil degradation especially through erosion. However, conservation agriculture practices can exhibit a higher risk of contamination through vertical flows. The objectives of this study were to (i) characterise water and pesticide transfers in two different soils both managed under conventional and conservation agriculture and (ii) assess the effects of pesticide properties, soil type and agricultural system on pesticide fate. We studied the behaviour of two herbicides (nicosulfuron and mesotrione) and a molluscicide (metaldehyde) in percolation experiments in undisturbed soil columns. A series of two rain events (one with a high, the other with a low intensity) separated by a two-day flow interruption was applied three days after the pesticides and bromide application. Batch sorption coefficients, K-d, were also measured. While the Pesticides Properties Data Base (2020) indicated a decrease of sorption in the order mesotrione > metaldehyde > nicosulfuron, the measured K-d, decreased in the order mesotrione (2.3 +/- 1.4 L.kg(-1)) > nicosulfuron (0.7 +/- 0.4 L.kg(-1)) > metaldehyde (0.1 +/- 0.1 L.kg(-1)). We highlighted distinct behaviour of pesticide leaching depending mainly on soil type, agricultural practices and pesticide properties. For low degree of preferential flow, pesticide leaching can be related to the sorption properties of pesticides. Nicosulfuron and mesotrione delays are more pronounced under conservation management while metaldehyde always arrived with no delay. During the high intensity rain event, on one soil type, high degree of preferential flow masked sorption effect on leaching since every pesticide arrived at the same time as the tracer and amounted to up to 21% of pesticide recovery compared to 4% on the other soil type. Conservation agriculture was found to improve the vertical transfers of water and pesticides while, on one of the studied soil type, the presence of a low conductive plough pan significantly limits water drainage.

An active biomonitoring approach using three-spined stickleback (*Gasterosteus aculeatus*, L.) to assess the efficiency of a constructed wetland as tertiary treatment of wastewater

Authors: Catteau A, Bado-Nilles A, Beaudouin R, Joachim S, Palluel O, Turies C, Galet C, Geffard A, Porcher JM

Source: ECOLOGICAL INDICATORS 114:106238, 2020, DOI: 10.1016/j.ecolind.2020.106238

Abstract: The present work aimed to assess the efficiency of a constructed wetland as tertiary treatment on urban wastewater with a multibiomarker approach using caged three-spined sticklebacks (*Gasterosteus aculeatus* L.). Fish were caged on three sites: at the entrance of the Constructed Wetland (CW), directly inside the wastewater effluent, at the exit of the CW, and in a weakly impacted site considered as a reference. After 21 days of caging, sticklebacks state of health was assessed using several biomarkers representing some biological functions such as innate immune and antioxidant systems, biotransformation enzymes, reproduction parameters and synaptic transmission. A strong inhibition of the innate immune system, an induction of EROD activity and an alteration of the hepatosomatic index were observed in fish caged at the entrance of the CW compared to those caged in the reference site. In addition, wastewater effluent induced a decrease of antioxidant system without induced oxidative damage on cell membranes. No improvement of these biomarkers was observed for antioxidant

parameters at the exit of the CW. However, in fish caged at the exit of the CW, the EROD induction observed at the entrance was reduced and the innate immune system presented the same level compared to fish caged in the reference site, underlying the beneficial effect of the CW for these parameters. Integrated Biomarker response (IBR) was equal to 25.2 at the entrance of the CW and 17.4 at the exit of the CW which highlighted the global positive effect of the CW on water quality based on fish biomarker measurement.

The Role of Legislation, Regulatory Initiatives and Guidelines on the Control of Plastic Pollution

Authors: da Costa JP, Mouneyrac C, Costa M, Duarte AC, Rocha-Santos T

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8:104, 2020, DOI: 10.3389/fenvs.2020.00104

Abstract: There has been an exponential interest in the occurrence and potential ecotoxicological consequences stemming from the growing prevalence of (micro)plastics in the environment. This has been especially evident by the increasing concern regarding the visible effects on marine ecosystems, with multiple local, regional, andtrans-national initiatives developed toward the mitigation of what has been construed as an environmental disaster. However, it is not clear what the benefits - if any - of the multitude of norms, regulations, laws and recommendations that have been proposed and/or implemented in recent years are. Furthermore, many of the proposed laws may be of limited applicability, particularly considering the extent to which plastic occurs in everyday life. Herein, the current regulatory instruments are overviewed, focusing on the existing proposals and the extent to which these are based on the currently available scientific data, as well as the foreseen challenges that may restrain the relevancy and suitability of such legislative proposals.

Ecotoxicity of trace elements to chicken *Gallus gallus* domesticus exposed to a gradient of polymetallic-polluted sites

Authors: Kribi-Boukhris SE, Boughattas I, Zitouni N, Helaoui S, Sappin-Didier V, Coriou C, Bussiere S, Banni M

Source: ENVIRONMENTAL POLLUTION 265:PT A Part: A:114831, 2020, DOI: 10.1016/j.envpol.2020.114831

Abstract: Mining activity may cause heavy metal accumulation, which threatens human and animal health by their long-term persistence in the environment. This study aims to assess the impact of polymetallic pollution on chicken (*Gallus domesticus*) from old lead mining sites in northeast of Tunisia: Jebel Ressas (JR). Samples of soil and chickens were collected from five sites being ranked along a gradient of heavy metal contamination. Heavy metal loads were evaluated in soil samples and in chicken liver and kidney. Biochemical evaluation of oxidative stress parameters termed as Catalase (CAT), Glutathione-S-Transferase (GST), and Malondialdehydes (MDA) accumulation was monitored. Metallothionein protein level was assessed as a specific response to heavy metals. DNA alteration was achieved using MNi frequency in the investigated tissues. Finally, the evaluation of gene expression levels of CAT, GST, mt1, mt4, P53, bcl2, caspase3 and DNA-ligase was performed. Our data showed the highest loads of Cd, Cu, Zn and Pb in tissues of animals from site 3, being more pronounced in kidney. Biochemical data suggested a significant increase in antioxidant enzymes activities in all sites respect to control except in site 3 were CAT and GST were inhibited. DNA alteration was observed in all tissues being very pronounced in animals from site 3. Overall, transcriptomic data showed that genes involved in apoptosis were up-regulated in animals exposed to the most contaminated soils. Our data suggest that

chicken and selected biomarkers offer a suitable model for biomonitoring assessment of heavy metals transfer through the food web in mining sites. Finally, the obtained results of heavy metals accumulation and related alterations should be carefully considered in view of the controversial relationship between distribution and toxicology of contaminants in exposed organisms. (C) 2020 Elsevier Ltd. All rights reserved.

Characterization of the nano-bio interaction between metallic oxide nanomaterials and freshwater microalgae using flow cytometry

Authors: Arze AR, Manier N, Chatel A, Mouneyrac C

Source: NANOTOXICOLOGY Early access, 2020, DOI: 10.1080/17435390.2020.1808106

Abstract: Since nanomaterials (NMs) are particulate contaminants, their first contact with organisms is a physical encounter ruled by physic-chemical processes that can determinate the potential NMs accumulation, toxicity, and trophic transfer. Freshwater ecosystems often become a final depository for NMs, so they can get in contact with the biota, especially primary organisms as algae. There are almost none comparative studies of this interaction using various NMs in the same conditions. This work identifies, analyzes, and compares the algae-NMs interaction by flow cytometry after a short-term contact test in which three freshwater algae (*Raphidocelis subcapitata*, *Desmodesmus subspicatus*, and *Chlorella vulgaris*) interact individually with a set of twelve metallic oxide NMs. Dose-response profiles and differences in the algae-NMs interaction were found according to each algae species (*C. vulgaris* had the most affinity, starting the interaction from 0.5 mg/L andD. subspicatushad the less affinity starting at 5 mg/L). Flow cytometry results were confirmed by optical microscopy. Some NMs characteristics were identified as key-factors that govern the algae-NMs interaction: NMs composition (no interaction for SiO2NMs), surface electric charge (higher interaction for the positively charged NMs and lower interaction for the negatively charged ones) and crystalline form (for TiO2NMs). The presented method can be useful for a rapid determination of the interaction between free cells organisms as microalgae and (nano)particulate substances.

REVUE DE PRESSE / ALTERNATIVES / BIOPESTICIDES

Intercropping technique may improve agricultural sustainability and productivity

Producing sufficient food supplies for our growing population is a major global challenge. Intercropping, an agricultural technique whereby multiple crop species are cultivated in the same field, may be more sustainable than mono-crop practices, resulting in a greater yield per unit of land and fertiliser than sole crops. This study analyses the effect of intercropping on yield gain, exploring the effects of different crop species combinations, temporal and spatial arrangements and fertiliser input. [...]

Accès au document

Info firmes Syngenta acquiert Valagro, leader dans la production de biostimulants

Terre-Net 06/10/20

Syngenta vient d'officialiser, le 6 octobre, l'acquisition de Valagro, leader dans la production de biostimulants et de produits de

https://doi.org/10.15454/6MQT-0H51

nutrition. Avec les semences et le digital, les produits biologiques (biocontrôle et biostimulation) représentent les axes stratégiques de développement de Syngenta France afin d'accompagner les agriculteurs dans la transition agro-écologique.

Lors d'une conférence de presse de Syngenta France, son président Bruno Baranne a rappelé la forte ambition de la firme concernant les produits biologiques (biocontrôle et biostimulation). Ils constituent « un des leviers majeurs pour accélérer la transition agro-écologique », indique Florence Louis, directrice "solutions alternatives". Afin de proposer un porte-feuille innovant répondant aux besoins des agriculteurs, la firme a notamment révélé l'acquisition de Valagro, « entreprise de premier plan dans le domaine des produits biologiques ». [...]

Accès au document

Betteraves - Programme Aker : Une diversité variétale élargie pour répondre aux défis de demain

Terre-Net 23/09/20

Alors que le contexte de la filière betterave-sucre est actuellement tendu, le colloque scientifique international, clôturant le 18 septembre dernier le programme d'investissements d'avenir Aker - Betteraves 2020 « L'innovation compétitive », a rendu un bilan très positif au terme de 8 années de travaux menés par 11 partenaires et une centaine de collaborateurs. Des variétés de betteraves plus performantes, issues de ce programme de recherche, pourraient être disponibles dès les semis 2025. [...]

Accès au document

Plant protein discovery could reduce need for fertilizer

EurekAlert! 04/09/20

Researchers have discovered how a protein in plant roots controls the uptake of minerals and water, a finding which could improve the tolerance of agricultural crops to climate change and reduce the need for chemical fertilisers.

The research, published in Current Biology, shows that members of the blue copper proteins family, the Uclacyanins are vital in the formation of Casparian strips. These strips are essential structures that control mineral nutrient and water use efficiencies by forming tight seals between cells in plants, blocking nutrients and water leaking between. [...]

Accès au document

REVUE DE PRESSE / ASSOCIATIONS

Politique agricole commune : La Pac rate son cap vert

QueChoisir 29/10/20

Et de trois ! Le Parlement européen a voté sa proposition de réforme de la Politique agricole commune (Pac) vendredi 23 octobre, à l'issue d'une semaine très agricole. Trois jours plus tôt, c'était le Conseil des ministres de l'Agriculture des 27 États membres qui s'accordait laborieusement sur un accord, lui-même basé sur les propositions de la Commission européenne. Place désormais au trilogue entre ces trois institutions, pour négocier un compromis entre leurs versions pour le printemps 2021. Au cours des prochains mois, les tractations coutumières sur les chiffres et pourcentages du texte final iront bon train, accompagnées des pressions des lobbies agro-industriels ou environnementalistes. Mais l'architecture générale de la prochaine Pac, qui régira notre agriculture et plus largement notre modèle alimentaire de 2023 à 2030 (1), est posée. Et elle est décevante pour les défenseurs de l'environnement et d'une alimentation saine. [...]

