Bulletin de veille du réseau d'écotoxicologie terrestre et aquatique N°45

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Bulletin de veille du réseau d'écotoxicologie terrestre et aquatique

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Edito

Voici notre 45ème bulletin de veille, toujours dense ! Nous remercions les nombreux lecteurs qui ont répondu à notre enquête portant sur votre percpetion du bulletin. Nous vous présenterons prochainement les résultats ainsi que nos propositions d'évolution. Dans ce bulletin, nous amorçons une thématique « biocontôle » concernant l'impact des molécules d'origine biologique.

Nous vous proposons dans ce bulletin une tribune portant sur la bioaccumulation et le transfert trophique de contaminants dans les écosystèmes aquatiques : challenges & perspectives pour le réseau Ecotox. 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-27-juin-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 un bel été et une bonne lecture de ce bulletin !

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Tribune libre

Bioaccumulation et transfert trophique de contaminants dans les écosystèmes aquatiques : challenges & perspectives pour le réseau Ecotox

Une question interdisciplinaire rassemblant écotoxicologues et chimistes

Plusieurs écotoxicologues et chimistes environnementaux membres ou sympathisants du réseau ECOTOX INRAE ont contribué, au cours de la dernière décennie, aux travaux menés dans le thème de recherche « Réponses biologiques et écologiques aux contaminations du milieu aquatique », animé par Jeanne Garric au sein de l'ancien Département Eaux d'Irstea[1]. Dans ce contexte, et sous l'impulsion de Marc Babut, s'est formé en 2015 un groupe de travail focalisé sur la question de la bioaccumulation des contaminants dans les milieux aquatiques continentaux. Cette initiative avait, entre autres, permis de constituer un collectif de 14 scientifiques (tableau 1) qui ont tous participé à ce thème de recherche (comme chercheur, post-doc ou doctorant), en vue de rédiger un article de synthèse sur le sujet. L'objectif était de rassembler les connaissances et d'identifier les principaux challenges scientifiques concernant la bioaccumulation dans les biofilms aquatiques (associés au périphyton, au compartiment sédimentaire ou aux litières végétales immergées) et son rôle dans le transfert des contaminants le long des chaînes trophiques (Bonnineau et al., 2020). Il s'agissait ainsi de :

i) rappeler les mécanismes responsables de la bioaccumulation dans ces assemblages microbiens,
ii) dresser un état des lieux des méthodes disponibles pour détecter, identifier et quantifier les contaminants bioaccumulés,
iii) proposer une revue critique de la littérature décrivant la bioaccumulation dans les biofilms et ses conséquences pour les chaînes trophiques et,
iv) identifier des perspectives de recherche pour mieux appréhender cette question complexe mais majeure pour améliorer les procédures d'évaluation des risques et impacts écotoxicologiques directs et indirects dans les écosystèmes aquatiques contaminés.

L'objectif de cette tribune libre est de présenter les principales conclusions de ce travail et de proposer des perspectives qui pourraient être déclinées à l'échelle du réseau ECOTOX. Cela pourrait notamment permettre de renforcer les liens entre les écotoxicologues et les chimistes environnementaux en fédérant les acteurs de ces deux disciplines autour de questions de recherche communes, transposables à différents types de contaminants ou d'écosystèmes.

[1] Jusqu'en 2018, les thèmes de recherche (TR, au nombre de 12) constituaient l'entité structurante des recherches au sein des Départements Irstea. Regroupant des équipes de différentes Unités (UR ou UMR), ils étaient notamment chargés de la programmation et de l'évaluation scientifique (sous l'égide du Département auquel ils étaient rattachés).

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Tableau 1 : *Liste des contributeurs, par ordre alphabétique, à l'article de synthèse Bonnineau et al. (2020)*

La bioaccumulation des contaminants par les communautés microbiennes benthiques

Dans les écosystèmes d'eau douce, les communautés microbiennes benthiques jouent un rôle écologique majeure par leur contribution aux cycles biogéochimiques (e.g. production primaire, dégradation de la matière organique). Ces assemblages microbiens complexes sont composés de différents micro-organismes (bactéries, cyanobactéries, micro-algues, hyphomycètes, protozoaires…) vivant en étroite interaction au sein d'une matrice de substances polymériques extracellulaires (EPS). Ces communautés microbiennes sont attachées à différents substrats : les communautés périphytiques (ou périphyton) se retrouvent sur les cailloux et sont dominées par les organismes autotrophes alors que les organismes hétérotrophes dominent les assemblages microbiens associés respectivement aux sédiments et aux litières végétales immergées.

En écotoxicologie, ces communautés microbiennes sont reconnues (et utilisées) comme des indicateurs pertinents de l'exposition aux contaminants en milieu aquatique et des effets toxiques qui en résultent. Les contaminants présents dans l'eau de surface (sous forme dissoute ou particulaire) sont susceptibles d'entrer en contact avec les biofilms, de s'y associer et de s'accumuler. Cette accumulation peut s'opérer soit à l'intérieur ou à la surface des micro-organismes ou soit dans la matrice EPS, via différents mécanismes : sorption, accumulation ou séquestration (pour les métaux) comme illustré par la Figure 1.

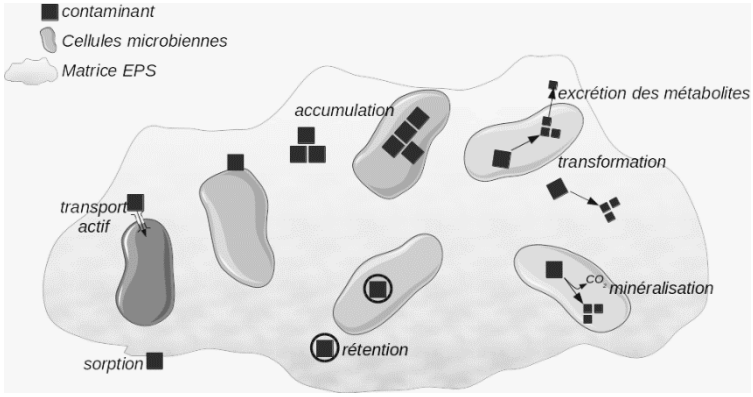

Figure 1 : *Représentation schématique des interactions possibles entre contaminants et biofilms microbiens naturels*

Le développement des méthodes analytiques a permis d'améliorer la quantification des contaminants accumulés dans les biofilms. Ces méthodes sont présentées plus en détail dans l'article de synthèse (Bonnineau et al. 2020). Si les premières études dans les années 90 étaient centrées sur les métaux, les développements analytiques de la dernière décennie ont également permis la détection et la quantification dans les biofilms des contaminants organiques (e.g. HAPs, PCBs, pesticides, substances pharmaceutiques dont les antibiotiques). Cependant, la très grande majorité des études de bioaccumulation porte sur le périphyton pour lequel il est notamment possible de déterminer la distribution des contaminants (en particulier les métaux) dans ce type de biofilm (*e.g.* fraction intra-cellulaire vs fraction liée à la matrice). La

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distribution des contaminants dans les biofilms peut également être observée de manière plus précise grâce aux méthodes d'imagerie comme la microscopie confocale laser à balayage. Néanmoins, aucune technique ne permet à ce jour de quantifier les contaminants accumulés dans les communautés microbiennes attachées aux sédiments ou à la litière de feuilles indépendamment de leur substrat.

Une méta-analyse réalisée sur 24 études publiées, et détaillée dans l'article de synthèse (Bonnineau et al. 2020), a mis en avant l'importante diversité des contaminants retrouvés dans le périphyton (toutes les classes sont représentées ; Fig. 2). Les contaminants organiques apparaissent comme des composés fortement bioaccumulables, les facteurs de concentrations les plus élevés ayant été observés pour les composés halogénés comme l'hexachlorobenzène ou les PCBs (Fig. 2). Une grande variété de contaminants (e.g. métaux, HAPs, résidus pharmaceutiques, pesticides) a également été identifiée dans les sédiments, sans qu'il soit possible de distinguer les contaminants réellement bioaccumulés par les communautés microbiennes de ceux liés uniquement au substrat. Les études sur les communautés microbiennes associées à la litière de feuille sont plus rares mais ont pu démontrer l'association de métaux, d'herbicides et de fongicides sur la litière de feuille immergée et colonisée par du biofilm, sans pouvoir là encore identifier la fraction réellement accumulée dans ce compartiment microbien.

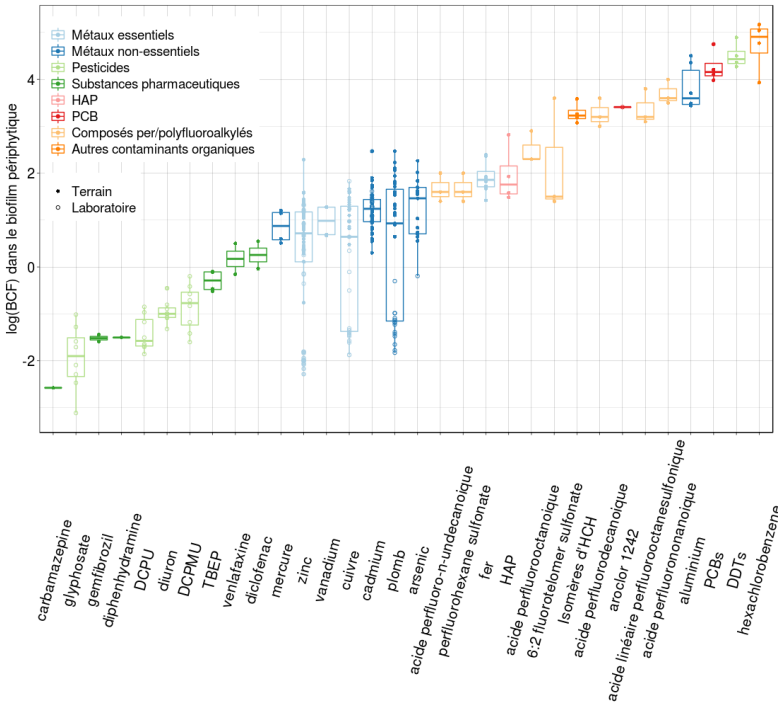

Figure 2 : Facteur de bioconcentration (log(BCF)) pour le biofilm périphytique (n=304), données issues de 22 études publiées.

Cercle plein : observations sur le terrain ; cercle vide : observations lors d'expérimentations en laboratoire.

HAP : hydrocarbure polycyclique aromatique, PCB : polychlorobiphényle, HCH : hexachlorocyclohexane, TBEP : tris(butoxyethyl)phosphate, DCPU : N-(3,4-dichlorophenyl)urea, DCPMU : N-3,4-dichlorophenyl)-N-(methyl) urea, DDTs : dichlorodiphenyltrichloroethane

Contribution aux transferts des contaminants dans les réseaux trophiques aquatiques

Dans les écosystèmes aquatiques d'eau douce, le biofilm, qui représente une ressource nutritive importante pour de nombreux macro-organismes (*e.g.* insectes, escargots, poissons, crevettes), joue un rôle pivot entre le réseau trophique vert (qui s'appuie sur la production primaire) et le réseau trophique brun (qui s'appuie sur l'apport de matière organique allochtone) (Bonnineau et al., 2020 ; Zou et al., 2016). De ce fait, il est potentiellement un acteur important du devenir et du transfert des contaminants dans ces réseaux trophiques. Cependant, nos recherches bibliographiques ont mis en évidence un nombre assez limité de travaux autour de cette question (Bonnineau et al. 2020). Quelques expériences en mésocosmes ont mis en évidence le transfert de métaux bioaccumulés dans le périphyton aux organismes consommateurs et ces travaux sont complétés par de rares études prenant en compte des contaminants organiques ou des nanoparticules. Il existe donc à ce jour un vrai déficit de connaissance concernant les

différents facteurs qui peuvent influencer le rôle des communautés microbiennes benthiques dans l'accumulation des contaminants dans les réseaux trophiques aquatiques.

Conclusion & perspectives

Cette revue de la littérature illustre les interactions entre les contaminants et les communautés microbiennes benthiques et montre l'importance de ces communautés dans la dynamique spatio-temporelle des contaminants dans les milieux aquatiques continentaux. Cependant, d'importantes disparités de connaissances entre les différents types de biofilm (périphyton vs. communautés microbiennes attachées au sédiment ou à la litière de feuille) ou de contaminants (métaux vs. composés organiques) ont été mises en évidence, révélant les défis à relever pour améliorer notre compréhension du rôle des communautés microbiennes dans la dynamique des contaminants dans les écosystèmes aquatiques et leur transfert au sein des réseaux trophiques. Plus particulièrement, les défis ci-dessous sont essentiels à relever :

- Améliorer les méthodes analytiques pour quantifier les métaux et les composés organiques accumulés par les communautés microbiennes benthiques, indépendamment de leur substrat ;
- Mieux comprendre le lien entre les cinétiques de transfert, d'accumulation et de transformation des contaminants et leur toxicité pour les communautés microbiennes ;
- Préciser le rôle des communautés microbiennes dans la remobilisation ou le transport des polluants dans les milieux aquatiques ;
- Évaluer l'impact du changement climatique (e.g. sécheresse, hausse de température) sur la bioaccumulation des contaminants dans les biofilms et leur dynamique.

A l'intersection entre chimie environnementale, écotoxicologie, écologie, microbiologie, la résolution de ces problématiques requiert des collaborations étroites entre disciplines, qui pourraient se développer au sein du réseau Ecotox.

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Pour en savoir plus

Bonnineau, C.; Artigas, J.; Chaumet, B.; Dabrin, A.; Faburé, J.; Ferrari, B. J. D.; Lebrun, J. D.; Margoum, C.; Mazzella, N.; Miège, C.; Morin, S.; Uher, E.; Babut, M.; Pesce, S. (2020) Role of Biofilms in Contaminant Bioaccumulation and Trophic Transfer in Aquatic Ecosystems: Current State of Knowledge and Future Challenges. In: Reviews of Environmental Contamination and Toxicology (Continuation of Residue Reviews). Springer, New York. doi.org/10.1007/398_2019_39.