Accès au document

Vote de la loi sur les néonicotinoïdes - Après les députés, les sénateurs et sénatrices manquent de vision et de courage en votant pour le retour des « insecticides tueurs d'abeilles »

Que Choisir 29/10/20

Après les députés, le Sénat vient de donner son feu vert à la réautorisation des néonicotinoïdes. Malgré l'opposition déterminée de quelques sénateurs et sénatrices, la grande majorité a décidé d'entériner une décision qui met à mal la biodiversité dans un état déjà catastrophique et la durabilité de nos pratiques agricoles. Face à ce recul historique, nos organisations alertent les pouvoirs publics : elles n'en resteront pas là et se battront pour la biodiversité, la santé humaine et un avenir agricole durable. [...]

Accès au document

New European Union Looks at Chemical Mixtures

Beyond Pesticides, October 30, 2020

The European Union (EU) adopted, in mid-October, a new strategy on chemicals — including pesticides — that seeks to deal with their combined (synergistic) and cumulative impacts on human and environmental health. A highlight of the new strategy is the acceleration of work, already begun across the EU, to address the "chemical cocktail" impacts of pesticides and other chemicals. Human exposures to such "cocktails" can happen through use of multiple different agricultural pesticides that can persist as residues on food, and via industrial processes and consumer products. Beyond Pesticides has insisted for years that, here in the states, the Environmental Protection Agency (EPA) has been way behind the eight ball in dealing with the potential synergistic and cumulative impacts of the pesticides its registers for use. Advocates have argued that the agency must be far more rigorous in evaluating impacts of exposures to multiple pesticides, as well as cumulative impacts. [...]

Accès au document

Natural Areas Surrounding Farmland Critical to Reducing Pesticide Use

Beyond Pesticides, October 29, 2020

Natural areas around farmlands play an important role in managing pest outbreaks and therefore reducing insecticide use, a new study published in the journal Ecology Letters finds. While industrial agriculture puts pressure on farmers to grow single crops on ever larger farms to achieve economies of scale, these monoculture landscapes have significant downsides for public health and the environment. "Overall, our results suggest that simplified landscapes increase vineyard pest outbreaks and escalate insecticide spray frequencies," said lead author Daniel Paredes, PhD, to the Daily Democrat. "In contrast, vineyards surrounded by more productive habitats and more shrubland area are less likely to apply insecticides." [...]

Accès au document

Captured by Extremist Pro-Pesticide Agenda, A Broken EPA Reregisters Several Toxic Pesticides

Beyond Pesticides, October 28, 2020

https://doi.org/10.15454/6MQT-0H51

This month the U.S. Environmental Protection Agency (EPA) finalized decisions allowing continued use of a range of highly toxic pesticides, including the herbicide paraquat, and the and synthetic pyrethroid class of insecticides. The move has been met with stinging criticism from the health and environmental community, but the decisions come as no surprise. Continued allowance of hazardous pesticides is a result of a weak law, lax regulations, and an administration that has consistently refused to follow even deficient protections. [...]

Accès au document

23 organisations demandent au sénat de ne pas entériner le retour des insecticides tueurs d'abeilles

Générations futures 15/10/20

Alors que le Sénat doit se prononcer en assemblée plénière le 27 octobre prochain sur le projet de loi du gouvernement remettant en cause l'interdiction des insecticides néonicotinoïdes, une vingtaine d'organisations adressent aux sénateurs et sénatrices une note de synthèse détaillée sur les conséquences économiques, agronomiques, environnementales et sanitaires d'une telle régression du droit français.

Les organisations – associations environnementales et de défense des consommateurs, syndicats agricoles et apicoles – rappellent que les agriculteurs de la filière betteravière souffrent de difficultés économiques structurelles, liées à la dérégulation du marché, et proposent des solutions économiques et agronomiques pour préserver les emplois et rendre cette filière plus résiliente, sans ré-autorisation de substances dramatiquement dangereuses pour la biodiversité et la santé. [...]

PARMI LES ORGANISATIONS SIGNATAIRES DE LA NOTE : Agir pour l'Environnement, Alerte des médecins sur les pesticides, Attac France, Combat Monsanto, Confédération Paysanne, Fédération Nature & Progrès, Fondation Nicolas Hulot, Foodwatch France, France Nature Environnement, Générations Futures, Greenpeace Fédération Nature & Progrès, France, Ingénieurs sans Frontière Groupe Agriculture et souveraineté alimentaire (Agrista), Justice Pesticides, LPO, POLLINIS, Terre d'Abeilles, Union Nationale de l'Apiculture Française, WECF France, Eau et rivières de Bretagne,Mouvement de l'Agriculture BioDynamique, Syndicat des Apiculteurs d'Occitanie, Syndicat National d'Apiculture.

Accès au document

Commission spéciale sur la Lutte contre le Cancer - Mes priorités en tant que coordinatrice pour le groupe Verts/ALE

Michele-Rivasi, 12 octobre 2020

La Commission Spéciale sur la Lutte contre le Cancer (BECA) a débuté ses travaux aujourd'hui. (1) L'eurodéputée EELV Michèle Rivasi, coordinatrice pour le groupe Verts/ALE, présente ses priorités au sein de cette commission spéciale qui va durer un an.

"Nous vivons actuellement une véritable épidémie de cancer, avec près de 2,8 millions de nouveaux cas de cancer en Europe chaque année.

" Au sein de cette commission j'insisterai sur la prévention. La meilleure thérapie contre le cancer est d'abord de ne pas en en développer. Il faut donc garantir un environnement sain pour tous et toutes, car l'origine des cancers peut se trouver prioritairement dans l'environnement naturel, surtout alimentaire. L'Europe porte cette responsabilité et doit rationnaliser son combat contre les pollutions chimiques, les perturbateurs endocriniens et face aux ondes électromagnétiques, classées cancérigènes possibles par l'OMS. [...]

Accès au document

Combination of Pesticide Exposure, Limited Food Lead to Wild Bee Declines

Beyond Pesticides, October 20, 2020

The additive stress of pesticide exposure and food scarcity leads to significant declines in wild pollinator populations, according to research published by scientists at University of California, Davis. Although it is well known that insect and pollinators populations are at risk from multiple stressors related to industrial agriculture, comprehensive evaluations are a challenging scientific undertaking. "Just like humans, bees don't face one single stress or threat," said lead author Clara Stuligross, a PhD. candidate in ecology at UC Davis. "Understanding how multiple stressors interplay is really important, especially for bee populations in agricultural systems, where wild bees are commonly exposed to pesticides and food can be scarce."

To better understand the interplay between these two stressors, researchers designed a field study. [...]

Accès au document

Switzerland to stop exporting banned pesticides

Panna 16/10/20

Earlier this week the government of Switzerland announced that it will no longer allow exports of five pesticides that have long been banned in their own country due to known health and environmental harms. Given that pesticide industry giant Syngenta is based in Switzerland, this is incredibly significant — and very, very good news.

The decision comes after increasing pressure from Pesticide Action Network (PAN) partner groups in Europe to stop allowing this egregious double standard in pesticide trade.

Switzerland-based Public Eye has been particularly focused on the issue over the past year, documenting both the huge industry-wide profits from highly hazardous pesticide (HHP) sales ($13.7 billion in 2017), and the impact of these chemicals on farmers, workers and communities in the Global South. [...]

Accès au document

Scientists Warn of Another Pandemic If Officials Continue to Ignore Explosion of 'Antimicrobial Resistance'

Beyond Pesticides, October 16, 2020

The Lancet has published an article that identifies several of the multiple and interacting crises the U.S. and world face, with a focus on another "looming potential pandemic. [a] rise in multidrug-resistant bacterial infections that are undetected, undiagnosed, and increasingly untreatable, [whose rise] threatens the health of people in the USA and globally." It calls on leaders in the U.S. and beyond, asking that even as they address the current coronavirus pandemic, they also attend to the antimicrobial resistance (AMR) problem, which is a growing threat to public health. The co-authors outline a number of strategies for progress on AMR, including banning of medically important antibiotics in agribusiness, and promoting consumer, and supplier and private sector, awareness and action on food choices. Beyond Pesticides endorses these strategies, but insists that a genuine solution would include the transition to organic agriculture, not least for the health benefits it would provide. [...]

Accès au document

https://doi.org/10.15454/6MQT-0H51

Literature Review: Pesticides Exposure Highly Correlated with Respiratory Diseases

Beyond Pesticides, October 15, 2020

A review of scientific literature on the correlation between respiratory diseases and pesticides exposure—published in the journal Annals of Agricultural and Environmental Medicine (AAEM), "Influence of pesticides on respiratory pathology—a literature review"—finds that exposure to pesticides increases incidents of respiratory pathologies (i.e., asthma, lung cancer, and chronic obstructive pulmonary disease [COPD]—or chronic bronchitis). The review by researchers at the Iuliu Hatieganu' University of Medicine and Pharmacy Cluj-Napoca, Cluj-Napoca, Romania, looks at how pesticide exposure adversely propagates and reinforces respiratory diseases in humans. This review highlights the significance of evaluating how pesticide exposure impacts respiratory function, especially since contact with pesticides can happen at any point in the production, transportation preparation, or application treatment process. Researchers in the study note, "Knowing and recognizing these respiratory health problems of farmers and their families, and also of [pesticide] manipulators/retailers, are essential for early diagnosis, appropriate treatment, and preventive measures." This study results are critically important at a time when exposure to respiratory toxicants increases vulnerability to Covid-19, which attacks the respiratory system, among other organic systems. [...]

Accès au document

Insecticide Linked to Testicular Cancer, With Latinos Disproportionately Affected

Beyond Pesticides, October 14, 2020

Exposure to certain endocrine disrupting pesticides increases the risk men, and Hispanic men in particular, will contract testicular cancer, according to research presented at the American Association for Cancer Research Conference on the Science of Cancer Health Disparities in Racial/Ethnic Minorities and the Medically Underserved. The data show that living near the use of the insecticide acephate presents the greatest cancer risk. "Testicular cancer rates have been rising for decades and are rising especially quickly among Hispanics in the United States," said Scott Swartz, an MD candidate in University of California Berkeley-UCSF Joint Medical Program, to Healio. "Given that Hispanics are disproportionately exposed to many endocrine-disrupting pesticides in California, we were interested in investigating the potential effects of nearby endocrine-disrupting pesticide application on testicular cancer among Hispanics in California." [...]

Accès au document

Victoire juridique : La France était légitime pour prendre son interdiction des néonicotinoïdes en 2016

Générations futures 09/10/20

La cour européenne conclut que la France était légitime à prendre l'interdiction de 2016 contre les néonicotinoïdes considérée comme une mesure d'urgence, sous réserve de l'appréciation du Conseil d'Etat.

La CJUE, saisie sur renvoi préjudiciel du Conseil d'État suite à la plainte déposée par l'UIPP

https://doi.org/10.15454/6MQT-0H51

(affaire 424617), a rendu son arrêt sur la conformité au droit de l'Union des mesures d'interdiction des néonicotinoïdes prises par la France. La Cour considère en substance que la France était légitime à prendre cette interdiction, considérée comme une mesure d'urgence, sous réserve du contrôle par le Conseil d'État des modalités de présentation de ces mesures à la Commission Européenne et aux autres États-Membres. [...]

Accès au document

Plan de sortie du glyphosate : Un rapport qui sonne comme un renoncement à l'interdiction !

Génération futures 09/10/20

Dans le cadre du 'plan de sortie du glyphosate' engagé par le gouvernement, l'Anses a lancé une évaluation des alternatives non chimiques à cet herbicide dont les résultats ont été rendus publics ce 9 octobre 2020. [...]

Conclusion :

Ce rapport de l'ANSES est très préoccupant car il n'avance qu'un nombre très restreint d'usages pour lesquels des alternatives au glyphosate existent qui doivent être considérées comme courantes et sans impact économique. Pour ces usages le glyphosate sera interdits. Elles ont été sélectionnées en observant les pratiques d'une agriculture aujourd'hui très dépendante au glyphosate sans chercher à retenir celles qui, bien que considérées non courantes aujourd'hui, pourraient le devenir demain, avec quelques aides PAC ciblées pour la réduction des pesticides par exemple. Le rapport ne va donc pas créer une vraie dynamique pour les changements de pratiques mais plutôt acter une sorte de statuquo en n'encourageant pas clairement la montée en puissance d'alternatives déjà existantes pour la plupart. [...]

Accès au document

La PAC post-2020 face à l'urgence écologique

FNE 05/10/20

À l'approche du vote au Parlement européen de la nouvelle PAC, France Nature Environnement vous résume ses propositions. Celles-ci s'attachent à promouvoir une agriculture qui réponde à l'enjeu alimentaire tout en respectant l'ensemble des grands équilibres environnementaux et en tenant compte du bien-être animal. [...]

Les pratiques à favoriser :

[...]

Réduire l'usage des intrants (engrais et pesticides de synthèse, aliments, énergie, eau d'irrigation, etc.) et interdire les OGM et nouveaux OGM [...]

Accès au document

Alimentation : vers un indicateur environnemental des produits

Que Choisir 05/10/20

Réchauffement climatique et perte de biodiversité obligent, les consommateurs attendaient une note de l'impact environnemental de leur alimentation, sur le modèle des scores nutritionnels. Une première étape a été franchie, avec la publication d'une énorme base de données. Nommée Agribalyse, elle fournit des indicateurs environnementaux pour environ 200 produits agricoles et 2 500 aliments. Décryptage.

La base de données Agribalyse (1), gratuite et ouverte à tous mais complexe à interpréter, est plutôt destinée à aider les filières agricoles et agroalimentaires à améliorer leurs pratiques. Elle utilise la méthode d'Analyse du cycle de vie (ACV) pour calculer 14 indicateurs (lire l'encadré) qui prennent en compte toutes les étapes « du champ à l'assiette » (production, stockage, pertes, transformation, transport…). Plus le score global est faible, moindre est l'impact environnemental. [...]

Accès au document

Exclusif : des néonicotinoïdes dans nos assiettes !

Générations futures 02/10/20

Alors que les députés s'apprêtent à débattre ce 5 octobre et à voter le 6 de ce même mois sur la loi en faveur de la ré-autorisation des insecticides néonicotinoïdes, notre association publie un nouveau rapport exclusif qui montre la présence de résidus de néonicotinoïdes dans des aliments vendus en France.

Notre travail d'analyse a porté sur les données 2017 des différents plans de la DGCCRF* et ce travail montre clairement que l'exposition aux néonicotinoïdes ne concerne pas que les pollinisateurs. [...]

Accès au document

What's on our food ? Sometimes, it's pesticides

PAN 09/10/20

We're all aware that fruits and vegetables are an important part of a healthy diet. But, some of that produce carries pesticide residues that can be harmful to our health and the health of our children.

Recent analysis of US Department of Agriculture data by Consumer Reports shows that some of the produce we are eating carries a high risk of contamination. The August 27 article, "Stop Eating Pesticides," shows conventionally-produced potatoes, green beans, cherries and peaches to be among those items most likely to carry harmful levels of pesticide residue. On the other hand, when certified organic produce data were available, the results showed lower risk for pesticide residue levels. [...]

Accès au document

EPA Dismisses Disproportionate Harm to Farmworker Children from Neurotoxic Insecticide Chlorpyrifos, Leaves in Food Supply, Rejects Scientific Method

Beyond Pesticides, October 2, 2020

The U.S. Environmental Protection Agency's (EPA) September 22 announcement asserts that, "despite several years of study, the science addressing neurodevelopmental effects [of the insecticide chlorpyrifos] remains unresolved," as reported in The New York Times. This conclusion contradicts both ample scientific evidence and the agency's own findings. Beyond Pesticides has repeatedly advocated for a ban on the use of chlorpyrifos because of the grave risks it poses.

This organophosphate pesticide is used on approximately 60 different crops, including almonds, cotton, citrus fruits, grapes, corn, broccoli, sugar beets, peaches, and nectarines. It is also commonly employed for mosquito-borne disease control, and on some kinds of managed turf, including golf courses. Exposure to the pesticide has been identified repeatedly as problematic. Most residential uses were taken off the market in 2000, after the manufacturer, DowDupont (now Corteva) was faced with EPA action. [...]

Accès au document

Seed Keepers and Truth Tellers: From the Frontlines of GM Agriculture

PANNA 02/10/20

On Tuesday November 17, PAN and our partners at Hawai'i Alliance for Progressive Action (HAPA) will launch the video Seed Keepers and Truth Tellers: From the Frontlines of GM Agriculture.

This animated short, launching in the midst of the COVID-19 crisis, shines a bright light on how fragile and unjust so many of our interconnected global systems are. The video focuses on genetically modified (GM, also known as GMO) seeds and the story of their global impacts. [...]

Harmful, accelerating "pesticide treadmill"

Just as farmers, workers, and rural communities predicted when the floodgates first opened wide for GM seeds, weed resistance to the herbicides that these seeds are modified to withstand is accelerating fast. Around the world, GM agriculture is driving dramatic increases in herbicide use to combat these resistant "superweeds." [...]

Accès au document

New Insecticides Escalate Indiscriminate Harm to All Organisms

Beyond Pesticides, October 9, 2020

A new study demonstrates that emerging "novel" insecticides can cause significant, sublethal harm to beneficial organisms at typical "real life" exposure levels. As neonicotinoid insecticides have come under fire for their terrible impacts on a broad variety of beneficial insects — including their major contributions to the decline of critical pollinators — more such "novel" pesticides are being brought to market in response. The study results, the co-authors say, "confirm that bans on neonicotinoid use will only protect beneficial insects if paired with significant changes to the agrochemical regulatory process. A failure to modify the regulatory process will result in a continued decline of beneficial insects and the ecosystem services on which global food production relies." Beyond Pesticides would add that the study outcome points, yet again, to the grave recklessness of the pervasive "addiction" to chemical pesticides in agriculture. The solution to this chemical morass is known, doable, and scalable: a transition to organic, regenerative agricultural practices that get everyone off the "toxic treadmill." [...]

Accès au document

Common Fungicide Causes a Decrease in Antioxidant Responsible for Defense Against Diseases like COVID-19

Beyond Pesticides, October 8, 2020

Research from the University of Wisconsin—Madison (UWM), suggests that fludioxonil—a commonly used agricultural fungicide—decreases the human body's ability to defend itself against illnesses, like COVID-19, and promotes disease permanency. Tristan Brandhorst, a Ph.D. scientist at UWM, notes that a pesticide-induced reduction in the antioxidant glutathione could be responsible for this lack of bodily defense against disease. Although many studies examine how pesticides adversely affect the human body (i.e., cancer, respiratory issues, etc.), very few studies assess how pesticides reinforce chemical disruption patterns that reduce levels of vital chemicals needed for normal bodily function. [...]

Accès au document

https://doi.org/10.15454/6MQT-0H51

Glyphosate : l'Anses restreint les usages agricoles de l'herbicide

Terre-Net 09/10/20

Plafonnement des volumes, usages limités : l'agence sanitaire Anses a annoncé vendredi des restrictions d'utilisation du glyphosate pour la viticulture, l'arboriculture ou les céréales, qui entreront en vigueur dans les six mois pour avancer vers la fin totale de l'herbicide promise pour 2023.

« Cette limitation des conditions d'emploi et des doses par hectare contribuera à réduire dès 2021 les quantités de glyphosate utilisées en France », indique l'Anses, qui ne donne pas d'estimation de cette baisse. Le glyphosate est le deuxième produit phytosanitaire le plus utilisé en France (derrière le souffre), avec 9 700 tonnes de la substance active vendues en 2018 (contre 8 800 en 2017). [...]

Accès au document

Néonicotinoïdes : le projet de loi « n'oppose pas économie et écologie »

Terre-Net 06/10/20

Le projet de loi controversé permettant la réintroduction temporaire des néonicotinoïdes pour préserver la filière betteraves « ne veut pas opposer économie et écologie » mais est une question de « souveraineté », a affirmé le ministre de l'agriculture, Julien Denormandie, lundi devant l'Assemblée nationale.

« C'est un texte difficile, important qui ne veut pas opposer économie et écologie », a déclaré le ministre de l'agriculture en ouvrant les débats dans l'hémicycle. « La question est celle de notre souveraineté », a-t-il ajouté. « La filière de la betterave est aujourd'hui en danger », a mis en avant Julien Denormandie. En raison de la prolifération d'un puceron vert vecteur de la maladie qui affaiblit les plantes dans de nombreuses régions, les betteraves issues de semences non enrobées d'insecticide sont atteintes de « jaunisse ». La réintroduction de semences enrobées avec des néonicotinoïdes doit permettre de protéger les rendements sucriers. [...]

Accès au document

Néonicotinoïdes : Nicolas Hulot « appelle les députés à ne pas voter cette loi »

Terre-Net 04/10/20

L'ancien ministre de l'Ecologie Nicolas Hulot « appelle les députés à ne pas voter » le projet de loi controversé permettant la réintroduction temporaire des néonicotinoïdes pour préserver la filière betteraves, dont l'examen commence lundi à l'Assemblée.

« J'appelle les députés à ne pas voter cette loi. Prolonger l'usage des néonicotinoïdes pour la filière de la betterave, alors que leur interdiction a été votée en 2016, ce n'est pas une solution », déclare-t-il dans un entretien au Journal du dimanche. Le projet de loi prévoit le recours temporaire et encadré à ces insecticides néfastes pour les abeilles. [...]

Accès au document

Webinaire “Pesticides interdits ici, mais exportés hors UE”

Michèle Rivasi 25/09/20

Le 29 septembre, de 14h30 à 16h30, nous vous invitons à participer en ligne à la conférence “Pesticides interdits ici, mais exportés hors UE”organisée par les eurodéputés Eric Andrieu (S&D), Anja Hazenkamp (GUE) et Michèle Rivasi (Verts / ALE), en collaboration avec les ONGs PAN Europe et Public Eye.

Les citoyens européens s’inquiètent de plus en plus de l’utilisation de pesticides dangereux dans la production alimentaire et de leur impact sur la

santé humaine et la biodiversité à l'échelle mondiale. La loi européenne qui vise à garantir un niveau élevé de protection contre les pesticides en Europe et l'engagement de la Commission européenne dans le cadre de la Stratégie « De la ferme à la fourchette » d'interdire progressivement les pesticides dangereux de l'agriculture et de promouvoir des pratiques alternatives sont sans aucun doute extrêmement importants.

Cependant, la législation européenne n'interdit pas les entreprises ou les Etats membres de produire ces pesticides dangereux pour les exporter. Le 10 septembre 2020, les ONGs Public Eye et Greenpeace UK dévoilaient que plus de 81.000 tonnes de pesticides extrêmement dangereux ont été vendues en 2018 hors de l'Union européenne. [...]

Accès au document

Neonicotinoid Insecticides Trigger Neurodegeneration and Can Blind Insects at Low Doses

Beyond Pesticides, September 30, 2020

Low doses of neonicotinoid (neonic) insecticides are known to disrupt insect learning and behavior, but new science is providing a better understanding of how these effects manifest at a cellular level. Published in the Proceedings of the National Academy of Sciences, this study finds that the neonic imidacloprid binds to brain receptors, triggering oxidative stress, reducing energy levels, and causing neurodegeneration. [...]

Accès au document

Bayer Coordinated with U.S. Government on Pressure Campaign to Stop Thailand from Banning Glyphosate

Beyond Pesticides, September 23, 2020

Multinational agrichemical corporation Bayer coordinated with the U.S. government to pressure Thailand to drop plans to ban glyphosate use, according to documents obtained by the Center for Biological Diversity (CBD). CBD is now suing the Trump Administration after it refused to release additional documents pertaining to the pressure campaign. The incident is the latest example of an administration that has allowed corporate interests to dictate American governmental action on toxic pesticides. [...]