Bibliographie citée

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ERA / PUBLICATIONS SCIENTIFIQUES / COMMUNAUTES MICROBIENNES AQUATIQUES

Ecotoxicological effects of sulfonamides and fluoroquinolones and their removal by a green alga (*Chlorella vulgaris*) and a cyanobacterium (*Chrysosporum ovalisporum*)

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

Source: ENVIRONMENTAL POLLUTION 263:114554, 2020, DOI: 10.1016/j.envpol.2020.114554

Abstract: In recent years, antibiotic pollution has become worse, especially in China. In this study, the ecotoxicological effects of four frequently used antibiotics with different lipophilic degrees (log Kow) (sulfadiazine (SD), sulfamethazine (SM2), enrofloxacin (ENR), and norfloxacin (NOR)) at four concentrations of 1, 5, 20, and 50 mg L-1 were examined using batch cultures of green alga *Chlorella vulgaris* and *cyanobacterium Chrysosporum ovalisporum* for 16 days based on changes in chlorophyll fluorescence parameters (chl a, Fv/Fm, and Phi PSII) and responses of the antioxidant system. Besides, the antibiotics removal efficiencies of the two microalgae were investigated. Sulfonamides (SD and SM2) had no significant inhibitory effect on the growth of *C. ovalisporum*, but had an inhibitory effect on C. *vulgaris*, whereas fluoroquinolones (ENR and NOR) significantly inhibited *C. ovalisporum*. The activities of superoxide dismutase, catalase, and glutathione reductase suggested that *C. vulgaris* was more tolerant to these antibiotics than *C. ovalisporum*. The increased malondialdehyde level in both algae indicated their tolerance against antibiotics. When compared with *C. ovalisporum*, *C. vulgaris* presented better capacity to remove antibiotics. In summary, the four antibiotics exerted time- or concentration-dependent ecotoxicological effects on the microalgae examined, whereas the microalgae could remove the antibiotics based on the log Kow of the antibiotics. The findings of this study contribute to effective understanding of the ecotoxicological effects of antibiotics and their removal by microalgae.

Accès au document

Microplastics provide new microbial niches in aquatic environments

Authors: Yang YY, Liu WZ, Zhang ZL, Grossart HP, Gadd GM

Source: APPLIED MICROBIOLOGY AND BIOTECHNOLOGY Early Access, 2020, DOI: 10.1007/s00253-020-10704-x

Abstract: Microplastics in the biosphere are currently of great environmental concern because of their potential toxicity for aquatic biota and human health and association with pathogenic microbiota. Microplastics can occur in high abundance in all aquatic environments, including oceans, rivers and lakes. Recent findings have highlighted the role of microplastics as important vectors for microorganisms, which can form fully developed biofilms on this artificial substrate. Microplastics therefore provide new microbial niches in the aquatic environment, and the developing biofilms may significantly differ in microbial composition compared to natural free-living or particle-associated microbial populations in the surrounding water. In this article, we discuss the composition and ecological function of the microbial communities found in microplastic biofilms. The potential factors that influence the richness and diversity of such microbial microplastic communities are also evaluated. Microbe-microbe and microbe-substrate interactions in microplastic biofilms have been little studied and are not well understood. Multiomics tools together with morphological, physiological and biochemical analyses should be combined to provide a more comprehensive overview on the ecological role of microplastic biofilms. These new microbial niches have so far

unknown consequences for microbial ecology and environmental processes in aquatic ecosystems. More knowledge is required on the microbial community composition of microplastic biofilms and their ecological functions in order to better evaluate consequences for the environment and animal health, including humans, especially since the worldwide abundance of microplastics is predicted to dramatically increase.

Accès au document

Behavior of tetracycline and polystyrene nanoparticles in estuaries and their joint toxicity on marine microalgae *Skeletonema costatum*

Authors: Feng LJ, Shi Y, Li XY, Sun XD, Xiao F, Sun JW, Wang Y, Liu XY, Wang SG, Yuan XZ

Source: ENVIRONMENTAL POLLUTION 263(A):114453, 2020, DOI: 10.1016/j.envpol.2020.114453

Abstract: Polystyrene nanoplastics (PS NPs), which are newly emerging as particulate pollutants, are one of the most abundant plastic types in marine debris. Although there has been extensive research on microplastics, the sorption behavior of PS NPs in surface waters remains unknown. In addition, in the previous joint toxicity studies, the concentration of organic pollutant in the joint system was based on the EC50 of this pollutant, rather than the actually amount of this pollutant adsorbed on nanoplastics (NPs). In this study, the sorption behavior of PS NPs with different surface charges in the surface water of estuaries and joint toxicity of that absorbed tetracycline antibiotic in equilibrium were investigated for the first time. Because of the electrostatic repulsion, salting-out effect, and partition function, the sorption capacity of tetracycline antibiotic by differently charged PS NPs was enhanced with increasing salinity. The biological effects of exposure to tetracycline-saturated PS NPs were complicated, which can be attributed to the surface characteristics of mixtures such as hydrophobicity and charges. Thus, the role of NPs in the natural environment as a carrier of antibiotics may provide an alternative for antibiotic inputs from inland water to coastal marine water, which would not only change the environmental fate and ecotoxicology of antibiotics and NPs, but also pose challenges to the safety of coastal aquaculture and marine ecosystem.

Accès au document

Combined effects of 17 beta-estradiol and copper on growth, biochemical characteristics and pollutant removals of freshwater microalgae *Scenedesmus dimorphus*

Authors: Li SX, Chu RY, Hu D, Yin ZH, Mo F, Hu TY, Liu CC, Zhu LD

Source: SCIENCE OF THE TOTAL ENVIRONMENT 730:138597, 2020, DOI: 10.1016/j.scitotenv.2020.138597

Abstract: Contamination by estrogens and heavy metals can cause great environment concern and necessitate efficient approaches for their removals. In this study, the combined effects of 17 beta-estradiol (E2) and Cu(II) on microalgae growth and biochemical characteristics were investigated. Results showed that 1 mg/L Cu(II) promoted the growth of *Scenedesmus dimorphus*, while 2 mg/L Cu(II) exhibited growth inhibition, compared with the same concentration of E2. Biochemical characteristics including enzyme activities as well as the contents of chlorophyll, protein and carbohydrate were significantly affected by the coexistence of E2 and Cu(II) after 12 d of cultivation. *S. dimorphus* exhibited high E2 and Cu(II) removal efficiencies (89.9% of E2 and 76.6% Cu(II) under the coexistence of 0.5 mg/L E2 and 1 mg/L Cu(II), respectively). Lower concentration of Cu(II) might serve as a bridge during E2 removal by S. dimorphuswhile competitive adsorption of Cu(II) and E2 occurred under the condition of excessive Cu(II). Results could confirm that *S. dimorphus* was a potential bioresource for the effective removal of E2 and Cu(II).

Accès au document

Pesticide Mixtures Cause Short-Term, Reversible

Effects on the Function of Autotrophic Periphyton Assemblages

Authors: Bighiu MA, Gottschalk S, Arrhenius A, Goedkoop W

Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY Early access, 2020, DOI: 10.1002/etc.4722

Abstract: In a laboratory experiment we investigated the effects of pesticide mixtures on the structure and function of freshwater biofilms, with focus on their photoautotrophic component. We identified 6 herbicides and 1 fungicide commonly found in Swedish streams at relatively high concentrations and created 3 ternary mixtures that were tested in concentration series ranging from observed environmental concentrations to up to 100 times higher. Biofilms were exposed to these pesticide mixtures for 8 d and then allowed to recover for another 12 d. Our results show a rapid and consistent inhibition of photosynthesis after just 24-h exposure to the highest test concentration of pesticides, as well as in some treatments with lower concentrations (i.e., 10 times the environmental level), on exposure. Interestingly, the observed effects were reversible because biofilm photosynthesis recovered rapidly and completely in clean media in all but one treatment. In contrast to the functional response, no effects were observed on the algal assemblage structure, as assessed by diagnostic pigments. We conclude that the pesticide mixtures induce a rapid but reversible inhibition of photosynthesis, without short-term effects on biofilm structure.

Accès au document

Selective grazing behaviour of chironomids on microalgae under pesticide pressure

Authors: Neury-Ormanni J, Doose C, Majdi N, Vedrenne J, Traunspurger W, Morin S

Source: SCIENCE OF THE TOTAL ENVIRONMENT 730:138673, 2020, DOI: 10.1016/j.scitotenv.2020.138673

Abstract: The herbicide diuron and the insecticide imidacloprid are amongst the most frequently detected pesticides in French rivers, and each is known to affect many aquatic organisms. However, the question of whether and how both pesticides together might induce multi-stress conditions, which could induce indirect effects such as the modification of biological interactions within freshwater microbial communities has not received much attention. This studywas undertaken to determine the effect of diuron and imidacloprid alone and in combination on the feeding behaviour of chironomid larvae.

An initial experiment measured the impact of the different contamination conditions at environmental concentrations (5 µg L-1 for each pesticide) on the grazing rate of chironomids on three microalgae species, independently. Two diatom species, Gomphonema gracile (two different morphotypes: normal and teratogen) and Planothidium lanceolatum, and one green alga Desmodesmus sp. were offered as food, during 24 h. Chironomids grazing rates varied according to the pesticide and algae species. Indeed, diuron impacted algae more strongly and probably affected their palatability, leading chironomids to increase grazing pressure on less nutritionally interesting algae. Imidacloprid, by targeting insect larvae, increased or inhibited their grazing capacity depending on the food source.

In a second experiment (cafeteria design), the food selectivity of chironomids on previous algae was determined under similar contamination conditions during 4 h: under diuron, larvae switched equally between the microalgae andwere asmobile as in the controlwithout pesticide. However, imidacloprid and the pesticidemixture condition altered chironomid movements and grazing behaviour.

By investigating the impact of an herbicide and an insecticide, alone and in combination, on the responses of food (algae growth rate) and biological (mortality) and behavioural (mobility, food selection) responses of chironomid larvae, this study provided new insights on the direct and indirect effects of pesticide contamination on a simplified trophic web.

Accès au document

Effects of Combined Ag and ZnO Nanoparticles on Microbial Communities from

Crab Orchard Creek, Illinois, USA

Authors: Campobasso M, Peiravi M, Xia CJ, Liang YN, Liu J

Source: JOURNAL OF ENVIRONMENTAL ENGINEERING 146(7):04020067, 2020, DOI: 10.1061/(ASCE)EE.1943-7870.0001745

Abstract: The widespread use of Ag and ZnO nanoparticles (NPs) in commercial products has raised concern of their potential adverse impact on humans and the environment. These NPs most commonly enter the environment from the effluents of wastewater treatment plants (WWTPs). To understand the impact of these NPs on microbial communities, this study focused on adding environment-relevant concentrations of Ag (1 μg/L), ZnO (0.1 μg/L), and Ag+ZnO (1 μg/L+0.1 μg/L) to water collected from where the Carbondale Southeast WWTP effluent mixes with Crab Orchard Creek in IL, USA. Nanoparticles-spiked samples were withdrawn immediately and after 72 h for dynamic light scattering analysis. Optical density analysis by ultraviolet-visible spectroscopy, quantitative PCR analysis, and deoxyribonucleic acid sequencing were also conducted after 72 h. The results showed that ZnO NPs, at the studied concentration, were toxic, as a decrease in microbial biomass at Day 3 compared to the Control was reached, with an increase in mass fraction of nanoscale particles over time. However, when ZnO NPs were added in combination with Ag NPs, the adverse impact of ZnO NPs was mitigated, as an increase in microbial biomass was reached compared to the Control at Day 3, with a decrease in mass fraction of nanoscale particles over time. Ag NPs alone, at the studied concentration, did not bring significant impact on the microbial biomass. The relative abundance of the bacterial population affected the most by the addition of NPs was Firmicutes, with an increase in 13.74% compared to the Control when Ag+ZnO NPs were added. This study demonstrated the response of microbial communities to increased environment-relevant concentrations of NPs in a short period of time. The result will provide information that may aid in the preparation of guidance or regulations related to discharge of mixtures of NPs to surface water.

Accès au document

Chronic exposure to CuO nanoparticles induced community structure shift and a delay inhibition of microbial functions in multi-species biofilms

Authors: Miao LZ, Wang PF, Hou J, Ning DL, Liu ZL, Liu SQ, Li TF

Source: JOURNAL OF CLEANER PRODUCTION 262:121353,2020, DOI: 10.1016/j.jclepro.2020.121353

Abstract: Periphytic biofilms have served as a potentially important environmental media of contaminants removal and an important indicator of the health of aquatic systems. When the nanoparticles (NPs) released, they are likely to encounter periphytic biofilms, and then their ecosystem functioning might be changed. Here, we explored the long-term (28 days) impacts of CuO NPs (mM magnitude) on the microbial biomass, metabolic activities, community structure and associated ecosystem-level processes in multi-species biofilms inoculated from lake water. Slight aggregation of CuO NPs was observed during the exposure experiment. All of the algal, fungal, and bacterial community structure in biofilms were already altered by seven days of exposure to 0.781 and 7.81 mM CuO NPs, but a series of functional endpoints did not show clear differences, suggesting the functional redundancy within biofilm communities. After 28 days, however, a wide range of microbial endpoints that are specific to autotrophs (photosynthetic yield) or heterotrophs (basal respiration) or enzymes that represent the target communities were significantly affected. These decreases matched with the total copper content in biofilms, and indicated the negative effects of CuO NPs on the primary production and nutrient cycling of biofilms. Overall, the response of biofilms to CuO NPs produced a slow and delayed effect on microbial-mediated functions over community structure. These results highlight the highly sensitive responses of biofilms in fresh water to CuO NP, suggesting that CuO NPs (at environmentally relevant doses) would, although changes are slow, affect the biofilms' functioning and services, such as their sustainability for purification of polluted surface water.

Accès au document

Microplastics affect sedimentary microbial communities and nitrogen cycling

Authors: Seeley ME, Song B, Passie R, Hale RC

Source: NATURE COMMUNICATIONS 11:1, 2020, DOI: 10.1038/s41467-020-16235-3

Abstract: Microplastics are ubiquitous in estuarine, coastal, and deep sea sediments. The impacts of microplastics on sedimentary microbial ecosystems and biogeochemical carbon and nitrogen cycles, however, have not been well reported. To evaluate if microplastics influence the composition and function of sedimentary microbial communities, we conducted a microcosm experiment using salt marsh sediment amended with polyethylene (PE), polyvinyl chloride (PVC), polyurethane foam (PUF) or polylactic acid (PLA) microplastics. We report that the presence of microplastics alters sediment microbial community composition and nitrogen cycling processes. Compared to control sediments without microplastic, PUF- and PLA-amended sediments promote nitrification and denitrification, while PVC amendment inhibits both processes. These results indicate that nitrogen cycling processes in sediments can be significantly affected by different microplastics, which may serve as organic carbon substrates for microbial communities. Considering this evidence and increasing microplastic pollution, the impact of plastics on global ecosystems and biogeochemical cycling merits critical investigation. Plastic pollution has infiltrated every ecosystem, but few studies have quantified the biogeochemical or ecological effects of plastic. Here the authors show that microplastics in ocean sediment can significantly alter microbial community structure and nitrogen cycling.