Accès au document

EPA Reapproves Toxic Weedkiller Atrazine with Fewer Protections for Children's Health

Beyond Pesticides, September 22, 2020

Use of the highly hazardous, endocrine disrupting weed killer atrazine is likely to expand following a decision made earlier this month by the U.S. Environmental Protection Agency (EPA). Under the guise of "regulatory certainty," the agency is reapproving use of this notorious herbicide, as well as its cousins simazine and propazine in the triazine family of chemicals, with fewer safeguards for public health, particularly young children. Advocates are incensed by the decision and vow to continue to put pressure on the agency. "Use of this extremely dangerous pesticide should be banned, not expanded," Nathan Donley, PhD, a senior scientist at the Center for Biological Diversity said in a press release. "This disgusting decision directly endangers the health of millions of Americans." Beyond Pesticides has long argued against the continued use of the triazine herbicides, which includes atrazine. [...]

Accès au document

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La HVE fait de l'ombre au bio, il faut l'éliminer

Alerte-Environnement 17/09/20

HVE, comme « Haute Valeur Environnementale » est sans doute ce qui fait de mieux en agriculture pour à la fois produire bon et sain, et respecter l'environnement. En voici la définition exacte : L'agriculture à haute valeur environnementale (HVE) est une certification créée et encadrée par le Ministère de l'Agriculture, de l'Agroalimentaire et de la Forêt qui vise à valoriser les productions issues d'exploitations agricoles qui s'engagent volontairement dans des démarches respectueuses de l'environnement. Initiée en 2011, c'est une démarche globale de préservation de l'environnement qui ne certifie pas la qualité d'un produit mais la qualité environnementale d'une ferme. La certification HVE est une démarche à l'initiative des agriculteurs et accompagnée par l'ensemble des acteurs concernés des sphères agricole et agro-alimentaire. La démarche contient 3 niveaux, seul le niveau 3 autorise l'utilisation de la mention « haute valeur environnementale ».

Mais voilà, la démarche HVE a deux défauts majeurs pour le lobby bio : elle ne bannit pas l'usage des produits phytosanitaires de synthèse, évidemment employés lorsque c'est ultra nécessaire. Et surtout, la « marque » HVE commence à être reconnue et à faire de l'ombre au bio. Il faut dire que la HVE garantit un respect total de l'environnement, sans le dogmatisme anti-pesticides de synthèse version Coquelicots, Générations Futures & Co… et sans les prix astronomiques du bio sur nos étals. [...]

Accès au document

10 raisons de ne pas revenir sur l'interdiction des néonicotinoïdes

FNE 15/09/20

France Nature Environnement et 30 autres organisations demandent aux parlementaires d'avoir le courage politique de s'opposer au projet de loi de dérogation à l'interdiction des néonicotinoïdes annoncé par le Ministre de l'Agriculture en août dernier : un projet dangereux pour la biodiversité, la santé environnementale et l'avenir de notre agriculture.

La décision de retrait des néonicotinoïdes en France, actée en 2016, est l'une des décisions politiques les plus fortes de ces vingt dernières années en matière de pesticides. Elle permet enfin d'envisager un nouveau modèle agricole basé sur l'agroécologie, l'optimisation et la régulation naturelle des prédateurs des cultures.

Or, le 6 août 2020, le Ministre de l'Agriculture annonçait vouloir lever l'interdiction sur l'utilisation des néonicotinoïdes pour la betterave sucrière en 2021. Cette dérogation, qui sera examinée à la rentrée par l'Assemblée Nationale, s'étendrait jusqu'en 2023 et n'est pas circonscrite –dans le texte soumis au vote– à la seule culture de la betterave. [...]

Accès au document

Épandage de pesticides : recul sur la protection des riverains

Que Choisir 15/09/20

Les chartes départementales dites « de concertation » sur l'épandage des pesticides à proximité des habitations sont désormais validées par les préfets dans une majorité de départements. Partout, les distances déjà minimales prévues par la réglementation ont encore été réduites. Une vraie mascarade, dénoncent les associations.

En juin 2019, le Conseil d'État retoquait en partie le décret sur l'utilisation des pesticides, soulignant que les riverains de cultures traitées « doivent être regardés comme des habitants fortement exposés aux pesticides sur le long

https://doi.org/10.15454/6MQT-0H51

terme ». Le gouvernement avait donc revu sa copie et imposé des distances sans traitement à proximité de tous les lieux habités : 5 mètres pour les céréales et les légumes, 10 mètres pour la vigne et les arbres fruitiers.

Même si c'était une grande première, ces distances restaient insuffisantes pour protéger les habitants. En 2016, une direction du ministère de l'Agriculture, la DGAL, avait en effet recommandé 5 mètres pour les céréales et les légumes, 20 mètres pour la viticulture et 50 mètres pour l'arboriculture.

Mais malgré les faibles distances retenues, les lobbies de l'agriculture productiviste ont mené une lutte acharnée et obtenu une contrepartie, les fameuses chartes d'engagement départementales qui peuvent encore réduire ces distances après concertation entre agriculteurs, élus locaux et riverains. [...]

Accès au document

Fake news autour du glyphosate : François Veillerette frappe encore

Alerte-environnement 13/09/20

François Veillerette s'est répandu le 9 septembre dernier sur RTL à propos du glyphosate. Face à lui, un journaliste impartial mais mal renseigné (comme souvent), ce qui l'a empêché de relever les contradictions et les mensonges de l'activiste.

Les contradictions tout d'abord : interdire le glyphosate, c'est accroître les achats de tracteurs et la consommation de gazoil, un peu comme interdire le nucléaire signifie rouvrir et construire des centrales thermiques ou à charbon… Ce sont des écolos qui réclament ces aberrations anti-environnement. [...]

Accès au document

Lettre ouverte d'un lecteur au député Matthieu Orphelin

Alerte-environnement 11/09/20

Matthieu Orphelin est député dans la première circonscription de Maine-et-Loire depuis les législatives de 2017 (élu sous l'étiquette LREM, puis apparenté Libertés et territoires puis Écologie démocratie solidarité).

Le 2 août sur votre compte Twitter, vos commentaires sur la culture de la betterave sucrière ne sont pas passés inaperçus. Vos propos ont fait apparaître votre méconnaissance des pratiques agricoles.

« On se renseigne avant de dire n'importe quoi », vous ont tweeté plusieurs internautes spécialistes de la culture de la betterave. Vous avez très rapidement supprimé votre tweet…

En 2018, contre l'avis des producteurs et de nombreux scientifiques, vous avez voté la loi concernant la suppression des néonicotinoïdes en enrobage des semences en culture de betteraves sucrières. Selon vous, il existe des alternatives et il n'y a pas d'interdiction sans solution… [...]

Accès au document

Ré-autorisation des néonicotinoïdes : vraiment pas d'alternative ?

Que Choisir 10/09/20

Alors qu'ils sont interdits en France et en Europe en raison de leur toxicité sur les abeilles et l'environnement, le gouvernement veut ré-autoriser les insecticides néonicotinoïdes pour la culture de la betterave sucrière. Une fuite en avant au service de l'agriculture intensive, sans même chercher à faire évoluer ses pratiques.

Si les producteurs parlent d'attaques de pucerons exceptionnelles sur les semis de betteraves en 2020, ils n'ont pas vraiment d'élément de comparaison. Depuis 20 ans qu'on enrobait les semences avec des néonicotinoïdes

en agriculture conventionnelle, le problème des pucerons était résolu. Durant ces deux décennies, on n'a donc pas fait de recherches sur les méthodes de lutte alternatives, on n'a pas non plus travaillé sur des variétés de betteraves résistantes à la jaunisse, on s'est seulement évertué à agrandir la taille des parcelles aux dépens des arbres et des haies. Alors, dès la première alerte, les exploitants ont assiégé le gouvernement. [...]

Accès au document

Reining in a dangerous tool

PANNA 18/09/20

Skilled farmers are aware that every tool and every technique for raising a crop has its risks and rewards. Cultivation and tillage can damage soil structure, promote erosion and disturb important soil organisms. Cover crops could tie up nutrients and become weeds in future crops. This is why growers learn how to manage the tools they use, so they can maximize the benefits and control the detrimental effects.

Unfortunately, producers on an overwhelming majority of production acres in the United States overuse the pesticide hammer from the agricultural toolbox without considering the risks. But, there is some hope on the horizon with the introduction of proposed national legislation called the Protect America's Children from Toxic Pesticides Act (PACTPA). [...]

Accès au document

Yep, pesticides are still making us sick

PANNA 17/09/20

In August, the California Department of Pesticide Regulation released new data on acute pesticide-related illnesses and injuries in the state from the year 2017. The grim — though unsurprising — findings ? Each year, pesticide use continues to harm hundreds of farmworkers and rural community members across California. [...]

Accès au document

Primates, Both Wild and Captive, Are Being Exposed to Toxic Pesticides and Flame Retardants

Beyond Pesticides, September 15, 2020

Both wild and captive primates are being exposed to hazardous pesticides and flame retardants, according to research published this month in the journal Environmental Science and Technology. This is the first study to look at the threat anthropogenic (man-made) chemicals may present for this important order of animals. "We think a lot about habitat disturbance, logging, and hunting as threats to these species, while pollution has been overlooked," study co-author Michael Wasserman, told Environmental Health News (EHN). [...]

Accès au document

Pesticides and Heavy Metals Found in Blunt (Cigar) Wrappers, Cellulose-Based Rolling Papers, and other Plant-based Rolling Paper Products

Beyond Pesticides, September 10, 2020

A new analysis by Science of Cannabis Laboratories Inc. (SC Labs) finds detectable concentrations of pesticides and heavy metals in rolling papers, with hemp/blunt wraps and cellulose-based rolling papers containing the highest levels of contaminants. The analysis follows a SC Labs' finding of high levels of chlorpyrifos—a neurotoxic, organophosphate

insecticide—in the rolling paper of pre-rolled cannabis, which was undergoing compliance testing. [...]

Accès au document

Une association dénonce des résidus de pesticides dans des vins certifiés HVE

Agri-mutuel 17/09/20

L'association bordelaise Alerte aux toxiques a dénoncé la présence de résidus de pesticides de synthèse dans 22 vins certifiés Haute valeur environnementale (HVE), une présence qui a été qualifiée de « globalement relativement basse » par le laboratoire d'analyses.

Il a été « mesuré les écarts entre les belles promesses, les annonces de virage écologique dans le Bordelais et la réalité de ce label qui se voudrait équivalent au bio », a déclaré mercredi à l'AFP la porte-parole de cette association, Valérie Murat. « Il ne l'est pas puisqu'il utilise des pesticides de synthèse parmi les plus dangereux », a-t-elle poursuivi, prônant à la place les logos en agriculture biologique (AB) et en biodynamie (Biodyvin, Bio Cohérence et Demeter). Le Conseil interprofessionnel du vin de Bordeaux (CIVB) a dénoncé « une escroquerie intellectuelle dans la mesure où les produits trouvés sont à des doses 50 à 1000 fois inférieures à la limite autorisée ». [...]

Accès au document

Pesticides : la maladie de Parkinson est plus facilement reconnue comme maladie professionnelle

Actu-environnement 15/09/20

Le délai de prise en charge de la maladie de Parkinson au titre des maladies professionnelles résultant de l'exposition aux pesticides passe de 1 à 7 ans. Cette modification résulte d'un décret paru le 12 septembre au *Journal officiel* qui vient modifier le tableau n° 58.

« *Cette amélioration permettra une augmentation des victimes indemnisées au titre de la maladie professionnelle* », se félicite l'association Phytovictimes. Le délai de prise en charge est en effet le délai maximal entre la fin de l'exposition au risque et la première constatation médicale de la maladie. [...]

Accès au document

Nouveau procès bâillon mené par des promoteurs de pesticides

Générations futures 8/9/20

Quand la liberté d'expression est menacée par ceux qui ne veulent pas qu'on parle des pesticides !

Des écologistes allemands et un auteur autrichien se retrouvent assignés en justice dans le nord de l'Italie suite à des critiques formulées contre l'utilisation massive de pesticides.