Accès au document

Microalgal Metallothioneins and Phytochelatins and Their Potential Use in Bioremediation

Authors: Balzano S, Sardo A, Blasio M, Chahine TB, Dell'Anno F, Sansone C, Brunet C

Source: FRONTIERS IN MICROBIOLOGY 11:517, 2020, DOI: 10.3389/fmicb.2020.00517

Abstract: The persistence of heavy metals (HMs) in the environment causes adverse effects to all living organisms; HMs accumulate along the food chain affecting different levels of biological organizations, from cells to tissues. HMs enter cells through transporter proteins and can bind to enzymes and nucleic acids interfering with their functioning. Strategies used by microalgae to minimize HM toxicity include the biosynthesis of metal-binding peptides that chelate metal cations inhibiting their activity. Metal-binding peptides include genetically encoded metallothioneins (MTs) and enzymatically produced phytochelatins (PCs). A number of techniques, including genetic engineering, focus on increasing the biosynthesis of MTs and PCs in microalgae. The present review reports the current knowledge on microalgal MTs and PCs and describes the state of art of their use for HM bioremediation and other putative biotechnological applications, also emphasizing on techniques aimed at increasing the cellular concentrations of MTs and PCs. In spite of the broad metabolic and chemical diversity of microalgae that are currently receiving increasing attention by biotechnological research, knowledge on MTs and PCs from these organisms is still limited to date.

Accès au document

Nanoplastics exposure modulate lipid and pigment compositions in diatoms

Authors: Gonzalez-Fernandez C, Le Grand F, Bideau A, Huvet A, Paul-Pont I, Soudant P

Source: ENVIRONMENTAL POLLUTION 262:114274, 2020, DOI: 10.1016/j.envpol.2020.114274

Abstract: The impact of nanoplastics (NP) using model polystyrene nanoparticles amine functionalized (PS-NH2) has been investigated on pigment and lipid compositions of the marine diatom Chaetoceros neogracile, at two growth phases using a low (0.05 µg mL-1) and a high (5 µg mL-1) concentrations for 96 h. Results evidenced an impact on pigment composition

associated to the light-harvesting function and photo-protection mainly at exponential phase. NP also impacted lipid composition of diatoms with a readjustment of lipid classes and fatty acids noteworthy. Main changes upon NP exposure were observed in galactolipids and triacylglycerol's at both growth phases affecting the thylakoids membrane structure and cellular energy reserve of diatoms. Particularly, exponential cultures exposed to high NP concentration showed an impairment of long chain fatty acids synthesis. Changes in pigment and lipid content of diatom' cells revealed that algae physiology is determinant in the way cells adjust their thylakoid membrane composition to cope with NP contamination stress. Compositions of reserve and membrane lipids are proposed as sensitive markers to assess the impact of NP exposure, including at potential predicted environmental doses, on marine organisms.

Accès au document

Impact of polystyrene nanoparticles on marine diatom *Skeletonema marinoi* chain assemblages and consequences on their ecological role in marine ecosystems

Authors: Bellingeri A, Casabianca S, Capellacci S, Faleri C, Paccagnini E, Lupetti P, Koelmans AA, Penna A, Corsi I

Source: ENVIRONMENTAL POLLUTION 262:114268, 2020, DOI: 10.1016/j.envpol.2020.114268

Abstract: Marine diatoms have been identified among the most abundant taxa of microorganisms associated with plastic waste collected at sea. However, the impact of nano-sized plastic fragments (nanoplastics) at single cell and population level is almost unknown. We exposed the marine diatom *Skeletonema marinoi* to model polystyrene nanoparticles with carboxylic acid groups (PS-COOH NPs, 90 nm) for 15 days (1, 10, 50 µg/mL). Growth, reactive oxygen species (ROS) production, and nano-bio-interactions were investigated. No effect on diatom growth was observed, however Dynamic light scattering (DLS) demonstrated the formation of large PS aggregates which were localized at the diatoms' fultoportula process (FPP), as shown by TEM images. Increase production of ROS and reduction in chain length were also observed upon PS NPs exposure (p < 0.005). The observed PS-diatom interaction could have serious consequences on diatoms ecological role on the biogeochemical cycle of carbon, by impairing the formation of fast-sinking aggregates responsible for atmospheric carbon fixation and sequestration in the ocean sea floor.

S. marinoi exposure to PS NPs caused an increase of intracellular and extracellular oxidative stress, the reduction of diatom's chain length and the adhesion of PS NPs onto the algal surface.

Accès au document

Interplay between extracellular polymeric substances (EPS) from a marine diatom and model nanoplastic through eco-corona formation

Authors: Grassi G, Gabellieri E, Cioni P, Paccagnini E, Faleri C, Lupetti P, Corsi I, Morelli E

Source: SCIENCE OF THE TOTAL ENVIRONMENT 725:138457, 2020, DOI: 10.1016/j.scitotenv.2020.138457

Abstract: The occurrence of nanoplastics in oceans' surface waters is no more a hypothesis and it could severely affect marine organisms from different trophic levels. Nanoscale particles interaction with dissolved natural organic matter (NOM) significantly influence their behaviour and consequently bioavailability and toxicity to marine species. Extracellular polymeric substances (EPS) are among the main components of the NOM pool in seawater yet have been so far little investigated for their effect in altering the physical-chemical properties of nanosized objects. Here we employed EPS from marine diatom Phaeodactylum tricornutum to study the evolution of an eco-corona formation upon incubation with 60 nm carboxylated polystyrene nanoparticles (PS-COOH NPs), as proxy for nanoplastics in seawater. EPS significantly

reduced PS-COOH NPs aggregation rate compared to biomolecule free natural seawater (NSW) and caused the formation of complexes constituted by both carbohydrate and protein components. Size Exclusion Chromatography (SEC) revealed four main distinct groups of peaks, spanning from high (100 kDa) to low molecular weight (20 kDa) molecules, characterized by a high chemical heterogeneity. The lowering of the chromatographic signals detected after EPS incubation with PS-COOH NPs, mainly in the eluates at high molecular weight, suggests that an important fraction of EPS remained adsorbed on PS-COOH NPs. In agreement, SDS-PAGE analysis of proteins adsorbed on PS-COOH showed the occurrence of an eco-corona formed by proteins in the range of molecular weight 30-100 kDa. No toxicity to diatoms was observed upon PS-COOH exposure (72 h, 1-100mg L-1) even by adding a further source of exogenous EPS during exposure. Moreover, the addition of EPS reduced ROS production, even when cells were incubated with PS-COOH NPs at 10 and 50 mg L-1, suggesting an antioxidant scavenging activity of EPS.

Accès au document

An exploratory study of benthic diatom communities in stormwater ponds of different land uses and varying biocide contamination

Authors: Minelgaite G, van Alst N, Stephansen DA, Bollmann UE, Bester K, Fejerskov ML, Nielsen AH, Vollertsen J

Source: AQUATIC ECOLOGY Early Access, 2020, DOI: 10.1007/s10452-020-09773-x

Abstract: Stormwater retention ponds receive a variety of urban and highway pollutants that may have adverse effects on water-dwelling organisms. In this exploratory study, the benthic diatom community composition at genus level of nine such ponds servicing highway, residential, industrial, and mixed industrial/residential catchments was examined. Thirteen biocides were measured in the pond water as one of the possible explanatory factors for diatom taxonomic variability. The uppermost 1 cm of sediment was sampled, and a total of 50 diatom genera were identified. Moderate to high similarities were found among the diatom communities of the ponds. Two genera, namely Navicula and Nitzschia, were the most abundant and accounted for 19-47% of the relative abundance in the ponds. Estimated relative abundances of diatom genera and measured biocide concentrations in the ponds were grouped according to land use. Highway ponds were found to be significantly different from ponds servicing residential and industrial catchments, while no significant differences were found between residential and industrial ponds. The presence of biocides alone could not explain diatom taxonomic variability, although some evidence was found that communities differed depending on the catchment type of the ponds. The results of this exploratory study are an important contribution to future works investigating stormwater diatom communities, where combined effects of biocides and other stormwater contaminants and community stressors, e.g., metals, PAHs, road salt, should be explicitly looked at.

Accès au document

Differential Effects of the Allelochemical Juglone on Growth of Harmful and Non-Target Freshwater Algae

Authors: Park MH, Kim K, Hwang SJ

Source: APPLIED SCIENCES-BASEL 10(8):2873, 2020, DOI: 10.3390/app10082873

Abstract: Allelopathy has been applied to control nuisance algae in aquatic systems, but the effects of allelochemicals on the broad spectrum of algae are not well understood. We investigate algicidal effects of the allelochemical juglone on the bloom-forming, harmful algae *Microcystis aeruginosa* and *Stephanodiscus hantzschii*, and on several non-target algal species including cyanobacteria (Anabaena flos-aquae, *Oscillatoria curviceps*, and *Phormidium subfuscum*), diatoms (*Asterionella formosa*, *Fragilaria crotonensis*, and *Synedra acus*), and green algae (*Chlorella vulgaris*, *Scenedesmus ecornis*, and *Scenedesmus quadricauda*), in laboratory and field enclosure bioassays. Under three treatment concentrations (0.01, 0.1, and 1 mg L-1) of juglone, Microcystis cell density is significantly reduced by 35-93%. Concentrations of 0.1 and 1 mg L-1 inhibits

Stephanodiscus growth almost equally (66% and 75%, respectively). To contrast, juglone produces a stimulatory allelopathic effect on three green algae, and other tested diatoms showed hormesis. Overall, the cyanobacteria are more sensitive to juglone than the green algae and diatoms. These results indicate that the allelopathic effects of juglone on microalgae vary depending on their characteristic cellular morphology and anatomy.

Accès au document

Influence of biofilm on the transport and deposition behaviors of nano- and micro-plastic particles in quartz sand

Authors: He L, Rong HF, Wu D, Li M, Wang CY, Tong MP

Source: WATER RESEARCH 178:115808, 2020, DOI: 10.1016/j.watres.2020.115808

Abstract: Biofilm, community of bacteria ubiquitously present in natural environment, may interact with plastic particles and affect the transport of plastic particles in environment. The significance of biofilm (Escherichia coli) on the transport and deposition behaviors of three different sized plastic particles (0.02 μm NPs, 0.2 μm MP and 2 μm MP) were examined under both 10 mM and 50 mM NaCl solutions by comparing the breakthrough curves and retained profiles of plastic particles in bare sand versus those in biofilm-coated sand. Regardless of ionic strengths, the presence of biofilm increases the deposition of all three sized plastic particles in porous media. Via employing X-ray microtomography imaging (XMT) and Scanning electron microscope (SEM), we find that the presence of biofilm could narrow the flow path especially near to the inlet of the column and increase the surface roughness of porous media (by decreasing DLVO repulsive interaction), which contributes to the enhanced the deposition of plastic particles. Extracellular polymeric substances (EPS) present on the biofilm are found to contribute to the enhanced deposition of plastic particles. Packed column experiments, quartz crystal microbalance with dissipation (QCM-D) as well as parallel plate flow chamber experiments all show that three major components of EPS, proteins, polysaccharide, and humic substances all contribute to the enhanced deposition of plastic particles. O-H and N-H groups present on cell surfaces are highly likely to form hydrogen bond with plastic particles and increase the deposition plastic particles. Elution experiments show that decreasing solution ionic strength could release small portion of plastic particles from both bare and biofilm-coated sand columns especially from the segments near to the column inlet (with slighter lower percentage from biofilm-coated columns based on the total mass of retained plastics). In contrast, increasing flow rate does not obviously detach the plastic particles that already deposited onto porous media. The results of this study clearly show that the presence of biofilm in natural environment could enhance the deposition and decrease the transport of plastic particles.

Accès au document

Pesticide bioaccumulation in epilithic biofilms as a biomarker of agricultural activities in a representative watershed

Authors: dos Santos DR, Lima JAMD, de Vargas JPR, Bastos MC, dos Santos MAS, Mondamert L, Labanowski J

Source: ENVIRONMENTAL MONITORING AND ASSESSMENT 192(6):381, 2020, DOI: 10.1007/s10661-020-08264-8

Abstract: Brazil is one of the largest consumers of pesticides in the world. The high rainfall rate and inadequate soil use and management promote the transfer of these compounds to the aquatic system. The aim of this study was to identify and quantify pesticides present in epilithic biofilms in order to evaluate the effectiveness of this matrix as a bioindicator able to discriminate areas and periods with different inputs of pesticides. Among the 25 pesticides analyzed in the biofilms, 20 compounds were detected. The epilithic biofilms picked up pesticides independent of their polarities, even in the period of lower use. The frequency and median concentration of five herbicides (2,4-D, atrazine, desethyl-atrazine, simazine, nicosulfuron), three fungicides (carbendazim,

epoxiconazole, tebuconazole), and one insecticide (imidacloprid) were highest in biofilms sampled in summer crops during the growing period. Biofilms collected in the upper region of the catchment, where genetically modified soybean and corn cultivated in a no-tillage system prevail, the highest frequency and median concentration of three herbicides (2,4-D, thifensulfuron, isoproturon), four fungicides (carbendazim, epoxiconazole, tebuconazole, metconazole), and one insecticide (imidacloprid) were observed. Despite the excessive amounts of pesticides used in the catchment, the median values of all pesticides in the epilithic biofilm were considered low. The lower diversity and concentration of pesticides observed in the autumn/winter season is representative of lower use of pesticides, barriers to pesticide transfer from soil to water, and the biofilm's resilience capacity to decompose pesticides.

Accès au document

Investigating the composition and distribution of microplastics surface biofilms in coral areas

Authors: Feng LM, He L, Jiang SQ, Chen JJ, Zhou CX, Qian ZJ, Hong PZ, Sun SL, Li CY

Source: CHEMOSPHERE 252:126565, 2020, DOI: 10.1016/j.chemosphere.2020.126565

Abstract: In recent years, global climate change and pollution of the marine environment have caused large-scale coral deaths and severe damages to coral reef ecosystems. Numerous studies have shown that coral diseases are closely related to microorganisms. And microplastics (MPs) are a potential threat to corals. In marine ecosystems, MPs are an emerging contaminant. MPs have a strong adsorption effect on pollutants in the water environment, and they are very easily colonized by microorganisms to form biofilms. Biofilms may accumulate many pathogens, increasing the probability of coral disease. However, there is no report about the composition of biofilms on the surface of microplastics in coral growth areas. In this study, nine kinds of MPs were chosen in the experiments, which are commonly found in the ocean. Four stakeout points were selected in the coral area. Biofilms were cultivated in natural environment. The composition and distribution of biofilms on the surface of the MPs were analyzed by 16 S rRNA sequencing. The characteristics of biofilms were observed by scanning electron microscopy (SEM). The experimental results show that the species composition and abundance distribution of the biofilm on the MP surface are significantly different from the surrounding seawater. The type of MPs and the stake out point are important factors affecting the structure of the biofilm bacterial community. Compared to seawater samples, MPs are enriched with certain dominant bacteria such as Vibrionaceae, Rhodobacteraceae, Flavobacteraceae, Microtrichaceae and Sphingomonadaceae. Among them, Vibrionaceae, Rhodobacteraceae and Flavobacteraceae are closely related to the tissue damage of stony corals, and Vibrios are also the main pathogens of coral albinism. In addition, Pseudomonas and Bbellvibrio cholerae are also detected on the MPs biofilm. SEM graphs of the MPs after culture could clearly observe rodshaped bacteria and Streptococci. This study can provide a new direction for the study of coral toxicology by MPs and provide basic data for the toxicology research of MPs.

Accès au document

Do environmental concentrations of zinc oxide nanoparticle pose ecotoxicological risk to aquatic fungi associated with leaf litter decomposition?

Authors: Du JJ, Zhang YY, Yin YT, Zhang J, Ma H, Li K, Wan N

Source: WATER RESEARCH 178:115840, 2020, DOI: 10.1016/j.watres.2020.115840

Abstract: Ecotoxicological risk of ZnO nanoparticles at environmental levels is a key knowledge gap for predicting how freshwater ecosystems will respond to nanoparticle pollution. A microcosm experiment was conducted to explore the chronic effects of ZnO nanoparticle at environmental concentrations (30, 300, 3000 ng L-1) on aquatic fungi associated with the decomposing process of poplar leaf litter (45 days). ZnO nanoparticles led to 9-33% increases in fungal biomass after acute exposure (5 days), but 33-50% decreases

after chronic exposure (45 days), indicating that the hormetic effect of ZnO nanoparticles at the environmental level may occur during acute exposure. Besides, ZnO nanoparticles had negative effects on microbial enzyme activity, especially on day 10, when the activities of N-acetylglucosaminidase, glycine-aminopeptidase, aryl-sulfatase, polyphenol oxidase, and peroxidase were significantly inhibited. After chronic exposure, the fungal community structure was significantly impacted by ZnO nanoparticles at 300 ng L-1 due to the reduced proportion of Anguillospora, which eventually caused a significant decrease in litter decomposition rate. Therefore, ZnO nanoparticles may pose ecotoxicological effects on aquatic fungi even at a very low concentration and eventually negatively affect freshwater functioning.

Accès au document

Toxicity of ten herbicides to the tropical marine microalgae *Rhodomonas salina*

Authors: Thomas MC, Flores F, Kaserzon S, Fisher R, Negri, AP

Source: SCIENTIFIC REPORTS 10(1), 2020, DOI: 10.1038/s41598-020-64116-y

Abstract: Herbicide contamination of nearshore tropical marine ecosystems is widespread and persistent; however, risks posed by most 'alternative' herbicides to tropical marine microalgae remain poorly understood. Experimental exposures of the important but understudied microalgae Rhodomonas salina to seven individual Photosystem II (PSII) inhibitor herbicides (diuron, metribuzin, hexazinone, tebuthiuron, bromacil, simazine, propazine) led to inhibition of effective quantum yield (Delta F/F-m ') and subsequent reductions in specific growth rates (SGR). The concentrations which reduced Delta F/F-m ' by 50% (EC50) ranged from 1.71-59.2 µgL-1, while the EC50s for SGR were 4-times higher, ranging from 6.27-188 µgL-1. Inhibition of Delta F/F-m ' indicated reduced photosynthetic capacity, and this correlated linearly with reduced SGR (R^2=0.89), supporting the application of F/F-m' inhibition as a robust and sensitive indicator of sub-lethal toxicity of PSII inhibitors for this microalga. The three non-PSII inhibitor herbicides (imazapic, haloxyfop and 2,4-Dichlorophenoxyacetic acid (2,4-D)) caused low or no toxic responses to the function of the PSII or growth at the highest concentrations tested suggesting these herbicides pose little risk to *R. salina*. This study highlights the suitability of including *R. salina* in future species sensitivity distributions (SSDs) to support water quality guideline development for the management of herbicide contamination in tropical marine ecosystems.

Accès au document

Effect of norfloxacin on performance, microbial enzymatic activity and microbial community of a sequencing batch reactor

Authors: Li SS, Ma BR, She ZL, Guo L, Zhao YG, Jin CJ, Gao MC

Source: ENVIRONMENTAL TECHNOLOGY & INNOVATION 18:100726, 2020, DOI: 10.1016/j.eti.2020.100726

Abstract: The performance, microbial community and enzymatic activity of a sequencing batch reactor have been assessed under norfloxacin stress. The COD removal was restrained at 5-30 mg/L norfloxacin, whereas there was a slight inhibition on the NH4+-N removal at 30 mg/L norfloxacin. The effluent NO3- kept an increasing trend under norfloxacin stress. The oxygen uptake rate, nitrifying rate and denitrifying rate of activated sludge maintained the decreasing trend with the increase of norfloxacin concentration from 0 to 30 mg/L. The variation tendencies of microbial enzymatic activity interrelated with nitrogen transformation was similar to the corresponding nitrifying rate and denitrifying rate under norfloxacin stress. The existence of norfloxacin promoted the extracellular polymeric substances (EPS) production, reactive oxygen species generation and lactate dehydrogenase release of microorganisms in activated sludge due to the potential biotoxicity of norfloxacin. The protein and polysaccharide contents of loosely bound EPS (LB-EPS) and tightly bound EPS (LB-EPS) maintained an increasing trend with the increase of norfloxacin concentration. The chemical composition of EPS was also impacted under

norfloxacin stress. The microbial diversity and richness displayed some distinct differences at different norfloxacin concentrations.

Accès au document

Dissolved organic matter does not promote glyphosate degradation in auto-heterotrophic aquatic microbial communities

Authors: Artigas J, Batisson I, Carles L

Source: ENVIRONMENTAL POLLUTION 259:113951, 2020, DOI: 10.1016/j.envpol.2020.113951

Abstract: Environmental dissolved organic matter (DOM) has been proved to increase microbial population sizes and stimulate the degradation of some pesticide molecules. Among these molecules, the present study investigated the biodegradation of the herbicide glyphosate depending on photoautotrophs DOM supply in a microbial consortium isolated from river biofilms. Degradation experiments in the laboratory were performed in dark and light conditions, as well as after antibiotic supply, in order to characterize the eventual interactions between photoautotrophs and heterotrophs activity during glyphosate degradation. Fifty percent of the initial concentration of glyphosate (0.6 mM) was transformed into aminomethyl phosphonic acid (AMPA) after 9 days in presence or absence of light. Accordingly, the photoautotrophic DOM supply was not stimulating glyphosate degradation by microbial heterotrophs. This lack of response was probably explained by the low net primary production values and weak dissolved organic carbon production recorded in light treatments. The supply of the antibiotic drastically stopped glyphosate transformation demonstrating the central role of bacteria in the biodegradation of the herbicide. Glyphosate also modified the structure of prokaryotes assemblages in the consortium by increasing the relative abundances of Alphaproteobacteria and slightly decreasing those of Gammaproteobacteria. The chemoorganotrophic bacteria Phenylobacterium sp. (Alphaproteobacteria) was related to the transformation of glyphosate in our microbial consortium. The present study highlights the complexity of microbial interactions between photoautotrophs and heterotrophs in microbial assemblages that can contribute to the degradation of pesticides present in aquatic environments.

Accès au document

Impacts of organic matter on the toxicity of biosynthesized silver nanoparticles to green microalgae *Chlorella vulgaris*

Authors: Khoshnamvand M, Ashtiani S, Chen YS, Liu JF

Source: ENVIRONMENTAL RESEARCH 185:109433, 2020, DOI: 10.1016/j.envres.2020.109433

Abstract: The increasing production of eco-friendly nanoparticles like biosynthesized nanoparticles (BNPs) calls for study on their environmental and biological safety. Herein, the impact of natural organic matter on the toxicity of BNPs was studied. Using leaf extract of herbal plant *Allium fistulosum*, the *Allium fistulosum*-silver nanoparticles (AF-AgNPs) were synthesized with the yield of around 100% and used to explore the impacts of natural organic matter (Suwannee river humic acid) on their toxicity to green microalgae *Chlorella vulgaris*. The results showed that the as-prepared AF-AgNPs could decrease the end-points of biomass and chlorophyll a content of *C. vulgaris* in a dose-dependent manner. In addition, AF-AgNPs enhanced algal aggregation and decreased size of cells, especially at higher concentrations. However, organic matter showed an ameliorative effect on the toxicity of AF-AgNPs, and significant enhancement of biomass and chlorophyll a content ($p < 0.05$) were observed in media treated with higher contents of AF-AgNPs. Organic matter could also prevent more cellular aggregation and size reduction of *C. vulgaris*. Our results are helpful for understanding the effects of organic matter on the toxicity of BNPs to aquatic organisms.

Accès au document

Biofilms Provide New Insight into Pesticide Occurrence in

Streams and Links to Aquatic Ecological Communities

Authors: Mahler BJ, Schmidt TS, Nowell LH, Qi SL, Van Metre PC, Hladik ML, Carlisle DM, Munn MD, May J

ENVIRONMENTAL SCIENCE & TECHNOLOGY 54(9):5509-5519, 2020, DOI: 10.1021/acs.est.9b07430

Abstract: Streambed sediment is commonly analyzed to assess occurrence of hydrophobic pesticides and risks to aquatic communities. However, stream biofilms also have the potential to accumulate pesticides and may be consumed by aquatic organisms. To better characterize risks to aquatic life, the U.S. Geological Survey Regional Stream Quality Assessment measured 93 current-use and 3 legacy pesticides in bed sediment and biofilm from 54 small streams in California across a range of land-use settings. On average, 4 times as many current-use pesticides were detected in biofilm at a site (median of 2) as in sediment (median of 0.5). Of 31 current-use pesticides detected, 20 were detected more frequently in biofilm than in sediment and 10 with equal frequency. Pyrethroids as a class were the most potentially toxic to benthic invertebrates, and of the 9 pyrethroids detected, 7 occurred more frequently in biofilm than sediment. We constructed general additive models to investigate relations between pesticides and 6 metrics of benthic community structure. Pesticides in biofilm improved fit in 4 of the 6 models, and pesticides in sediment improved fit in 2. The results indicate that the sampling of stream biofilms can complement bed-sediment sampling by identification of more current-use pesticides present and better estimation of ecological risks.

Accès au document

Infrared spectroscopy as a tool to monitor interactions between nanoplastics and microalgae

Authors: Deniel M, Lagarde F, Caruso A, Errien N

Source: ANALYTICAL AND BIOANALYTICAL CHEMISTRY, Early Access, 2020, DOI: 10.1007/s00216-020-02683-9

Abstract: The unicellular photosynthetic organisms known as microalgae are becoming one of the most important models for aquatic system studies. Among them, *Chlamydomonas reinhardtii* is widely used as a bioindicator of pollution or of different changes in the environment. Numerous pollutants are present in aquatic environments, particularly plastics and nanoplastics. Physiological variations after an environmental change highlight variation in the macromolecular composition of microalgae (proteins, nucleic acids, lipids and carbohydrates). Recently, Fourier transform infrared vibrational spectroscopy has been described as a reliable tool, sensitive and allowing rapid measurement of macromolecular composition of microalgae. Coupled with preprocessing and principal component analysis, it is well adapted to monitoring the effect of environmental stress on biochemical composition. In this study, infrared spectroscopy, combined with multivariate analysis, has been tested first on known environmental stresses such as light intensity variation and nitrogen limitation. Then, this technique has been applied to monitor the interaction and potential impacts of polystyrene nanoparticles on microalgae. The results showed slight variations on protein and carbohydrates bands in the presence of nanoplastics, suggesting that their presence led to modifications in the biochemical composition of the microalgae. To confirm the interaction between microalgae and nanoplastics, visualization by confocal microscopy and cytotoxicity measurement has been carried out. Results showed that polystyrene nanoparticles seemed to adsorb on microalgae surface, leading to a loss of plasma membrane integrity. The resulting chemical modifications, even if moderate, could be detected by infrared spectroscopy, showing that this tool could be very helpful in the understanding of nanoparticle-microalgae interaction mechanisms.

Accès au document

Effects of Bisphenol A on the microalga *Chlamydomonas reinhardtii* and the clam *Corbicula fluminea*

Authors: Esperanza M, Seoane M, Servia MJ, Cid A

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 197:110609, 2020, DOI: 10.1016/j.ecoenv.2020.110609

Abstract: Bisphenol A (BPA) is used throughout the world and it could enter aquatic ecosystems causing harmful effects on humans, animals and plants. The current study relies on the investigation of the toxicity of this emerging pollutant on two freshwater species from different trophic levels: the microalga *Chlamydomonas reinhardtii* and the clam *Corbicula fluminea*.

After 96 h of exposure to several concentrations of BPA, the growth of C. reinhardtii was affected, being the 96 h-EC50 value for growth 30 mg L-1. The toxicity and bioaccumulation of 30 mg L-1 BPA in microalgae after 24 h of exposure were studied. Several cytotoxicity biomarkers such as vitality, oxidative stress and cytoplasmic membrane potential were altered in exposed cells and microalgae accumulated 0.16 pg BPA cell(-1).

Regarding *C. fluminea*, four treatments were established: control without BPA (C); BPA in the food (microalgae pre-exposed for 24 h to 30 mg L-1) (M); BPA in the water (7.5 mg L-1) (W); BPA in both food and water (M + W). After one month of exposure, treated bivalves showed a significantly decrease in the filtration rate and increased lipid peroxidation levels, indicating fitness reduction and oxidative damage. Furthermore, the activities of catalase, glutathione reductase, Se-dependent and total glutathione peroxidase enzymes increased significantly in W and M + W treatments with respect to the control. Clams of the M + W treatment were the most affected, indicating that the little amount of BPA bioaccumulated by microalgae could increase the damage. Emerging contaminants may accumulate in several organisms, such as microalgae, and could have negative impacts on ecosystems.