Le procès débute au tribunal régional de Bozen / Bolzano, en Italie, le 15 septembre avec des menaces d'emprisonnement et d'amendes, ainsi que des demandes potentielles de millions d'euros de dommages et intérêts.

Il s'agit sans conteste d'une tentative d'intimidation à l'encontre des personnes et ONG qui dénoncent la forte utilisation des pesticides au Tyrol du Sud (Südtirol / Alto Adige), l'une des plus grandes régions pomicoles d'Europe. Cette poursuite correspond à une stratégie, de plus en plus fréquemment utilisée en Europe pour faire taire les critiques militants et journalistes. [...]

Accès au document

Interview : Les Perturbateurs Endocriniens

https://doi.org/10.15454/6MQT-0H51

CRIIGEN 6/9/20

Joël SPIROUX, président du CRIIGEN et médecin environnementaliste, intervient au sein de « Visite Actuelle » du printemps 2020. Le moyen de toucher un public non habitué à nos messages de sensibilisation sur les effets néfastes des perturbateurs endocriniens.

Héraclite (450 ans av. J.-C.) le disait : « L'état de santé de l'homme est le reflet de l'état de santé de la terre ». Le constat de l'augmentation de la pollution environnementale et de ses effets sur les écosystèmes ne peut être qu'inquiétant et en contradiction avec la loi constitutionnelle de 2005 qui énonce dans son article premier : « Chacun a le droit de vivre dans un environnement équilibré et favorable à sa santé. ». Dans un tel contexte, l'étude des perturbateurs endocriniens (PE) représente un enjeu majeur pour le corps médical, les pouvoirs publics et la recherche.

Accès au document

Néonicotinoïdes : les parlementaires doivent dire NON !

Générations futures 3/9/20

Le ministre de l'Agriculture présente ce jour au conseil des ministres le projet de Loi relatif à l'autorisation des insecticides néonicotinoïdes pour au moins 3 années et pour toutes les cultures !

C'est un recul inacceptable et jugé comme tel par plus de 125 000 citoyen.nes. C'est d'ailleurs le message que comptent leur faire passer de nombreuses ONG qui préparent un courrier à l'intention des députés et sénateurs qui devront voter sur ce sujet. [...]

Accès au document

Take Action by Sept. 13 : Tell Canada to Ban Horrifically Hazardous Wood Preservative Pentachlorophenol

Beyond Pesticides, September 8, 2020

Canada should be in accordance with international treaty to eliminate persistent pollutants.

Canada is considering the elimination of one of the worst persistent pollutants—pentachlorophenol (penta)—that dot our landscape in utility poles and railroad ties. This wood preservative—a cancer-causing chemical with dioxin, furans, and hexachlorobenzene that causes health and environmental degradation—has no place in society as we struggle with shared global challenges of public and worker health threats, the climate crisis, and biodiversity decline. We have a chance to urge Canada to move ahead with a pentachlorophenol ban, joining with Mexico to show leadership in the protection of health and the environment—something the U.S. has not done. [...]

Accès au document

Pesticide Drift from Greenhouses Adversely Affects Children Living Nearby

Beyond Pesticides, September 4, 2020

When pesticide drift is investigated, it is most often drift from agricultural fields that is examined. A new study shows that off-target drift of pesticides from greenhouses is also a reality. This research deduced such drift of organophosphate and carbamate pesticides from crop applications done in Ecuadoran floriculture greenhouses by evaluating the acetylcholinesterase enzyme (AChE) activity, necessary to the transmission of nerve impulses, in children residing nearby. The team finds that

children living in homes near greenhouses in which these insecticides (widely recognized as cholinesterase inhibitors) are used exhibit reduced activity of this enzyme and abnormal functioning of the nervous system. Beyond Pesticides has monitored the pesticide drift issue intensively, and has long advocated for far better protections for farmworkers. This new information connects those issues, and expands the “drift” concerns to include risks to people working in greenhouses, and to those, especially children, who happen to live near greenhouse-type structures in which these toxic chemicals are used. [...]

Accès au document

Work-Related Exposure to Pollutants Increases the Risk of Developing Heart Defects in among Hispanic/Latinx Communities

Beyond Pesticides, September 3, 2020

Occupational exposure to pollutants including, those from wood burning, pesticides, metals, and vehicle combustion, increases the risk of developing heart abnormalities among Latinx individuals, according to new research published in the Journal of the American Heart Association. Although previous research focuses on the impact of pollutants on human health from occupational or residential exposure, this study highlights the risk chemical exposure can have on communities, especially for those underrepresented in conventional occupational health studies, such as those with Hispanic or Latinx backgrounds. People of color communities are already at greater risk of exposure to environmental and health harms, such as pesticide pollution, which has been identified as environmental racism. Additionally, not only are people of color at risk of developing various, serious health issues associated with additional or cumulative pesticide exposure, they disproportionately face an elevated risk from Covid-19 as essential workers or family members of those workers. [...]

Accès au document

Ré-autorisation de pesticides interdits : l'UFC-Que Choisir dénonce une grave atteinte démocratique, environnementale et sanitaire

UFC-Que choisir 01/09/20

En voulant ré-autoriser les néonicotinoïdes, dans un premier temps pour la betterave et potentiellement pour toutes les cultures, le Gouvernement met en péril la stratégie française d'éradication des pesticides les plus dangereux. Ce projet, déjà ficelé, ne fera l'objet d'aucun débat au CNTE réuni mardi 1er septembre, d'aucun avis, mais d'une simple présentation. Dans ces conditions, l’UFC-Que Choisir boycottera cette séance en signe de vive protestation quant aux conditions d'élaboration d'un projet aussi critiquable, tant dans ses conséquences sanitaires qu'environnementales. [...]

Accès au document

EU microplastics ban set to make a growing problem worse

EEB 1/09/20

The world is being smothered by a growing cloud of toxic plastic particles, which the EU has pledged to ban. But the typical cast of powerful industrial polluters has secured a loophole that excludes nano, the most dangerous form of microplastic.

The EU has promised to tackle microplastic pollution. Its own scientists are warning that the

situation is out of control and will be a "widespread risk within a century." [...]

Accès au document

Monarch massacre: hundreds of Monarch butterflies die after aerial mosquito spraying in North Dakota

Beyond Pesticides, September 2, 2020

It's being called the Monarch Massacre—hundreds of monarch butterflies found dead after the Vector Control Department of Cass County, North Dakota aerially sprayed the county for mosquito control. This incident occurred during a moment in history that is seeing monarchs at the edge of extinction, with the number of monarch butterflies overwintering in Mexico having declined 53% from last year, according to a count conducted by World Wildlife Fund (WWF) Mexico. This tragedy happened as the nation and the world are experiencing an insect apocalypse and severe biodiversity decline, threatening the web of life. (See Study Predicts Demise of Insects within Decades if Pesticide Dependence Continues.) [...]

Accès au document

REVUE DE PRESSE / RECHERCHE ET MEDIAS

Reduction by reduction: Novel approach to mitigating chromium contamination in wastewater

EurekAlert! 28/10/20

The element chromium, despite having various applications, has a bad reputation. This is because exposure to chromium compounds leads to a higher risk of respiratory cancer and other damaging effects on human health. To add to this problem, chromium also happens to be a major contributor to water pollution due to its presence in industrial waste.

There is, however, a silver lining. As chemists have observed, the toxicity of chromium is dependent on its "valence state" (a state that is dictated by the number of electrons in the outer shell of an atom). Of the two stable states that chromium exhibits, "hexavalent chromium" or Cr(VI) and "trivalent chromium" Cr(III), the former is more toxic and soluble. Thus, chromium contamination can be mitigated by simply converting Cr(VI) to Cr(III) via a process called "reduction." Unfortunately, most approaches involved in reducing Cr(VI) to Cr(III) are either expensive and hazardous or have high energy requirements. [...]

Accès au document

New study reveals United States a top source of plastic pollution in coastal environments

EurekAlert! 30/10/20

A study published today in the journal Science Advances has revealed that the United States ranks as high as third among countries contributing to coastal plastic pollution when taking into account its scrap plastic exports as well as the latest figures on illegal dumping and littering in the country. The new research challenges the once-held assumption that the United States is adequately "managing" - that is, collecting and properly landfilling, recycling or otherwise containing - its plastic waste. A previous study using 2010 data that did not account for plastic scrap exports had ranked the United States 20th, globally, in its contribution

to ocean plastic pollution from mismanaged waste. [...]

Accès au document

Le biocontrôle et les variétés résistantes plébiscités pour obtenir des CEPP

Cultivar 30/10/20

Le dispositif des CEPP… vise à inciter les distributeurs de produits phytosanitaires à promouvoir ou à mettre en œuvre auprès des utilisateurs professionnels des actions qui permettent de réduire l'utilisation, les risques et impacts de ces produits. Le ministère de l'Agriculture vient de publier son bilan CEPP pour l'année 2019.

… en 2019, 1070 entreprises étaient obligées du dispositif de CEPP, pour un total de 16,6 millions d'obligations de certificats pour 2021 à obtenir par la mise en place d'actions standardisées. Parmi les 65 actions standardisées, 55 ont été sollicitées avec obtention de 2,5 millions de CEPP. Près de 87% des actions sollicitées concernent l'utilisation de variétés résistantes ou tolérantes et le recours à des méthodes alternatives (dont les produits de biocontrôle). [...]

Accès au document

Biosolutions : De Sangosse vise 17 millions d'hectares couverts en 2030

Terre-net 30/10/20

De Sangosse entend « accompagner la transformation profonde des filières agricoles en mettant à la disposition des agriculteurs des biosolutions permettant de nourrir, stimuler, protéger les cultures pour une triple performance économique, sociale et écologique », selon Nicolas Fillon, son directeur général. L'entreprise vise 17 millions d'hectares développés avec ses biosolutions en France d'ici 2030. [...]

Accès au document

Filière betteravière : Feu vert du Sénat pour l'usage dérogatoire des néonicotinoïdes

Terre-net 28/10/20

Le Sénat à majorité de droite a donné son aval dans la nuit de mardi à mercredi au projet de loi permettant la réintroduction temporaire des néonicotinoïdes pour sauver la filière betteravière, au terme d'un débat parfois tendu avec la gauche et après un incident de vote.

Il a été adopté en première lecture par 184 voix pour, 128 contre et 28 abstentions. Au sein de la majorité sénatoriale, 12 sénateurs LR ont voté contre, de même que 8 centristes et un Indépendants. Dix LR, 10 centristes et 3 Indépendants se sont abstenus. [...]

Accès au document

Phytosanitaires : le retour des néonicotinoïdes au Sénat, en terre de droite

Terre-Net 27/10/20

Après avoir divisé les députés marcheurs, le projet de loi controversé permettant la réintroduction temporaire des néonicotinoïdes tueurs d'abeilles pour sauver la filière betteravière arrive au Sénat, où la majorité de droite entend privilégier une « urgence agricole et industrielle ».

Le texte sera examiné mardi en première lecture dans l'hémicycle du Palais du Luxembourg, où siège depuis la rentrée un tout nouveau groupe écologiste de 12 membres, pour qui ce sera l'occasion d'affirmer son identité. Malgré

l'opposition de la gauche, les sénateurs ont validé en commission le texte du gouvernement autorisant, à titre dérogatoire, les producteurs de betteraves à sucre à utiliser jusqu'en 2023 des semences traitées avec des pesticides de la famille des néonicotinoïdes, interdits depuis 2018. [...]

Accès au document

La pollution de l'air coûte cher aux villes européennes

Actu-environnement 22/10/20

La pollution de l'air coûterait plus de 166 milliards d'euros par an, soit en moyenne 385 millions d'euros par ville européenne, selon une étude réalisée pour l'Alliance européenne pour la santé publique (Epha). Celle-ci s'est basée sur la valeur monétaire des décès prématurés, des traitements médicaux, des jours de travail perdus et des autres problèmes de santé causés par trois polluants atmosphériques : les particules fines (PM), l'ozone (O3) et le dioxyde d'azote (NO_2). A travers ce filtre, elle a examiné 432 villes en Europe ainsi qu'au Royaume-Uni, en Norvège et en Suisse. [...]