Accès au document

Evaluation of toxic effects of platinum-based antineoplastic drugs (cisplatin, carboplatin and oxaliplatin) on green alga *Chlorella vulgaris*

Authors: Dehghanpour S, Pourzamani HR, Amin MM, Ebrahimpour K

Source: AQUATIC TOXICOLOGY 223:105495, 2020, DOI: 10.1016/j.aquatox.2020.105495

Abstract: Platinum-based antineoplastic drugs (PBADs) enter the environment via hospital and municipal wastes as reactive and highly toxic molecules. *Chlorella vulgaris* is a freshwater microalgae and is used as an excellent aquatic model for toxicity assessment. In the present study, the toxicity of PBADs to *C. vulgaris* was investigated for better understanding of PBADs environmental toxicity. The algae were cultured in Bold's Basal Medium (BBM) and exposed to different concentrations of PBAD5 for 48, 72 and 96 h. Then, cell proliferation, the synthesis of photosynthetic pigments, protein content, malondialdehyde (MDA) release and antioxidant potential were determined. IC(50)s of cisplatin, carboplatin and oxaliplatin for 96 h of exposure were 106.2, 124.3 and 153.9 mg/L respectively. Cell proliferation, synthesis of chlorophyll a, chlorophyll b and algal protein content significantly decreased in a time and dose-dependent manner. The release of MDA to culture media significantly increased and antioxidant potential decreased.

Cisplatin showed more toxic effects on *C. vulgaris* compared to carboplatin and oxaliplatin indicating its severe toxicity for marine organisms. PBADs induce their toxic effects in algal cells via the interaction with DNA, production of free radicals (such as reactive oxygen species), lipid peroxidation and cell wall damages. Due to these toxic effects of PBAD5 for various environmental organisms, there must be severe restriction on their release into the environment.

Accès au document

Major Role of Surrounding Environment in Shaping Biofilm Community Composition on Marine Plastic Debris

Authors: Basili M, Quero GM, Giovannelli D, Manini E, Vignaroli C, Avio CG, De Marco R, Luna GM

Source: FRONTIERS IN MARINE SCIENCE 7:262, 2020, DOI: 10.3389/fmars.2020.00262

Abstract: Plastic debris in aquatic environments is colonized by microbes, yet factors influencing biofilm development and composition on plastics remain poorly understood. Here, we explored the microbial assemblages associated with different types of plastic debris collected from two coastal sites in the Mediterranean Sea. All plastic samples were heavily colonized by prokaryotes, with abundances up to 1.9 x 10(7) cells/cm^2 . Microbial assemblages on plastics significantly differed between the two geographic areas but not between polymer types, suggesting a major role of the environment as source for the plastisphere composition. Nevertheless, plastic communities differed from those in the surrounding seawater and sediments, indicating a further selection of microbial taxa on the plastic substrates. The presence of potential pathogens on the plastic surface reflected the levels of microbial pollution in the surrounding environment, regardless of the polymer type, and confirmed the role of plastics as carriers for pathogenic microorganisms across the coastal ocean, deserving further investigations.

Accès au document

Lanthanum and Cerium Toxicity to the Freshwater Green Alga *Chlorella fusca*: Applicability of the Biotic Ligand Model

Authors: Aharchaou I, Beaubien C, Campbell PGC, Fortin C

Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY 39(5):996-1005, 2020, DOI: 10.1002/etc.4707

Abstract: The environmental risk assessment of rare earth elements (REEs) requires data on their potential toxicity. In the present study, the toxicity of lanthanum (La) and cerium (Ce) was studied in relation to metal speciation in solution. For both La and Ce, the use of organic ligands demonstrated that the calculated free ion concentration was a good indicator of toxicity. Whether in the absence or presence of organic ligands, when based on free ion concentrations, the obtained half-maximal effective concentrations were similar. When all generated data were pooled, Ce and La showed identical toxicity thresholds after 120 h of exposure with free ion concentration-based median effective concentration values (95% confidence intervals) of 0.48 (0.38-0.60) µM and 0.47 (0.36-0.61) µM for La3+ and Ce3+, respectively. The inhibition of algal growth was also correlated with the intracellular lanthanide concentrations, regardless of the ligand used. Finally, increasing the ambient calcium concentration protected the test algae by reducing the amount of lanthanide internalized into the cells. These results suggest that, at constant pH (5.5), REE accumulation and toxicity are linked to the free ion concentration and ambient calcium concentration, as predicted by the biotic ligand model.

Accès au document

Cultivation substrata differentiate the properties of river biofilm EPS and their binding of heavy metals: A spectroscopic insight

Authors: Wang LF, Chen W, Song XC, Li Y, Zhang WL, Zhang HJ, Niu LH

Source: ENVIRONMENTAL RESEARCH 182:109052, 2020, DOI: 10.1016/j.envres.2019.109052

Abstract: River biofilms inevitably serve as recipients of heavy metals including copper (Cu) and cadmium (Cd) following their introduction in fluvial systems. Nevertheless, the effects of cultivation substrata on the characteristics of river biofilm extracellular polymeric substances (EPS) and the binding behaviors of heavy metals on biofilms remain unclear. Integrating spectroscopic methods with chemometric analyses, we explored the binding behaviors of Cu(II) and Cd(II) onto biofilm EPS cultivated from two representative substrata at the molecular level. Chemical analysis revealed that biofilm cultivated on polyethylene (PE) pieces contained more non-fluorescent protein fractions, whereas EPS from periphyton grown on mineral, i.e., cobblestones was richer in aromatic fractions and polysaccharides. Excitation-emmision matrix combined with parallel factor analysis suggested a stronger interaction between fluorophores in periphytic EPS with Cu(II) compared to

fluorophores in plastic biofilm EPS. Integrated use of infrared spectroscopy and two-dimensional correlation analyses revealed that, during the heavy metal binding processes, the amines and phenolics in plastic biofilm EPS gave the fastest responses to metal binding. While the amides and the aliphatic fractions in periphytic EPS showed a preferential binding to heavy metals. This study differentiates the effects of cultivation substrata on structuring the biofilm EPS characteristics and offers new insights into the environmental behaviors of heavy metal discharge into fluvial systems in river biofilm matrix.

Accès au document

Reproductive cycle progression arrest and modification of cell morphology (shape and biovolume) in the alga *Pseudokirchneriella subcapitata* exposed to metolachlor

Authors: Machado MD, Soares EV

Source: AQUATIC TOXICOLOGY 222:105449, 2020, DOI: 10.1016/j.aquatox.2020.105449

Abstract: Metolachlor (MET) is an herbicide widely used and frequently found (at µg L-1) in aquatic systems. This work aimed to study the modes of action of MET on the green microalga *Pseudokirchneriella subcapitata*. Algae exposed to 115 or 235 µg L-1 MET, for 48 or 72 h, presented a reduction of metabolic activity, chlorophyll a and b content and photosynthetic efficiency. The exposure to 115 or 235 µg L-1 MET also induced growth yield reduction, mean cell biovolume increase and alteration of the typical algae shape (cells lunate or helically twisted) t(o) "French croissant"-type; at these MET concentrations, algal population was mainly composed by multinucleated cells (= 4 nuclei), which suggest that MET impairs the normal progression of the reproductive cycle but did not hinder nuclear division. The accumulation of multinucleated cells seems to be the consequence of the incapacity of the parent cell to release the autospores. In conclusion, MET disrupts the physiology of P. subcapitata cells; the disturbance of the progression of the reproductive cycle should be in the origin of growth slowdown (or even its arrest), increase of mean cell biovolume and modification of algal shape. This work contributed to elucidate, in a systematically and integrated way, the toxic mechanism of MET on the non-target organism, the alga P. subcapitata.

Accès au document

Resistant fungi isolated from contaminated uranium mine in Brazil shows a high capacity to uptake uranium from water

Authors: Coelho E, Reis TA, Cotrim M, Mullan TK, Correa, B

Source: CHEMOSPHERE 248:126068, 2020, DOI: 10.1016/j.chemosphere.2020.126068

Abstract: The Osamu Utsumi uranium mine occupies a 20 km^2 area in the city of Caldas, which is located in the state of Minas Gerais, Brazil. Since mining activities ended at Osamu Utsumi 24 years ago, the surrounding area has become contaminated by acid effluents containing high concentrations of uranium. Thus, the aim of this study was to assess the uranium bioremediation capacity of 57 fungi isolated from the mine area. In tolerance tests, 38% (22) of the fungal isolates were considered tolerant to uranium, including 10 Penicillium species. At a uranium concentration of 2000 mg L-1 48 fungi did not exhibit mycelial growth index inhibition. Minimal inhibitory concentration (MIC) analysis showed growth of 25 fungi above a uranium concentration of 8000 mg L-1. At high uranium concentrations, some fungi (i.e., *Talaromyces amestolkiae* and *Penicillium citrinum*) showed morphological changes and pigment (melanin) production. Among the fungal isolates, those considered to be more tolerant to uranium were isolated from soil and sediment samples containing higher concentrations of heavy metal. When comparing the results of resistance/tolerance tests with those for uranium biosorption capacity, we concluded that the fungi isolated from the Osamu Utsumi mine with the best potential for uranium bioremediation were Gongronella butleri, Penicillium piscarium, Penicillium citrinum,

Penicillium ludwigii, and Talaromyces amestolkiae. Biosorption tests with live fungal biomass showed that 11 species had a high potential for uranium uptake from contaminated water.

Accès au document

Understanding the influence of glyphosate on the structure and function of freshwater microbial community in a microcosm

Authors: Lu T, Xu NH, Zhang Q, Zhang ZY, Debognies A, Zhou ZG, Sun LW, Qian HF

Source: ENVIRONMENTAL POLLUTION 260:114012, 2020, DOI: 10.1016/j.envpol.2020.114012

Abstract: Glyphosate, one of the most popular herbicides, has become a prominent aquatic contaminant because of its huge usage. The eco-safety of glyphosate is still in controversy, and it is inconclusive how glyphosate influences aquatic microbial communities. In the present study, the effects of glyphosate on the structure and function of microbial communities in a freshwater microcosm were investigated. 165/185 rRNA gene sequencing results showed that glyphosate treatment (2.5 mg L-1, 15 days) did not significantly alter the physical and chemical condition of the microcosm or the composition of the main species in the community, but metatranscriptomic analyses indicated that the transcriptions of some cyanobacteria were significantly influenced by glyphosate. The microbial community enhanced the gene expression in pathways related to translation, secondary metabolites biosynthesis, transport and catabolism to potentially withstand glyphosate contamination. In the low phosphorus (P) environment, a common cyanobacterium, Synechococcus, plays a special role by utilizing glyphosate as P source and thus reducing its toxicity to other microbes, such as Pseudanabaena. In general, addition of glyphosate in our artificial microcosms did not strongly affect the aquatic microbial community composition but did alter the community's transcription levels, which might be potentially explained by that some microbes could alleviate glyphosate's toxicity by utilizing glyphosate as a P source.

Accès au document

Species-specific sensitivity of three microalgae to sediment elutriates

Abstract: Gallo A, Guida M, Armiento G, Siciliano A, Mormile N, Carraturo F, Pellegrini D, Morroni L, Tosti E, Ferrante MI, Montresor M, Molisso F, Sacchi M, Danovaro R, Lofrano G, Libralato G

Source: MARINE ENVIRONMENTAL RESEARCH 156:UNSP104901, 2020, DOI: 10.1016/j.marenvres.2020.104901

Abstract: Microalgae are considered good bioindicators of marine environmental quality. Frequently, they are used to investigate the toxicity of sediment elutriates, but their sensitivity is disputed. This paper compared the sensitivity of *Phaeodactylum tricornutum* (diatom), *Skeletonema costatum* (diatom), and *Dunaliella tertiolecta* (green alga), analyzing 257 samples of elutriates (1:4 sediment: water ratio), considering growth inhibition (72 h) as the reference endpoint and sediment chemical (metals, metalloids and polyaromatic hydrocarbons) and grain size. Results of the toxicity tests showed that the microalgae sensitivity was not correlated. The integration of chemical data did not allow to discriminate toxicity effects but contributed to highlight that *D. tertiolecta* was the most sensitive microalgae (no cell wall) followed by *P. tricornutum* and *S. costatum*. Further analysis, including lines of evidence and weight of evidence approaches to calculate risk quotients of elutriate samples, confirmed these results.

Accès au document

Effects of oxytetracycline on growth and chlorophyll a fluorescence in green algae (*Chlorella vulgaris*), diatom (*Phaeodactylum tricornutum*) and cyanobacteria

(*Microcystis aeruginosa* and *Nodularia spumigena*)

Authors: Siedlewicz G, Zak A, Sharma L, Kosakowska A, Pazdro K

Source: OCEANOLOGIA 62(2):214-225, 2020, DOI: 10.1016/j.oceano.2019.12.002

Abstract: The study aimed at measuring the influence of a wide range of oxytetracycline concentrations, with particular attention to the low levels of the antibiotic on cyanobacteria *Microcystis aeruginosa* and *Nodularia spumigena*, diatom *Phaeodactylum tricornutum* and the model green algae *Chlorella vulgaris* by conducting prolonged toxicity tests (lasting 10 days). Standard measurements (cell number, optical density, chlorophyll a concentration) were combined with photosynthetic parameters measurements. The obtained results show that concentrations of oxytetracycline present in the environment can affect tested microorganisms. It was found to decrease photosystem II efficiency and disrupt the photosynthesis process. A careful interpretation of photosynthetic parameters allowed a better understanding of the mode of action of oxytetracycline in relation to non-target photoautotrophic organisms like cyanobacteria and microalgae. In conclusion, it would appear that the use of standard chronic toxicity tests (72 h) does not allow to accurately and reliably assess the chronic impact of bioactive compounds including drugs and their metabolites on water organisms. On this basis, we recommend the application of extended duration tests.

Accès au document

Ecotoxicological effects of alpha-cypermethrin on freshwater alga *Chlorella* sp.: Growth inhibition and oxidative stress studies

Authors: Baruah P, Chaurasia N

Source: ENVIRONMENTAL TOXICOLOGY AND PHARMACOLOGY 76:103347, 2020, DOI: 10.1016/j.etap.2020.103347

Abstract: Alpha-cypermethrin (ACy) is a synthetic pyrethroid insecticide commonly used in agricultural practices for controlling a broad range of insect pests particularly belonging to the order Lepidoptera and Coleoptera. The present study aims to evaluate the toxic effect of ACy on microalgae by studying its influence on *Chlorella* sp. According to our knowledge, this is the first detailed study of ACy toxicity on microalgae. Significant growth inhibition of Chlorella sp. was observed at high ACy concentration (6-48 mg L-1) during the entire 96 h bioassay. The 96 h median effective concentration (EC50) of ACy was estimated to be 11.00 mg L-1. Flow cytometry analysis showed an enhanced generation of reactive oxygen species (ROS) and intracellular lipid accumulation after 96 h exposure to 11.00 mg L-1 of ACy. Further, the same ACy concentration showed a significant decrease in photosynthetic pigment content and an increase in antioxidant enzyme activity and malondialdehyde (MDA) content in *Chlorella* sp.