Accès au document

Bisphénol A dans les vêtements : la Commission européenne lance une consultation publique

Actu-environnement 27/10/20

Le 26 octobre, le Comité scientifique pour la sécurité des consommateurs de la Commission européenne a publié son avis préliminaire sur les risques liés à la présence de Bisphénol A (BPA) dans les articles vestimentaires. Pour rappel, en novembre 2019, l'exécutif européen a tiré la sonnette d'alarme, après avoir retrouvé des taux élevés de BPA dans des chaussettes pour nourrissons et jeunes enfantsen Espagne. La Commission européenne s'inquiète également du risque pour les femmes enceintes et l'enfant à naître. [...]

Accès au document

Néonicotinoïdes : le Sénat adopte le projet de loi contesté

Actu-environnement 28/10/20

Après l'Assemblée, le Sénat a adopté le projet de loi permettant à la filière de la betterave de déroger à l'interdiction des insecticides néonicotinoïdes jusqu'en 2023. Les défenseurs des abeilles dénoncent un recul du droit environnemental.

Après l'Assemblée nationale, le 6 octobre, le Sénat a adopté le 27 octobre le projet de loi qui autorise, à titre dérogatoire, l'utilisation des insecticides néonicotinoïdes pour la filière betteravière-sucre, touchée par la jaunisse. Dans la nuit du 27 au 28 octobre, les sénateurs ont adopté le texte, par 184 voix pour et 128 contre. Le projet de loi réintroduit des dérogations jusqu'au 1er juillet 2023 à l'utilisation de semences traitées avec des néonicotinoïdes pour la filière de la betterave. [...]

Accès au document

Nitrates dans l'eau potable : la Commission européenne met la France en demeure

Actu-environnement 30/10/20

L'exécutif européen a adressé ce vendredi 30 octobre une mise en demeure à la France pour non-respect des teneurs en nitrates dans l'eau destinée à la consommation humaine fixées par la directive du 3 novembre 1998. « Depuis longtemps, l'eau potable fournie à des dizaines de milliers de personnes en France contient des

https://doi.org/10.15454/6MQT-0H51

quantités excessives de nitrates », explique la Commission européenne.

Cette mise en demeure intervient alors que le gouvernement français a lancé début septembre une concertation sur le septième programme d'actions « nitrates ». La France a déjà été condamnée deux fois par la justice européenne sur le dossier des nitrates mais sur le fondement de la directive du 12 décembre 1991 sur la protection des eaux contre la pollution par les nitrates agricoles. [...]

Accès au document

Pollution aux particules : la France traduite devant la Cour de justice européenne

Actu-environnement 30/10/20

La Commission européenne annonce ce vendredi 30 octobre qu'elle traduit la France devant la Cour de justice de l'Union européenne (CJUE) pour non-respect des valeurs limites fixées par la directive sur la qualité de l'air ambiant en ce qui concerne les particules PM10.

« Le pays n'a pas respecté les valeurs limites journalières applicables aux particules PM10 qui sont juridiquement contraignantes depuis 2005 : les données fournies par la France confirment le non-respect systématique des règles de l'UE relatives aux valeurs limites des PM10 dans les zones de Paris et de Martinique pendant douze et quatorze ans respectivement », justifie l'exécutif européen. Les particules PM10 sont présentes dans les émissions provenant de l'industrie, de la circulation automobile, du chauffage domestique mais aussi de l'agriculture. [...]

Accès au document

Phytosanitaires : le fongicide mancozèbe sera interdit en Europe à partir de 2021

Actu-environnement 27/10/20

Les représentants des États membres européens ont décidé, le 23 octobre dans le cadre d'un comité permanent des végétaux, de ne pas renouveler l'autorisation du mancozèbe. Ce fongicide sera donc interdit à partir du 31 janvier 2021. L'agence française de sécurité sanitaire (Anses) préconisait, en avril dernier, de ne pas renouveler l'approbation de cette substance, considérée comme toxique pour la reproduction, de catégorie 1B. [...]

Accès au document

Consultation européenne sur la réglementation encadrant les substances chimiques

Actu-environnement 22/10/20

La Commission européenne met en consultation, du 19 octobre au 16 novembre, un projet de règlement visant à modifier certains aspects de la réglementation sur les substances chimiques (règlement Reach). « L'objectif est de clarifier les formulations peu claires ou incohérentes et de mettre à jour les exigences en matière de données, afin que les perturbateurs endocriniens, qui peuvent avoir des effets nocifs sur le système endocrinien (hormonal) de l'organisme, puissent être identifiés *et évalués plus facilement* », indique la Commission. [...]

Accès au document

More than 200 million Americans could have toxic PFAS in their drinking water

EurekAlert! 16/10/20

A peer-reviewed study by scientists at the Environmental Working Group estimates that more than 200 million Americans could have the toxic fluorinated chemicals known as PFAS in their drinking water at a concentration of 1 part per trillion, or ppt, or higher. Independent scientific studies have recommended a safe level for PFAS in drinking water of 1 ppt, a standard that is endorsed by EWG.

The study, published today in the journal Environmental Science & Technology Letters, analyzed publicly accessible drinking water testing results from the Environmental Protection Agency and U.S. Geological Survey, as well as state testing by Colorado, Kentucky, Michigan, New Hampshire, New Jersey, North Carolina and Rhode Island. [...]

Accès au document

Researchers step toward understanding how toxic PFAS chemicals spread from release sites

EurekAlert! 15/10/20

A study led by Brown University researchers sheds new light on how pollutants found in firefighting foams are distributed in water and surface soil at release sites. The findings could help researchers to better predict how pollutants in these foams spread from the spill or release sites - fire training areas or airplane crash sites, for example - into drinking water supplies.

Firefighting foams, also known as aqueous film forming foams (AFFF), are often used to combat fires involving highly flammable liquids like jet fuel. The foams contain a wide range of per- and polyfluoroalkyl substances (PFAS) including PFOA, PFOS and FOSA. Many of these compounds have been linked to cancer, developmental problems and other conditions in adults and children. PFAS are sometimes referred to as "forever chemicals" because they are difficult to break down in the environment and can lead to long-term contamination of soil and water supplies. [...]

Accès au document

COVID-19 lockdowns averted tens of thousands of premature deaths related to air pollution

EurekAlert! 15/10/20

Lockdowns initiated to curb the spread of the coronavirus in China and Europe at the beginning of the pandemic improved air quality, averting tens of thousands of deaths in regions where air pollution has a significant impact on mortality, a new study shows.

According to research published in The Lancet Planetary Health, scientists at the University of Notre Dame found that particulate matter concentrations in China dropped by an unprecedented 29.7 percent, and by 17.1 percent in parts of Europe, during lockdowns that took place between Feb. 1 and March 31 in China and Feb. 21 to May 17 in Europe. Particulate matter (PM2.5) - tiny airborne particles smaller than 1/10,000 of an inch in diameter - comes from various combustion-related sources including industrial emissions, transportation, wildfires and chemical reactions of pollutants in the atmosphere. [...]

Accès au document

Researchers awarded over $11 million to study multi-drug resistant infection factors

EurekAlert! 14/10/20

A study aimed at better understanding why some critically ill patients develop multidrug-resistant infections is underway by researchers at The

University of Texas Health Science Center at Houston (UTHealth). The multi-institution study will enroll patients at Memorial Hermann Hospital-Texas Medical Center and The University of Texas MD Anderson Cancer Center.

The Dynamics of Colonization and Infection by Multidrug-Resistant Pathogens in Immunocompromised and Critically Ill Patients program received an $11 million grant from the National Institute of Allergy and Infectious Diseases to conduct this five-year study.

The research team will seek to explain the microbial, clinical, and antimicrobial resistance factors of three major multidrug-resistant pathogens: Vancomycin-resistant enterococci, Enterobacterales producing extended spectrum β-lactamases/carbapenemases, and Clostridioides difficile. All three pathogens are resistant to antimicrobial treatment such as antibiotics. [...]

Accès au document

Light pollution alters predator-prey interactions between cougars and mule deer in western US

EurekAlert! 19/10/20

A new study provides strong evidence that exposure to light pollution alters predator-prey dynamics between mule deer and cougars across the intermountain West, a rapidly growing region where nighttime skyglow is an increasing environmental disturbance.

The University of Michigan-led study, published online Oct. 18 in the journal Ecography, is the first to assess the impacts of light pollution on predator-prey interactions at a regional scale. It combines satellite-derived estimates of artificial nighttime lights with GPS location data from hundreds of radio-collared mule deer and cougars across the intermountain West. [...]

Accès au document

Chemists create new crystal form of insecticide, boosting its ability to fight mosquitoes and malaria

EurekAlert! 12/10/20

Through a simple process of heating and cooling, New York University researchers have created a new crystal form of deltamethrin--a common insecticide used to control malaria--resulting in an insecticide that is up to 12 times more effective against mosquitoes than the existing form.

The findings, published in the journal Proceedings of the National Academy of Sciences (PNAS), may provide a much-needed and affordable insecticide alternative in the face of growing resistance among mosquitoes. [...]

Accès au document

Understanding how toxic PFAS chemicals spread from release sites

Sciencedaily 16/10/20

New lab studies are helping researchers to better understand how so called 'forever chemicals' behave in soil and water, which can help in understanding how these contaminants spread.

A study led by Brown University researchers sheds new light on how pollutants found in firefighting foams are distributed in water and surface soil at release sites. The findings could help researchers to better predict how pollutants in these foams spread from the spill or release sites - fire training areas or airplane crash sites, for example - into drinking water supplies.

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polyfluoroalkyl substances (PFAS) including PFOA, PFOS and FOSA. Many of these compounds have been linked to cancer, developmental problems and other conditions in adults and children. PFAS are sometimes referred to as "forever chemicals" because they are difficult to break down in the environment and can lead to long-term contamination of soil and water supplies. [...]

Accès au document

OECD, Experts Discuss Access to Information on Chemical Safety

IISD 14/10/20

The eChemPortal enables companies and countries to share the burden of work and avoid duplication of efforts, ensure resource efficiency, and reduce animal testing.

The portal enables searches by substance identification, chemical properties and effects, and classifications.

[...] It includes approximately 800,000 substance records from 34 databases of authorities and international organizations regarding chemicals, pesticides, and biocides. The number of data sources participating in eChemPortal is continuously increasing. Over four million searches were conducted in 2019 by users from industry, government, academics and the general public. [...]

Accès au document

Phytosanitaires : les contours du conseil aux utilisateurs professionnels sont définis

Actu-environnement 20/10/20

À partir du 1er janvier 2021, la vente de produits phytosanitaires et le conseil devront être pratiqués par des entités différentes. Un décret vient définir les modalités du conseil aux utilisateurs professionnels, qui devient également obligatoire.

[...] Il s'agit, pour le Gouvernement, de garantir l'indépendance du conseil aux agriculteurs et autres utilisateurs professionnels. Un décret, publié le 28 octobre, définit les deux types de conseils et leurs modalités d'exercice : le conseil stratégique et le conseil spécifique à l'utilisation de produits phytopharmaceutiques. [...]

Accès au document

Sortie du glyphosate : les usages désormais interdits et… les autres

Actu-environnement 09/10/20

Suite à l'évaluation des alternatives existantes à l'utilisation du glyphosate, l'Anses interdit désormais certains usages dans le cadre des autorisations de mise sur le marché, avec des conséquences sur le terrain en demi-teinte.

Après plusieurs mois de travaux, l'Anses a enfin fait le tri dans les usages du glyphosate pour identifier ceux qui n'ont pas d'« alternative non chimique possible à court terme ». Réciprocité positive, elle a aussi listé les usages qui en avaient et qui seront désormais systématiquement interdits. « *Ces restrictions sont désormais prises en compte par l'Agence pour délivrer les autorisations de mise sur le marché (AMM) des produits à base de glyphosate* », prévient-elle en tant que responsable de la délivrance de ces AMM. [...]