Accès au document

The potential assessment of green alga *Chlamydomonas reinhardtii* CC-503 in the biodegradation of benz(a)anthracene and the related mechanism analysis

Authors: Luo J, Deng JL, Cui LL, Chang P, Dai XZ, Yang CY, Li NN, Ren ZM, Zhang XH

Source: CHEMOSPHERE 249:126097, 2020, DOI: 10.1016/j.chemosphere.2020.126097

Abstract: Benz(a)anthracene (BaA) is a polycyclic aromatic hydrocarbons (PAHs), that belongs to a group of carcinogenic and mutagenic persistent organic pollutants found in a variety of ecological habitats. In this study, the efficient biodegradation of BaA by a green alga *Chlamydomonas reinhardtii* (*C. reinhardtii*) CC-503 was investigated. The results showed that the growth of C. reinhardtii was hardly affected with an initial concentration of 10 mg/L, but was inhibited significantly under higher concentrations of BaA (30 mg/L) ($p < 0.05$). We demonstrated that the relatively high concentration of 10 mg/L BaA was degraded completely in 11 days, which indicated that C. reinhardtii had an efficient degradation system. During the degradation, the intermediate metabolites were determined to be isomeric phenanthrene or anthracene, 2,6-

diisopropylnaphthalene, 1,3-diisopropylnaphthalene, 1,7-diisopropylnaphthalene, and cyclohexanol. The enzymes involved in the degradation included the homogentisate 1,2-dioxygenase (HGD), the carboxymethylenebutenolidase, the ribulose 1,5-bisphosphate carboxylase/oxygenase (Rubisco) and the ubiquinol oxidase. The respective genes encoding these proteins were significantly upregulated ranging from 3.17 fold to 13.03 fold and the activity of enzymes, such as HGD and Rubisco, was significantly induced up to 4.53 and 1.46 fold (p < 0.05), during the BaA metabolism. This efficient degradation ability suggests that the green alga *C. reinhardtii* CC-503 may be a sustainable candidate for PAHs remediation.

Accès au document

Nanoplastics Promote Microcystin Synthesis and Release from Cyanobacterial *Microcystis aeruginosa*

Authors: Feng LJ, Sun XD, Zhu FP, Feng Y, Duan JL, Xiao F, Li XY, Shi Y, Wang Q, Sun JW, Liu XY, Liu JQ, Zhou LL, Wang SG, Ding ZJ, Tian HY, Galloway TS, Yuan XZ

Source: ENVIRONMENTAL SCIENCE & TECHNOLOGY 54(6):3386-3394, 2020, DOI: 10.1021/acs.est.9b06085

Abstract: Although the fate of nanoplastics (< 100 nm) in freshwater systems is increasingly well studied, much less is known about its potential threats to cyanobacterial blooms, the ultimate phenomenon of eutrophication occurrence worldwide. Previous studies have evaluated the consequences of nanoplastics increasing the membrane permeability of microbes, however, there is no direct evidence for interactions between nanoplastics and microcystin; intracellular hepatotoxins are produced by some genera of cyanobacteria. Here, we show that the amino-modified polystyrene nanoplastics (PS-NH2) promote microcystin synthesis and release from Microcystis aeruginosa, a dominant species causing cyanobacterial blooms, even without the change of coloration. We demonstrate that PS-NH2 inhibits photosystem II efficiency, reduces organic substance synthesis, and induces oxidative stress, enhancing the synthesis of microcystin. Furthermore, PS-NH2 promotes the extracellular release of microcystin from M. aeruginosa via transporter protein upregulation and impaired cell membrane integrity. Our findings propose that the presence of nanoplastics in freshwater ecosystems might enhance the threat of eutrophication to aquatic ecology and human health.

Accès au document

Biofilm alters tetracycline and copper adsorption behaviors onto polyethylene microplastics

Authors: Wang Y, Wang XJ, Li Y, Li J, Wang F, Xia SQ, Zhao JF

Source: CHEMICAL ENGINEERING JOURNAL 392:123808, 2020, DOI: 10.1016/j.cej.2019.123808

Abstract: In this study, the adsorption properties of Cu(II) and tetracycline (TC) onto virgin and biofilm-developed polyethylene (PE) microplastics were investigated in batch sorption experiments. PE microplastics were placed at sewage outlets (Shanghai, China) for 20 days to develop biofilm on their surface. The adsorption and desorption isotherms of Cu(II) and TC were well fitted by the Freundlich model, and revealed that biofilm could enhance the adsorption and stabilization of Cu(II) and TC on microplastics. The linearity test of the film diffusion model in kinetic experiments suggested that the adsorption on virgin and biofilm-developed microplastics was dominated by intra-particle diffusion and film diffusion, respectively. Compared with the virgin microplastics, the adsorption of Cu(II) and TC on biofilm-developed microplastics was additionally affected by pH-dependent complexation interactions in the biofilm and competition interactions. Cu(II) pre-adsorbed on the biofilm could be released into solution because of competition effects of TC. Fourier transform infrared spectroscopy (FTIR) and density functional theory (DFT) further confirmed that the enhanced adsorption of TC on the biofilm could be attributed to the complexation of TC, Cu(II) and components in biofilm. This study illustrated that biofilms could enhance the role of microplastics in the Cu(II) and TC migration by

changing their adsorption properties on microplastics.

Accès au document

Metabolomic, functional, and ecologic responses of the common freshwater fungus *Neonectria lugdunensis* to mine drainage stress

Authors: Seena S, Sobral O, Cano A

Source: SCIENCE OF THE TOTAL ENVIRONMENT 718:137359, 2020, DOI: 10.1016/j.scitotenv.2020.137359

Abstract: Metal contamination of watersheds is a global problem. Here, we conducted litter decomposition studies with *Neonectria lugdunensis*, a cosmopolitan aquatic fungus. Fungal isolates from four reference (non-impacted) and six metal-contaminated streams (due to mine drainage) were exposed to mine drainage and reference stream waters in Central Portugal. Impact of mine drainage waters on *N. lugdunensis* hyphae was investigated by performing metabolomic profiling of 200 lipids and 25 amino acids (M) with ultra-high performance liquid chromatography-mass spectrometry. In parallel, functional response of *N. lugdunensis* isolates was assessed through expression profiles of a functional gene, cellobiohydrolase I (Cbhl). Ecological performance via leaf mass loss was also determined. Exposure to mine drainage waters altered the concentration of numerous AA and lipids. Most strikingly, a gradual increase in the concentration of the triacylglycerols (TAG) with shorter acyl chains and lesser unsaturation was observed after the exposure to mine drainage waters. In addition, the changes in the concentration of numerous TAG, lysophosphatidylcholines, and AA were more significant in the isolates from the metal-contaminated streams after exposure to mine drainage water. Cbhl gene of the isolates from reference streams was down-regulated by metal stress, while those from metal-contaminated streams remained unaffected. Finally, leaf mass loss was influenced by both exposure to mine drainage waters and the origin of isolates. Overall, our study demonstrates unique functional signatures displayed by fungi under metal stress and the relevant role that fungal AA and lipids play to cope with metal toxicity.

Accès au document

Resistance of cyanobacteria *Microcystis aeruginosa* to erythromycin with multiple exposure

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

Source: CHEMOSPHERE 249:126147, 2020, DOI: 10.1016/j.chemosphere.2020.126147

Abstract: Here we report a set of experiments in which water blooming cyanobacteria *Microcystis aeruginosa* was repeatedly exposed to erythromycin. Growth inhibition increased with increasing erythromycin concentration (1-150 μg/L) upon first exposure. Maximum inhibition rate (76.06%), occurred under 150 μg/L erythromycin. Moreover, 96-h 50% effective concentration (EC50) was 22.97 μg/L, indicating that the growth of M. aeruginosa was affected by erythromycin under common environmental concentrations. Photosynthesis was hindered by chlorophyll and photosystem II limitations. Malondialdehyde, reactive oxygen species, and superoxide dismutase contents increased significantly under certain concentrations of erythromycin, but superoxide dismutase was suppressed by 150 μg/L erythromycin. Synthesis of intracellular and extracellular microcystins was promoted by 10-60 and by 20-60 μg/L erythromycin, respectively, but both were inhibited by 100-150 μg/L. Principal component analysis and Pearson's correlation revealed the accumulation of reactive oxygen species as the dominant mechanism of erythromycin toxicity to cells. M. aeruginosa repeatedly subjected to erythromycin exposure showed obvious resistance against the antibiotic, especially when treated twice with 60 μg/L erythromycin. The 96-h EC50 was 81.29 μg/L. As compared to the first exposure to erythromycin, photosynthetic and antioxidant activities increased, while growth inhibition and oxidation stress decreased upon multiple exposures. Production and release of microcystins were enhanced by repeated exposure to the antibiotic. Thus, erythromycin persistence in water should be examined, as repeated exposure may lead to serious environmental and human health hazards.

Accès au document

Interaction of Cyanobacteria with Nanometer and Micron Sized Polystyrene Particles in Marine and Fresh Water

Authors: de Oliveira TTS, Andreu I, Machado MC, Vimbela G, Tripathi A, Bose A

Source: LANGMUIR 36(14):3963-3969, 2020, DOI: 10.1021/acs.langmuir.9b03644

Abstract: Microplastics and nanoplastics are emerging pollutants, widespread both in marine and in freshwater environments. Cyanobacteria are also ubiquitous in water and play a vital role in natural ecosystems, using photosynthesis to produce oxygen. Using photography, fluorescence microscopy and cryogenic and scanning electron microscopy (cryo-SEM, SEM) we investigated the physicochemical response of one of the most predominant seawater cyanobacteria (Synechococcus elongatus, PCC 7002) and freshwater cyanobacteria (S. elongatus Nageli PCC 7942) when exposed to 10 μm diameter polystyrene (microPS) and 100 nm diameter polystyrene (nanoPS) particles. Marine and freshwater cyanobacteria formed aggregates with the nanoPS, bound together by extracellular polymeric substances (EPS), and these aggregates sedimented. The aggregates were larger, and the sedimentation was more rapid for the marine system. Aggregate morphologies were qualitatively different for the microPS samples, with the bacteria linking up a small number of particles, all held together by EPS. There was no sedimentation in these samples. The cyanobacteria remained alive after exposure to the particles. The particle size- and salt concentration-dependent response of cyanobacteria to these anthropogenic stressors is an important factor to consider for a proper understanding of the fate of the particles as well as the bacteria.

Accès au document

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

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

Source: CHEMICAL GEOLOGY 540:UNSP 119565, 2020, DOI:1 0.1016/j.chemgeo.2020.119565

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

Accès au document

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

Authors: Baysal A, Saygin H, Ustabasi GS

Source: ENVIRONMENTAL MONITORING AND ASSESSMENT 192(5): 276, 2020, DOI:1 0.1007/s10661-020-08254-w

Abstract: To assess the fate and behavior of engineered nanoparticles in the environment, it is important to examine the physicochemical and toxicological transformation of nanoparticles as

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

Accès au document

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

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

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

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

Accès au document

Portable Microalgal Biosensor for Herbicide Monitoring

Authors: Boron I, Juarez A, Battaglini F

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

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

Accès au document

https://doi.org/10.15454/BGEP-SC64

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

Authors: Navada KK, Kulal A

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

Abstract: Managing triphenylmethane class of dyes such as aniline blue present in the effluents is a nightmare for the industries and environmentalists. There are physical and chemical approaches available for degrading these recalcitrant dyes. However, these methods become expensive process and also degraded products are not ecofriendly in nature. Laccase from white rot fungi had been used for biotransformation of triphenylmethane class of dyes except for aniline blue. This study focussed on laccase from gamma irradiated endophytic fungus (*Phomopsis* sp.) and its enhanced activity in degrading aniline blue as well as textile dye effluent. Laccase production was increased in 1.2 kGy gamma irradiated endophytic fungus (2 fold) and hence dye degradation was enhanced when compared to the non-irradiated (wild) fungus. The laccase activity exhibited appreciable stability for metal ions (Zn2+, Cu2+, Cr2+ and Ca2+) up to 10 mM concentration. The highest laccase activity and dye decolourisation rate was observed around 30 degrees C temperature at pH 5. The degraded intermediates were identified and a mechanism of degradation was proposed based on UV-vis, FTIR and LC-MS analysis. The aniline blue degradation kinetics strictly followed Michaelis-Menten model. The degraded aniline blue dye samples had reduced COD and were non-toxic to plants and microorganisms. To substantiate the industrial application, textile effluent was treated with laccase from the endophytic fungus and found 99 % decolourisation within 2.5 h. There was a 67 % reduction in COD and a 47 % reduction in BOD in laccase mediated textile effluent treatment.

Accès au document

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

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

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

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

Accès au document

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

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

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

Abstract: Lindane (gamma-hexachlorocyclohexane) is an organochlorine pesticide that has been widely used in agriculture over the last seven decades. The increasing residues of lindane in soil and water environments are toxic to humans and other organisms. Large-scale applications and residual toxicity in the environment require urgent lindane removal. Microbes, particularly Gram-negative bacteria, can transform lindane into non-toxic and environmentally safe metabolites. Aerobic and anaerobic microorganisms follow different metabolic pathways to degrade lindane. A variety of enzymes participate in lindane degradation pathways, including dehydrochlorinase (LinA), dehalogenase (LinB), dehydrogenase (LinC), and reductive dechlorinase (LinD). However, a limited number of reviews have been published regarding the biodegradation and bioremediation of lindane. This review summarizes the current knowledge regarding lindane-degrading microbes along with biodegradation mechanisms, metabolic pathways, and the microbial remediation of lindane-contaminated environments. The prospects of novel bioremediation technologies to provide insight between laboratory cultures and large-scale applications are also discussed. This review provides a theoretical foundation and practical basis to use lindane-degrading microorganisms for bioremediation.