Accès au document

Can organic plant protection products damage crops ?

https://doi.org/10.15454/6MQT-0H51

Science daily 07/10/20

Some organic pesticides contain live spores of the fungus Trichoderma to suppress other pathogens. Researchers found one Trichoderma species can cause severe rot in cobs of maize (corn).

Share: Protecting crops against pests and diseases is essential to ensure a secure food supply. Around 95 percent of food comes from conventional agriculture, which uses chemical pesticides to keep crops healthy. Increasingly, however, organic pesticides are also being sought as an alternative. Some organic pesticides contain live spores of the fungus Trichoderma, which have the ability to suppress other pathogens. Researchers at the University of Göttingen have now discovered that one Trichoderma species can cause severe rot in cobs of maize (corn). [...]

Accès au document

Pesticide Trade Group Wrote U.S. Government Policy to Undermine International Efforts to Combat Antibiotic Resistance

Beyond Pesticides, October 6, 2020

Despite the rapid rise of antibiotic resistance in the United States and throughout the world, new documents find the Trump Administration worked on behalf of a chemical industry trade group to weaken international guidelines aimed at slowing the crisis. Emails obtained by the Center for Biological Diversity through the Freedom of Information Act show that officials at the U.S. Department of Agriculture (USDA) worked to downplay the role of industrial agriculture and pesticide use in drug-resistant infections. [...]

Accès au document

Denormandie veut les mêmes normes environnementales en agriculture pour l'Europe

Agri-mutuel 07/10/20

Les normes environnementales « doivent être les mêmes partout en Europe » pour les produits alimentaires dans le cadre de la future politique agricole commune (Pac), a estimé mercredi le ministre de l'agriculture, au lendemain de la réautorisation en France des insecticides néonicotinoïdes pour la culture des betteraves.

« L'Europe est un marché commun (…) il est inacceptable que dans nos étals de supermarchés vous ayez un concombre européen qui n'a pas les mêmes normes écologiques qu'un concombre français » a déclaré Julien Denormandie sur Europe 1. « Ce sur quoi je me bats auprès de la Commission européenne et des autres ministres européens, c'est que les règles environnementales s'appliquent partout en Europe », a déclaré le ministre. Pour y arriver, « on a un événement historique, qui est cette nouvelle politique agricole commune » en cours de négociation. « Quand vous négociez les règles de la politique agricole commune, vous demandez que ces règles s'appliquent partout pareil » a-t-il ajouté. [...]

Accès au document

Interdiction des néonicotinoïdes en 2018 : la justice européenne renvoie la balle au Conseil d'État

Actu-environnement 08/10/20

Concours de circonstance : alors que la France s'apprête à réautoriser par dérogation certains pesticides néonicotinoïdes, la Cour de justice de l'Union européenne (CJUE) s'est prononcée sur l'interdiction française prise en 2018. Elle estime valable que la façon dont la France a prévenu la Commission européenne de sa volonté de légiférer respecte le droit européen. « *La France*

a valablement informé la Commission de la nécessité d'adopter des mesures visant notamment à protéger les abeilles », estime la CJUE dans son arrêt du 8 octobre. Elle se prononce dans le cadre d'une requête de l'Union des industries de la protection des plantes (UIPP), introduite auprès du Conseil d'État, afin d'obtenir l'annulation du décret d'interdiction de cinq substances de la famille des néonicotinoïdes. [...]

Accès au document

Néonicotinoïdes : les députés votent en faveur des dérogations

Actu-environnement 06/10/20

Les députés ont adopté, à 313 voix pour et 158 voix contre, le projet de loi relatif aux conditions de mise sur le marché de certains produits phytopharmaceutiques en cas de danger sanitaire, lors d'un vote solennel mardi 6 octobre. Ce texte permet au Gouvernement de délivrer, à titre dérogatoire, des autorisations d'utilisation de néonicotinoïdes. Ces insecticides, pointés du doigt pour leurs impacts sur les pollinisateurs et les oiseaux, sont interdits depuis 2018. Mais le Gouvernement souhaite réautoriser, jusqu'en 2023, les semences enrobées aux néonicotinoïdes pour la betterave à sucre, après que la filière a connu en 2020 une invasion de pucerons provoquant des pertes de rendement estimés à 15 % à l'échelle de la filière. [...]

Accès au document

Je voterai contre le projet de loi néonicotinoïdes proposé par le Gouvernement

Actu-environnement 02/10/20

Alors que l'Assemblée nationale examine ce lundi 5 octobre le projet de loi qui revient sur l'interdiction des néonicotinoïdes, Jean-Charles Colas-Roy, le Monsieur environnement de LReM, annonce qu'il ne le votera pas.

Actu-Environnement : Bien qu'appartenant à la majorité présidentielle, vous vous apprêtez à voter contre le texte. Pour quelles raisons ?

Jean-Charles Colas-Roy : Il nous faut soutenir la filière betterave-sucre et les agriculteurs mais sans pour autant ré-autoriser les néonicotinoïdes, ces pesticides très puissants qui s'attaquent en particulier aux abeilles. La semaine prochaine, je voterai donc contre le projet de loi « néonicotinoïdes » proposé par le Gouvernement. [...]

Accès au document

How a toxic chromium species could form in drinking water

EurekAlert! 30/09/20

The water crisis in Flint, Michigan, brought much-needed attention to the problem of potentially toxic metals being released from drinking water distribution pipes when water chemistry changes. Now, researchers reporting in ACS' Environmental Science & Technology have investigated how hexavalent chromium, known as Cr(VI), can form in drinking water when corroded cast iron pipes interact with residual disinfectant. Their findings could suggest new strategies to control Cr(VI) formation in the water supply. [...]

Accès au document

URI grad student finds PFAS in seabirds from Narragansett

https://doi.org/10.15454/6MQT-0H51

Bay, Massachusetts Bay, Cape Fear

Eurekalert! 24/09/20

Evidence continues to accumulate about human and wildlife exposure to chemical compounds called per- and polyfluoroalkyl substances, collectively referred to as PFAS, and their deleterious effects on the environment. The latest study, by a University of Rhode Island graduate student, found high levels of the compounds in seabirds from offshore Massachusetts and coastal Rhode Island and North Carolina.

Chief among the findings was the discovery that one type of PFAS, perfluorooctanesulfonic acid or PFOS, which has not been produced since the early 2000s, is the most dominant PFAS compound in the birds from all three sites, further illustrating how these chemicals do not breakdown in the environment and can remain in animal tissues for many years. [...]

Accès au document

Two pesticides approved for use in US harmful to bees

EurekAlert! 30/09/20

A previously banned insecticide, which was approved for agricultural use last year in the United States, is harmful for bees and other beneficial insects that are crucial for agriculture, and a second pesticide in widespread use also harms these insects. That is according to a new analysis from researchers at The University of Texas at Austin.

As the agricultural industry turns to new types of pesticides to protect crops, the biologists behind the recent large-scale meta-analysis warn that two of these - flupyradifurone (sold under the brand name Sivanto®) and the recently approved pesticide sulfoxaflor (sold under the name Transform® WG) - have harmful effects similar to a class of pesticides known as neonicotinoids, several of which were recently banned in the European Union and Canada. Neonicotinoid pesticides have been shown to be detrimental to honeybees and other beneficial insects. [...]

Accès au document

In the arctic, extreme air pollution kills trees, limits growth by reducing sunlight

EurekAlert! 29/09/20

Scientists that includes a USDA Forest Servicescientist based in New Hampshire used tree rings to document how "Arctic dimming," the interference with sunlight caused by extreme pollution such as that at an industrial complex in northern Siberia, is killing trees and possibly affecting how trees respond to climate change.

The study, "Arctic Dimming and the Divergence Problem," was published this week by the journal Ecology Letters. Kevin T. Smith, a supervisory plant physiologist with the Forest Service's Northern Research Station, is the sole North American co-author of the study; lead author is Alexander V. Kirdyanov of the University of Cambridge in the United Kingdom. [...]

Accès au document

Insect Armageddon: low doses of the insecticide, Imidacloprid, cause blindness in insects

EurekAlert! 28/09/20

New research has identified a mechanism by which low levels of insecticides such as, the neonicotinoid Imidacloprid, could harm the nervous, metabolic and immune system of insects, including those that are not pests, such as our leading pollinators, bees.

A study published today in the Proceedings of the National Academy of Sciences USA, led by researchers at the University of Melbourne and

Baylor College of Medicine, shows that low doses of Imidacloprid trigger neurodegeneration and disrupt vital body-wide functions, including energy production, vision, movement and the immune system, in the vinegar fly, Drosophila melanogaster. [...]

Accès au document

First evidence that air pollution particles and metals are reaching the placenta

EurekAlert! 24/09/20

Pollution particles, including metals, have been found in the placentas of fifteen women in London, according to research led by Queen Mary University of London.

The study, funded by Barts Charity and published in the journal Science of The Total Environment, demonstrate that inhaled particulate matter from air pollution can move from the lungs to distant organs, and that it is taken up by certain cells in the human placenta, and potentially the foetus.

The researchers say that further research is needed to fully define the direct effect that pollution particles may have on the developing foetus. [...]

Accès au document

UK lockdown and air pollution: Nitrogen dioxide halved but sulphur dioxide doubled

EurekAlert! 24/09/20

A University of Liverpool study of air pollution in the UK during the first 100 days of lockdown has revealed that whilst nitrogen oxide levels were cut by half, levels of sulphur dioxide increased by over 100%.

Researchers from the University's School of Environmental Sciences analysed data from the Department for Environment, Food & Rural Affairs (DEFRA) air-quality sensors and UK Met Office stations to see how lockdown measures had affected levels of nitrogen dioxide, sulphur dioxide, particle matter (PM2.5) and ozone, and compare it to data from the past seven years.

The study revealed that during this period (from 23rd March to 13 June 2020) nitrogen dioxide (NO2) levels were cut by half which would relate to the reduction in vehicle emissions. More surprisingly, though, the analysis found that levels of sulphur dioxide (SO2), typically created by UK industry but in sharp decline, were more than double that of previous years. [...]

Accès au document

Premier feu vert sous conditions des députés, malgré la grogne

Agri-mutuel 24/09/20

Les députés ont donné mercredi un premier feu vert, mais sous conditions, au projet de loi permettant la réintroduction temporaire des néonicotinoïdes afin de sauver la filière betteraves, en dépit de la ferme opposition des pro-environnement.

Les députés, qui examinaient le projet de loi controversé en commission des affaires économiques, ont validé le texte en lui apportant certains garde-fous, conformes aux attentes du groupe LREM, mais loin de satisfaire les opposants qui réclament son abandon pur et simple. [...]

Accès au document

https://doi.org/10.15454/6MQT-0H51

Synthetic clothing fibers contribute vast amounts of plastic pollution on land

EurekAlert! 16/09/20

176,500 metric tons of synthetic microfibers -chiefly polyester and nylon -are released every year onto terrestrial environments across the globe, according to a new study in the open access journal PLOS ONE by Jenna Gavigan and colleagues at the University of California at Santa Barbara. The microfibers are shed from clothing during washing, and the amount ending up on land now exceeds the amount that enters waterbodies.

Plastic pollution in the ocean has received lots of attention in recent years, but waterways are not the only place that plastic accumulates. Fourteen percent of all plastic is used to make synthetic fibers, chiefly for clothing. Microfibers, defined as particles less than 5 millimeters in length, are generated in large quantities at every stage of a fiber's life cycle, especially during washing, which mechanically fragments synthetic fibers. When wash water becomes part of the flow to a wastewater treatment plant, the microfibers it contains may be retained along with biosolid sludge, which may be applied to cropland or buried in landfills. [...]