Accès au document

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

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

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

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

Accès au document

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

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

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

Abstract: Microalgae-mediated biodegradation of antibiotics has recently gained increased attention from international scientific community. However, limited information is available regarding microalgae-mediated biodegradation of SMX in a co-metabolic system. Here we investigated the biodegradation of sulfamethoxazole (SMX) by five algal species (*Pseudokirchneriella subcapitata*, *Scenedesmus quadricauda*, *Scenedesmus obliquus*, *Scenedesmus acuminatus* and *Chlorella pyrenoidosa*), and its transformation pathways by *C. pyrenoidosa* in a sodium acetate (3 mM) co-metabolic system. The results showed that the highest SMX dissipation (14.9%) was detected by *C. pyrenoidosa* after 11 days of cultivation among the five tested algal species in the absence of other carbon sources. The addition of sodium acetate (0-8 mM) significantly enhanced the dissipation efficiency of SMX (0.4 μM) from 6.05% to 99.3% by *C. pyrenoidosa* after 5 days of cultivation, and the dissipation of SMX followed the first-order kinetic model with apparent rate constants (k) ranging from 0.0107 to 0.9811 d(-1). Based on the results of mass balance analysis, biodegradation by *C. pyrenoidosa* was the main mechanism for the dissipation of SMX in the culture medium. Fifteen phase I and phase II metabolites were identified, and subsequently the transformation pathway was proposed, including oxidation, hydroxylation, formylation and side chain breakdown, as well as pterin-related conjugation. The majority of metabolites of SMX were only observed in the culture medium and varied with cultivation time. The findings of the present study showed effective co-metabolism of a sulfonamide by microalgae, and it may be applied in the aquatic environment remediation and wastewater treatment in the future.

Accès au document

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

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

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

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

Accès au document

https://doi.org/10.15454/BGEP-SC64

MICROBIOLOGIE ET CONTAMINANTS

Alleviation of Cd phytotoxicity and enhancement of rape seedling growth by plant growth-promoting bacterium *Enterobacter* sp. Zm-123

Authors: Zhang M, Jin ZH, Zhang X, and more...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-09558-7

Abstract: The present study aims to investigate the impact of a metal-tolerant bacterium on metal detoxification and rape seedling growth promotion under Cd stress. The results showed that the isolated bacterium *Enterobacter* sp. Zm-123 has capability to resist Cd (200 mg/L), produce IAA (26.67 mg/L) and siderophores (82.34%), and solubilize phosphate (137.5 mg/L), etc. Zm-123 inoculation significantly enhanced the fresh weight of rape seedlings from 9.47 to 19.98% and the root length from 10.42 to 57.05% compared with non-inoculation group under different concentrations of Cd (0, 0.5, 1, 3, 5 mg/L) ($p < 0.05$). It also significantly increased the content of chlorophyll, soluble sugar, soluble protein, and proline (p < 0.05) in rape seedlings. Moreover, a significant elevation in catalase (CAT) and peroxidase (POD) activities and a significant reduction in malondialdehyde (MDA), electrolyte leakage (EL), and Cd content in rape seedlings were detected owing to Zm-123 inoculation ($p < 0.05$). The combined results imply that strain Zm-123 can alleviate the Cd phytotoxicity and promote the rape seedling growth by improving the physiological activity and antioxidant level, which can be potentially applied to protect plants from Cd toxicity.

Accès au document

Evaluating the protection of bacteria from extreme Cd (II) stress by P-enriched biochar

Authors: Chen HM, Tang LY, Wang ZJ, and more...

Source: ENVIRONMENTAL POLLUTION 263, A, 2020, DOI: 10.1016/j.envpol.2020.114483

Abstract: Cadmium cations (Cd2thorn) are extremely toxic to organisms, which limits the remediation of Cd by microorganisms. This study investigated the feasibility of applying biochar to protect bacteria from extreme Cd2thorn stress (1000 mg/L). An alkaline biochar (RB) and a slightly acidic biochar (SB) were selected. SB revealed a higher Cd2thorn removal than RB (15.5% vs. 4.8%) due to its high surface area. Addition of Enterobacter sp. induced formation of Cd phosphate and carbonate on both SB and RB surface. However, Cd2thorn removal by RB enhanced more evidently than SB (78.9% vs. 30.2%) due to the substantial microbial regulation and surficial alkalinity. Thermogravimetric analysis (TGA), X-ray photoelectron spectroscopy (XPS) and geochemical modeling (GWB) all confirmed that the formation of stable Cd phosphate on RB was superior to that in SB. These biomineralization, together with biochar pore structure, protect bacterial cells from Cd stress. Moreover, the alkalinity of biochar promoted the formation of carbonate, which strengthened the decline of Cd2thorn toxicity. The protection by RB was also confirmed by the intense microbial respiration and biomass (PLFA). Furthermore, this protection induced a positive feedback between P-abundant biochar and Enterobacter sp.: biochar provides P source (the most common limiting nutrient) to support microbial growth; bacteria secrete more organic acids to drive P release. This study therefore elucidated the protection of bacteria by P-enriched biochar based on both physic-chemical and microbial insights.

Accès au document

Self-cleaning of very heavily oil-polluted sites proceeds even under heavy-metal stress while involved bacteria exhibit bizarre pleomorphism

Authors: Ali N, Khanafer M, Al-Awadhi H, Radwan S

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 200, 2020, DOI: 10.1016/j.ecoenv.2020.110717

Abstract: Two substrates saturated with crude oil, a desert soil sample (17.3% oil) and an olive-pomace (plant-based oil sorbent) sample (41% oil) showed effective self-cleaning via their own native microorganisms. The oil in such systems did not gather in one compact layer as it may be expected, but became dispensed as vesicles of varying dimensions connected together with narrow tunnels. Bacteria colonized the oil vesicles but only at the borders between the oil and the watery substrates. Through this architectural arrangement, the cells were capable of absorbing oil through their oil-contact surfaces and oxygen, water and water soluble nutrients through their substrate-contact surfaces. The cells involved were those of indigenous hydrocarbonoclastic bacterial communities. Many of those bacteria also tolerated and removed the amended heavy-metals, Hg2+, Cd2+, Pb2+, AsO43- and AsO33-. In the presence of heavy-metals, some of the bacterial species particularly of the pseudomonads exhibited bizarre pleomorphic cell-forms. It was concluded that even environments toxified with extremely high oil concentrations and heavy-metals can be remediated rather effectively via their already existing native microorganisms.

Accès au document

Isolation and Identification of Endosulfan Degrading Native Bacterial Consortium from Agricultural Soils

Authors: Bilgin A, Sanin SL

Source: WASTE AND BIOMASS VALORIZATION 11, 7: 3303-3313, 2020, DOI: 10.1007/s12649-019-00662-5

Abstract: The environmental impact of chlorinated pesticides, including endosulfan, is not only caused by their persistency in the ecosystem but also from their toxic effects on off-target living organisms. In this study, three different strains of microorganisms, namely *Afipia genosp*, *Sphingomonas yanoikuyae* Q1 and *Methylobacterium rhodesianum* that are capable of biodegrading endosulfan at low concentrations (100 µu g/L) from a tea cultivation field were reported. The isolated microbial consortium biodegraded 59% of the total endosulfan (63% alpha-endosulfan, 57% beta-endosulfan) at pH 6.5. The same consortium biodegraded 98% of the total endosulfan (96% of alpha-endosulfan, 97% of beta-endosulfan) at pH 8.4. All endosulfan removal performances were observed for a period of 25 days and the experiments were conducted at 25 degrees C, which was a relatively lower temperature compared to other endosulfan biodegradation studies in the literature. Additional carbon source did not change the overall endosulfan removal. No endosulfan sulfate production was observed during the study.

Accès au document

A beneficial role of arbuscular mycorrhizal fungi in influencing the effects of silver nanoparticles on plant-microbe systems in a soil matrix

Authors: Cao JL, Feng YZ, Lin XG, Wang JH

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH 27(11), 2020, DOI: 10.1007/s11356-020-07781-w

Abstract: Silver nanoparticles (AgNPs) are considered to be emerging contaminant for plant-soil systems. AM arbuscular mycorrhizal (AM) fungi can alleviate the negative effects of a variety of pollutants on their hosts, but its potential roles in influencing the toxicity of AgNPs and the underlying mechanisms are still an open question. This study investigated the responses of maize (Zea mays L.) inoculated with or without AM fungi and soil microorganisms to different concentrations of AgNPs (0, 0.025, 0.25, and 2.5 mg kg(-1)). The inoculation of AM fungi helps to alleviate the AgNP-induced phytotoxicity. Compared to the non-AM fungal inoculated treatments, AM fungal inoculation significantly increased the mycorrhizal colonization, biomass and phosphorus (P)

acquisitions of maize, with an upregulation of P transporter gene expression under AgNP treatments. AM fungal inoculation decreased Ag content in plant shoots and roots, downregulated expression levels of genes involved in Ag transport and gene encoding a metallothionein involved in metal homeostasis. The beneficial role of AM fungi extended to soil microbes. Compared to the non-AM fungal inoculated treatments, AM fungal inoculation decreased the toxicity of AgNPs to soil microbial activities and bacterial abundance. AM fungal inoculation increased the bacterial diversity and induced changes in the soil bacterial community composition. Altogether, the present study revealed that AM fungal symbiosis can play beneficial roles in mediating the negative effects exposed by AgNPs on plants probably through changing the expressions of potential Ag transporters and cooperating with soil bacterial community.

Accès au document

Pesticide bioremediation in liquid media using a microbial consortium and bacteria-pure strains isolated from a biomixture used in agricultural areas

Authors: Gongora-Echeverria VR, Garcia-Escalante R, Rojas-Herrera R., and more...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 200, 2020, DOI: 10.1016/j.ecoenv.2020.110734

Abstract: Microorganisms' role in pesticide degradation has been studied widely. Insitu treatments of effluents containing pesticides such as biological beds (biobeds) are efficient biological systems where biomixture (mixture of substrates) and microorganisms are the keys in pesticide treatment; however, microbial activity has been studied poorly, and its potential beyond biobeds has not been widely explored. In this study, the capacity of microbial consortium and bacteria-pure strains isolated from a biomixture (soil-straw; 1:1, v/v) used to treat agricultural effluents under real conditions were evaluated during a bioremediation process of five pesticides commonly used Yucatan Mexico. Atrazine, carbofuran, and glyphosate had the highest degradations (> 90%) using the microbial consortium; 2,4-D and diazinon were the most persistent (DT50 = 8.64 and 6.63 days). From the 21 identified bacteria species in the microbial consortium, Pseudomonas nitroreducens was the most abundant (52%) according to identified sequences. For the pure strains evaluation 2,4-D (DT50 = 9.87 days), carbofuran (DT50 = 8.27 days), diazinon (DT50 = 8.80 days) and glyphosate (DT50 = 8.59 days) were less persistent in the presence of the mixed consortium (Ochrobactrum sp. DGG-1-3, Ochrobactrum sp. Ge-14, Ochrobactrum sp. B18 and *Pseudomonas citronellolis* strain ADA-23B). Time, pesticide, and strain type were significant ($P < 0.05$) in pesticide degradation, so this process is multifactorial. Microbial consortium and pure strains can be used to increase the biobed efficiency by inoculation, even in the remediation of soil contaminated by pesticides in agricultural areas.

Accès au document

Interactions of microplastics and cadmium on plant growth and arbuscular mycorrhizal fungal communities in an agricultural soil

Authors: Wang FY, Zhang XQ, Zhang SQ, and more...

Source: CHEMOSPHERE 254, 2020, DOI: 10.1016/j.chemosphere.2020.126791

Abstract: Microplastics (MPs) as emerging contaminants have attracted attention worldwide, but little is known on their interactions with metallic contaminants in soil-plant systems. Here, we investigated the interactions between MPs, i.e., polyethylene (PE) and polylactic acid (PLA), and cadmium (Cd) on plant performance and arbuscular mycorrhizal fungal community in an agricultural soil. PE showed no noticeable phytotoxicity, while 10% PLA decreased maize biomass and chlorophyll content in leaves. A significant interaction on root biomass occurred between PE and Cd, but not between PLA and Cd. Both PE and PLA caused increase in soil pH and DTPA-extractable Cd concentrations, but no alterations in Cd accumulation in plant tissues. Different numbers

of endemic and total OTUs were observed in various treatments. The relative abundance of arbuscular mycorrhizal fungi (AMF) genera highly varied with MPs and Cd. MPs altered AMF community structure and diversity, depending on their type and dose. Coexisting Cd produced slight but significant interactions with MPs on the dominant AMF genera. Overall, plant growth and AMF community varied with MPs type and dose, Cd, and their interactions, and the high dose of PLA produced stronger phytotoxicity. In conclusion, coexisting MPs and Cd can jointly drive shifts in plant performance and root symbiosis, thereby posing additional risks for agroecosystems and soil biodiversity.

Accès au document

Insights Into the Microbial Degradation and Biochemical Mechanisms of Neonicotinoids

Authors: Pang SM, Lin ZQ, Zhang WP, and more...

Source: FRONTIERS IN MICROBIOLOGY 11, 2020, DOI: 10.3389/fmicb.2020.00868

Abstract: Neonicotinoids are derivatives of synthetic nicotinoids with better insecticidal capabilities, including imidacloprid, nitenpyram, acetamiprid, thiacloprid, thiamethoxam, clothianidin, and dinotefuran. These are mainly used to control harmful insects and pests to protect crops. Their main targets are nicotinic acetylcholine receptors. In the past two decades, the environmental residues of neonicotinoids have enormously increased due to large-scale applications. More and more neonicotinoids remain in the environment and pose severe toxicity to humans and animals. An increase in toxicological and hazardous pollution due to the introduction of neonicotinoids into the environment causes problems; thus, the systematic remediation of neonicotinoids is essential and in demand. Various technologies have been developed to remove insecticidal residues from soil and water environments. Compared with non-bioremediation methods, bioremediation is a cost-effective and eco-friendly approach for the treatment of pesticide-polluted environments. Certain neonicotinoid-degrading microorganisms, including Bacillus, Mycobacterium, Pseudoxanthomonas, Rhizobium, Rhodococcus, Actinomycetes, and Stenotrophomonas, have been isolated and characterized. These microbes can degrade neonicotinoids under laboratory and field conditions. The microbial degradation pathways of neonicotinoids and the fate of several metabolites have been investigated in the literature. In addition, the neonicotinoid-degrading enzymes and the correlated genes in organisms have been explored. However, few reviews have focused on the neonicotinoid-degrading microorganisms along with metabolic pathways and degradation mechanisms. Therefore, this review aimed to summarize the microbial degradation and biochemical mechanisms of neonicotinoids. The potentials of neonicotinoid-degrading microbes for the bioremediation of contaminated sites were also discussed.