Accès au document

Scientists sound alarm on plastic pollution

EurekAlert! 17/09/20

In January 2018, China stopped accepting most plastic recyclables from Western nations. Within days, there was no hiding just how much plastic nations were producing and consuming. Piles of plastic sprung up in Britain, Europe, Canada, the United States, and elsewhere. Other Eastern nations began banning the import of plastic waste. Governments worldwide are now scrambling for solutions to mitigate the growing problem of plastic pollution.

Now a new study shows that despite global commitments to address plastic pollution, growth in plastic waste, or "plastics emissions" continues to outpace reduction. What's more, the study shows that even if governments around the world adhere to their ambitious commitments to curb plastic pollution, annual plastic emissions may increase more than six-fold by 2030.

The study, "Predicted Growth in Plastic Waste Exceeds Efforts to Mitigate Plastic Pollution," published in the Sept. 18 issue of the journal Science, evaluated the level of effort needed to achieve a targeted global reduction in plastic pollution. [...]

Accès au document

Pollution exposure linked to stroke risk in people with common heart rhythm disorder

EurekAlert! 16/09/20

People with one of the most common heart disorders who are exposed to greater levels of pollution have a 1.2-fold higher risk of stroke than their peers who live with less pollution, according to a JAMA Network Open study published recently by researchers at the UPMC Heart and Vascular Institute and University of Pittsburgh School of Medicine.

The study is the largest of its kind to include neighborhood-specific pollution data -rather than simply hospitalization data -and further emphasizes the importance of air pollution alerts in advising the activities of people with certain heart conditions. [...]

Accès au document

Research explores factors influencing soybean injury by synthetic auxin herbicides

https://doi.org/10.15454/6MQT-0H51

EurekAlert! 14/09/20

Synthetic auxin products have given growers an important option for managing weed populations resistant to glyphosate and other herbicides. But according to an article featured in the journal Weed Technology, there is one important downside to dicamba, 2,4-D and other synthetic auxins. They often move off-target and can cause severe injury to sensitive plants growing nearby.

Complaints about the issue persist, despite the introduction of products reported to have reduced volatility. For this reason, researchers from the University of Wisconsin-Madison decided to take a close look at factors that might influence synthetic auxin volatility and soybean injury, especially as it applies to the relationship between glyphosate and synthetic auxins commonly used in corn. [...]

Accès au document

L'exposition au plomb pendant la grossesse réduit le poids des nouveau-nés

Actu-environnement 16/09/20

Dans le cadre du projet européen « Helix » (Early-Life Exposome), l'Institut national de la santé et de la recherche médicale (Inserm) a participé à une vaste étude qui démontre une diminution du poids de naissance associée à l'exposition au plomb pendant la grossesse. Les travaux ont été publiés en mars 2020 dans la revue International Journal of Epidemiology. [...]

Accès au document

Pollution de l'air : le BEE cartographie les émissions des grandes installations de combustion européennes

Actu-environnement 11/9/20

Le 9 septembre, le Bureau européen de l'environnement (BEE) a lancé une base de données afin de cartographier la pollution industrielle en Europe. « La visionneuse de données sur les installations industrielles (IPDV) permet au public d'accéder aux données sur les émissions industrielles de plus de 3000 grandes installations de combustion à travers l'Union européenne », explique l'ONG. L'outil permet de comparer les émissions par installations, par entreprises et par pays. [...]

Accès au document

Urbanization and agriculture are land uses that most affect Brazil's rivers

EurekAlert! 9/9/20

A literature review by researchers affiliated with universities in Brazil and the United States produces the first ever nationwide survey of land use impacts on water quality

Brazil has more freshwater than any other country, but this resource is dwindling because of climate change, rising consumption and inadequate treatment, among other factors. Worse, Brazil's rivers are increasingly polluted due to a lack of proper land use planning.

Agriculture and urbanization are the main culprits, closely followed by mining. Although mining occupies a small percentage of Brazil's territory, it has a huge impact on water quality, according to a literature review by a group of researchers published in Journal of Environmental Management. [...]

Accès au document

More chemicals can be assessed for endocrine disrupting effects

https://doi.org/10.15454/6MQT-0H51

EurekAlert! 9/9/20

A European guidance document aimed at identifying endocrine disrupting pesticides can - with some modifications - be used to assess other chemicals' endocrine disrupting effects.

This is the finding of a new study conducted by the National Food Institute, Technical University of Denmark, and Copenhagen University Hospital.

According to EU regulation, all pesticides must be thoroughly assessed for potential endocrine disrupting effects before they can be approved for use. However, the same rules do not necessarily apply to chemicals that are used for other purposes.

Researchers at the National Food Institute are pointing out that the approval process for chemicals, which are used e.g. as additives in cosmetics or food, can thus overlook chemicals that are harmful to the human endocrine system. [...]

Accès au document

UBC scientists find clues to queen bee failure

EurekAlert! 08/09/20

Scientists at UBC are unravelling the mysteries behind a persistent problem in commercial beekeeping that is one of the leading causes of colony mortality--queen bee failure.

This occurs when the queen fails to produce enough fertilized eggs to maintain the hive, and is regularly cited by the Canadian Association of Professional Apiarists as one of the top causes of colony mortality.

In recent research outlined in BMC Genomics, University of British Columbia and North Carolina State University researchers identified specific proteins that are activated in queen bees under different stressful conditions: extreme heat, extreme cold, and pesticide exposure - conditions that can affect the viability of the sperm stored in the honey bee queen's body. If the queen does not have enough live sperm to produce enough fertilized eggs to maintain its population of worker bees, the colony will eventually die out. [...]

Accès au document

Safe thresholds for antibiotics in sewage needed to help combat antibiotic resistance

EurekAlert! 03/09/20

New research reveals current understanding of safe antibiotic levels in rivers may not prevent evolution of antibiotic resistance and fully protect human health. The study suggests the need to introduce thresholds to help fight the spread of resistant bacteria.

Around 70 per cent of the antibiotics we take as medicine end up in the natural environment, through flushed waste and discarded medicines, among other sources. These antibiotics interact with bacteria that are also present in the water, which can evolve resistance within these environments. The bacteria can then transfer resistance to human-associated bacteria, meaning antibiotics are less likely to work. [...]

Accès au document

Common sunscreen ingredients prove dangerous for freshwater ecosystems

EurekAlert! 02/09/20

The active ingredients found in sunscreen have detrimental effects on freshwater ecosystems, according to new research by University of Alberta biologists.

The results show that long-term exposure to ultraviolet (UV) filters--including avobenzone, oxybenzone, and octocrylene - is lethal for some

organisms living in freshwater environments. One of the largest sources of UV-filter contamination in both marine and freshwater environments is from sunscreen leaching off of the skin while swimming. [...]

Accès au document

Air pollution renders flower odors unattractive to moths

EurekAlert! 04/09/20

Tobacco hawkmoths are not attracted to flower odors when ozone levels are high; however, the moths are able to learn that odors modified by ozone may offer a reward, that is, nectar

VIDEO: Pollination in the Anthropocene: a Moth can Learn Ozone-altered Floral Blends view more
A team of researchers from the Max Planck Institute for Chemical Ecology in Jena, Germany, and the University of Virginia, USA, has studied the impact of high ozone air pollution on the chemical communication between flowers and pollinators. They showed that tobacco hawkmoths lost attraction to the scent of their preferred flowers when that scent had been altered by ozone. This oxidizing pollutant thus disturbs the interaction between a plant and its pollinator, a relationship that has evolved over millions of years. However, when given the chance, hawkmoths quickly learn that an unpleasantly polluted scent may lead to nutritious nectar (Journal of Chemical Ecology, September 2020, DOI: 10.1007/s10886-020-01211-4). [...]

Accès au document

Researchers warn of food-web threats from common insecticides

EurekAlert! 03/09/20

In light of emerging evidence showing how a commonly used class of insecticides can spread through the environment to pollinators, predators and other insects they are not intended to kill, researchers are warning about the potential for widespread environmental contamination.

In an opinion in the journal Proceedings of the National Academy of Sciences, researchers from North Carolina State University and Pennsylvania State University argued for curbing the use of neonicotinoid insecticides by discontinuing the practice of applying them preventively on crop seeds, since the practice is in wide use in the United States and has been found in one study to benefit a small fraction of crop fields. They argue that reducing this and other common preventive practices could reduce cascading effects on the environment from insecticides whose risks have not been fully characterized. [...]

Accès au document

Phytosanitaires : la majorité des départements ont une charte permettant de réduire les ZNT

Terre-net 9/9/20

La majorité des départements français disposent d'une charte régissant l'utilisation de produits phytosanitaires, rendant les zones de non traitement (ZNT) aux pesticides un peu moins contraignantes qu'initialement prévu pour les agriculteurs, ont fait savoir mardi les Chambres d'agriculture.

Cinquante-six départements sur les 96 métropolitains disposent d'une charte d'engagement validée au niveau préfectoral et « la plupart » des autres devraient en être dotés « dans les semaines qui viennent », a indiqué le président des Chambres d'agriculture, Sébastien Windsor, lors d'une conférence de presse. [...]

Accès au document

https://doi.org/10.15454/6MQT-0H51

Glyphosate « Plus de la moitié » des usages interdits en 2021, dit Barbara Pompili

Terre-net 8/9/20

Le gouvernement va interdire « plus de la moitié » des utilisations du glyphosate, désherbant très controversé, « dès le début de l'année prochaine », a déclaré mardi la ministre de la transition écologique Barbara Pompili.

« Sur le glyphosate on a une mission en cours (qui est) plutôt en train de bien avancer dans la recherche pour qu'on ait des alternatives. Donc on va avoir des interdictions de glyphosate sur certaines utilisations dès le début de l'année prochaine, » a déclaré la ministre sur la radio France Inter. [...]

Accès au document

Pollution au plomb : la ville de Carrières-sous-Poissy porte plainte

Actu-environnement 8/9/20

Eddie Aït, maire écologiste de Carrières-sous-Poissy (Yvelines), a annoncé lundi 7 septembre que sa commune déposait une plainte contre X pour pollution au plomb auprès du procureur de la République de Versailles. Elle réclame également la réparation du préjudice écologique subi.

Les plaines de cette commune, tout comme celles d'Achères, Triel-sur-Seine, Méry-sur-Oise et Pierrelaye ont « servi d'égouts » à la Ville de Paris et son agglomération entre 1890 et 2006. En octobre 2018, Santé publique France avait révélé que certaines zones présentaient des risques sanitaires inacceptables. Le vingtième cas d'intoxication au plomb diagnostiqué à Carrières-sous-Poissy et la décision de l'agence régionale de santé du 4 mars de renforcer son dispositif sanitaire sur les anciennes plaines sanitaires ont alarmé la ville, explique son premier édile. [...]

Accès au document

Néonicotinoïdes : le Gouvernement veut rassurer sur les conditions strictes d'application de la dérogation

Actu-environnement 03/09/20

Face à la grogne des associations, le Gouvernement tente de rassurer quant à la dérogation envisagée pour permettre à la filière betteravière sucrière d'utiliser des semences enrobées de substances néonicotinoïdes pour la campagne 2021, voire les deux suivantes, pour lutter contre la jaunisse. Un projet de loi sera présenté jeudi 3 septembre en Conseil des ministres. Il permet aux ministres de l'Agriculture et de la Transition écologique de prendre, de façon conjointe, un arrêté autorisant l'utilisation de produits contenant des néonicotinoïdes en cas de danger sanitaire. [...]

Accès au document

Innovative approaches to evaluating the effects of insecticides on non-Apis bees

EPA 02/09/20

Although no single cause has been identified, declines in some bee populations have been attributed to several environmental stressors including pesticides. Due to differences in life history and pesticide sensitivity, there is an ongoing international effort to develop toxicity testing methods that extend beyond honey bees (Apis mellifera) to include non-Apis bees. This presentation will discuss innovative research approaches and findings from laboratory studies performed using bumble bees (Bombus impatiens) and mason bees (Osmia lignaria). […]

Accès au document

https://doi.org/10.15454/6MQT-0H51