Accès au document

Long-term effects of copper exposure to agricultural soil function and microbial community structure at a controlled and experimental field site

Authors: Shaw JLA, Ernakovich JG, Judy JD, and more...

Source: ENVIRONMENTAL POLLUTION 263, A, 2020, DOI: 10.1016/j.envpol.2020.114411

Abstract: The long-term effect of heavy metals on soil microbial communities and their function is relatively unknown and little work has been done in field settings. To address this gap, we revisited a field-based experiment, 12 years after the application of copper (Cu) to agricultural soils, with treatment concentrations ranging from 0 to 3310 mg Cu kg(-1) soil. We measured the long-term effects of Cu exposure to soils using multiple functionality assessments and environmental DNA-based community analyses. The assessment results revealed that soils that received moderate to high Cu doses had still not recovered functionality 12-years post exposure. However, plots that received doses of 200 mg kg(-1) Cu or less appeared to have a functionality index not dissimilar to control plots. Environmental DNA analyses of the microbial communities revealed a high level of beta diversity in low Cu treatment plots,

whereas communities within high Cu treatment plots had similar community structures to one another (low beta diversity), indicating that specific Cu-tolerant or dormant taxa are selected for in high-Cu environments. Interestingly, high Cu plots had higher within-sample taxa counts (alpha diversity) compared with controls and low Cu plots. We hypothesise that taxa in high Cu plots activated dormancy mechanisms, such that their genetic signal remained present, whilst the functionality of the soil was reduced. Many species identified in high Cu plots are known to have associated dormancy mechanisms and survive in high stress environments. Understanding how these mechanisms collectively contribute to contaminant outcomes is of great importance for the goals of predicting and managing microbial communities and their function. As we found that Cu concentrations above 200 mg kg(-1) can cause significant functionality loss and a selective pressure on microbial communities, it is recommended that Cu concentrations above 200 mg kg(-1) are avoided in agricultural soils.

Accès au document

Antimony-oxidizing bacteria alleviate Sb stress in Arabidopsis by attenuating Sb toxicity and reducing Sb uptake

Authors: Gu TY, Yu H, Li F, and more...

Source: PLANT AND SOIL, 2020, DOI: 10.1007/s11104-020-04569-2

Abstract: Aims Antimony (Sb)-oxidizing bacteria play an important role in Sb biogeochemical cycle in soil, but the benefits of microbial oxidation for plants have not been well documented. The aim of this study was to explore the contribution of Sb(III)-oxidizing bacteria to alleviate the Sb toxicity in plants. Methods The plant growth-promoting (PGP) characteristics of Sb(III)-oxidizing bacterium Bacillus sp. S3 and the effects of bacterial inoculation on Arabidopsis plants were evaluated under controlled and Sb stressed conditions. Results Indole acetic acid (IAA) production and 1-aminocyclopropane-1-carboxylate-deaminase (ACC-deaminase) activity were the only two PGP strategies that Bacillus sp. S3 possessed, despite the production level of IAA and the activity of ACC deaminase sharply decreased under Sb stress. Bacillus sp. S3 inoculation significantly increased the plant biomass and chlorophyll content, alleviated the peroxidation of membrane lipids, decreased the activities of the antioxidant enzymes, and reduced the transcription of Sb transporters and reactive oxygen species (ROS)-related enzymes in Arabidopsis. Noteworthily, inoculation of Bacillus sp. S3 not only significantly decreased the Sb accumulation but also reduced the percentage of Sb(III) of total Sb in Arabidopsis. Conclusions This study indicates that the Sb(III)-oxidizing strain of Bacillus sp. S3 is a promising inoculant used for bacteria-assisted phytoremediation on Sb-contaminated sites.

Accès au document

Deciphering metal toxicity responses of flax (*Linum usitatissimum* L.) with exopolysaccharide and ACC-deaminase producing bacteria in industrially contaminated soils

Authors: Zainab N, Amna, Din BU, Javed MT, and more...

Source: PLANT PHYSIOLOGY AND BIOCHEMISTRY 152:90-99, 2020, DOI: 10.1016/j.plaphy.2020.04.039

Abstract: Rapid industrialization is the main reason of heavy metals contamination of soil colloids and water reservoirs. Heavy metals are persistent inorganic pollutants; deleterious to plants, animals and human beings because of accumulation in food chain. The aim of the current work was to evaluate the role of indole acetic acid (IAA), exopolysaccharide (EPS) and ACC-deaminase producing plant growth promoting rhizobacteria (PGPR) i.e .B. gibsonii PM11 and B. xiamenensis PM14 in metal phytoremediation of metals, their survival and plant growth promotion potential in metal polluted environment as well as alterations in physio-biochemical responses of inoculated L. usitatissimum plants towards heavy metal toxicity. Two bacterial strains Bacillus gibsonii (PM11) and Bacillus xiamenensis (PM14),

previously isolated from sugarcane's rhizosphere, were screened for metal tolerance (50 mg/l to 1000 mg/l) and plant growth promoting traits like IAA, ACC-deaminase, EPS production and nitrogen fixing ability under metal stress. The response of flax plant (*Linum usitatissimum* L.) was analyzed in a pot experiment containing both industrially contaminated and non-contaminated soils. Experiment was comprised of six different treatments, each with three replicates. At the end of the experiment, role of metal tolerant plant growth promoting bacterial inoculation was elucidated by analyzing the plant growth parameters, chlorophyll contents, antioxidative enzymes, and metal uptake both under standard and metal contaminated rhizospheres. Results revealed that root and shoot length, plant's fresh and dry weight, proline content, chlorophyll content, antioxidant enzymatic activity was increased in plants inoculated with plant growth promoting bacteria as compared to non-inoculated ones both in non-contaminated and industrial contaminated soils. In current study, inoculation of IAA, EPS and ACC-deaminase producing bacteria enhances plant growth and nutrient availability by minimizing metal-induced stressed conditions. Moreover, elevated phytoextraction of multi-metals from industrial contaminated soils by PGPR inoculated L. usitatissimum plants reveal that these strains could be used as sweepers in heavy metals polluted environment.

Accès au document

Can Toxicities Induced by Insecticide Methomyl be Remediated Via Soil Bacteria *Ochrobactrum thiophenivorans* and *Sphingomonas melonis*?

Authors: Tatar S, Yildirim NC, Serdar O, Erguven GQ

Source: CURRENT MICROBIOLOGY 77(7):1301-1307, 2020, DOI: 10.1007/s00284-020-02042-y

Abstract: The research study was about revealing the biochemical response of Gammarus pulex related to insecticide methomyl before and after bioremediation by two soil bacteria species, *Ochrobactrum thiophenivorans* and *Sphingomonas melonis*. Catalase (CAT), glutathione S-transferase.(GST), cytochrome. P4501A1 (CYP1A1) activities in *G. Pulex* related to methomyl solution were investigated in 24 h and 96 h. ELISA method was used for test studies. CAT enzyme was decreased in Gammarus pulex that was exposed to methomyl after all exposure period ($P < 0.05$). CAT activities were returned to control results after bioremediation assays. GST enzyme activity was decreased depending on methomyl exposure during 24 h but increased during 4 days ($P < 0.05$). After 8 days of bioremediation period, GST activity increased again during 24 h while decreased during 4 days ($P < 0.05$). CYP1A1 activity increased in Gammarus pulex that was exposed to methomyl after all exposure period ($P < 0.05$). After bioremediation, statistically significant changes were not revealed in CYP1A1 activities ($P < 0.05$). According to the results of our study, CYP1A1, CAT, and GST activities in *G. pulex* sanctioned the capability of *Ochrobactrum thiophenivorans* and *Sphingomonas melonis* in methomyl bioremediation. Isolated and enriched *Ochrobactrum thiophenivorans* and *Sphingomonas melonis* that were added to 2.5 ppb concentrations of methomyl for 8 days. Each day, chemical oxygen demand (COD) and biochemical oxygen demand (BOD5), pH and dissolved oxygen parameters were monitored. At the final phase of the bioremediation step, it was determined that these bacteria have efficient methomyl bioremediation properties in a mixed corsortia at a rate of 86%. These results show that these bacteria can be used for bioremediate the receiving environments that are polluted by these kinds of insecticides.

Accès au document

Bioremediation potency of multi metal tolerant native bacteria *Bacillus cereus* isolated from bauxite mines, kolli hills, Tamilnadu - A lab to land approach

Auhors: Anusha P, Natarajan D

Source: BIOCATALYSIS AND AGRICULTURAL BIOTECHNOLOGY 25, 2020, DOI: 10.1016/j.bcab.2020.101581

Abstract: Bioremediation approaches by native microorganisms are an effective and best

resolution for treating metal contaminated area. The aim of the study was to determine the metal remediation efficiency of native bacteria B.cereus in lab and field remediation study. Minimum inhibitory concentration of metals show, the isolate was highly resistant to lead ions followed by other test metals and also highly resistant to multiple antibiotics. The optimum pH (pH 7) and temperature (35 degrees C) for bacterial growth was determined. Bioremediation efficiency of batch culture method by the strain was found to be 91.98% (Cu), 79.9% (Cr), 97.17% (Pb), 77.44% (Zn), 81.6% (Fe), 62.8% (Mn) and 60.92% (Mg) respectively. FT-IR analysis, resulted N-H primary amine, C-C stretch and N-O aliphatic nitro compounds present in the lead treated by *B. cereus*. We noticed some functional groups may be altered in the treated sample than control (-C C- alkyne and C-N amine groups). The novelty of the work is the simplest trail for field based metal remediation by the multi metal tolerant bacteria in bauxite mined waste soil. The strain shows notable percentage of in-situ remediation over eight weeks of experiments i.e 71.8% (Pb), 53% (Cu) and 41.4% (Cr). The outcome of In-situ remediation results suggest that *B.cereus* have a noticeable remediation capacity to all the metals particularly lead, so it could be served as a potential strain for In-situ field based bioremediation and in future it can be used for soil reclamation of toxic soil into nontoxic soil.

Accès au document

Cd heavy metal and plants, rather than soil nutrient conditions, affect soil arbuscular mycorrhizal fungal diversity in green spaces during urbanization

Authors: Lin LT, Chen Y, Qu LY, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 726, 2020, DOI: 10.1016/j.scitotenv.2020.138594

Abstract: Urbanization accelerates pollution and habitat fragmentation, and the mechanism that shapes the arbuscular mycorrhizal (AM) fungal community in urban ecosystem still remains poorly understood. In this study, soil samples from 23 sites (from rural to urban), belonging to 4 green space types (country park, Co; urban park, Pa; roadside green space1, RoP1; and roadside green space2, RoP2), were collected to assess the effects of the urbanization on the AM fungal diversity.

Using 454 pyrosequencing, a total of 79 AM fungal OTUs were uncovered. We found that urbanization showed a neutral effect on Shannon diversity, Simpson diversity, Pielou diversity, and community composition of the AM fungi. Within urban areas, the composition of AM fungal community was significantly different between RoP1 and RoP2. The db-RDA analysis of RoP1 and RoP2 revealed that the soil Cd accounted for the largest community composition variation, with an explanation rate of 20.5%, followed by the SOC (15.1%).

Across 23 sites, Cd may have an obvious ecological toxicity on AM fungi, with significantly negative correlations between the soil Cd content and the AM fungal species richness and evenness. The AM fungal community also indicated significantly Mantel correlation with the soil Cd contents. Additionally, high herbaceous richness promoted rich AM fungi. The herbaceous composition, not the richness, has a significant impact on the AM fungal community composition. This study suggests that the toxicity of Cd from traffic should receive more attention during urban green space construction and management, and reasonable plant configuration contributed to the maintenance of the AM fungal community.

Accès au document

Effects of lead (Pb) in stormwater runoff on the microbial characteristics and organics removal in bioretention systems

Authors: Liu C, Lu Ji, Liu JQ, and more...

Source: CHEMOSPHERE 253, 2020, DOI: 10.1016/j.chemosphere.2020.126721

Abstract: Bioretention systems have been proved to be a natural approach for effectively reducing stormwater runoff pollution loads. However, the effects of heavy metals in stormwater runoff on microbial characteristics and organics removal in bioretention systems are unclear. In this study, two lab scale bioretention columns including the control and lead (Pb) treatment with the soil and

filler layer were established. The changes of organic matter and lead in the effluent water and the soil (or fillers) were monitored during 121 operation days. The soil (or fillers) microbial characteristics were also analyzed. The results showed that most of Pb was intercepted by soil, while a small amount accumulated in fillers after 121 days. The long-term Pb accumulation in the biorentention system negatively affected the microbial biomass and microbial activity, while positively affected the community diversity. Pb accumulation killed some microorganisms, but simultaneously stimulated the growth of some Pb-tolerance microorganisms. The abundance of bacteria with COD degradation function in soil layer decreased, while that in fillers increased, indicating the effect of Pb on the community structure of these two layers was different. The COD removal in the soil and filler layer was promoted and inhibited by Pb contamination respectively. Moreover, Pb affected the removal of organic matter by chelating organic matters and changing their composition. The results suggested that the long-term accumulation of heavy metals in bioretention system would affect microbial degradation function and pollutants removal, causing our concern for the long-term maintenance of the bioretention system.

Accès au document

Geo-distribution pattern of microbial carbon cycling genes responsive to petroleum contamination in continental horizontal oilfields

Authors: Li AY, Li GH, Yang JJ, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 731, 2020, DOI: 10.1016/j.scitotenv.2020.139188

Abstract: Contamination significantly affects soil microbial community structures, and the metabolisms of organic contaminants might particularly alter soil carbon cycling by shaping microbial carbon cycling genes. Although numerous studies have discussed the impacts of petroleum contamination on soil bacterial communities and relevant degrading genes, there is no work addressing how soil carbon cycling genes are affected by petroleum contamination. In this study, 77 soil samples were collected from five typical oilfields horizontally located in China to explore the influence of environmental variables and petroleum contamination on microbial carbon cycling genes. Results from Geochip suggested a geographic-determined distribution of carbon cycling genes. Although no significant correlation was observed between carbon cycling genes and soil physio-chemical properties for all soils, some relationships were identified in specific oilfield. Principle component analysis indicated that soil physiochemical properties, rather than petroleum contamination disturbance, are the key factors determining the degree of sample dispersion, whereas environmental variables predominantly control the degree of sample aggregation. Co-occurrence ecological network analysis revealed a more complex interactions of all functional genes in petroleum-contaminated soils, and carbon cycling genes were grouped with nitrogen related genes in petroleum-contaminated communities. Soil moisture and heterogeneity were identified as the main drivers for the abundance and diversity of carbon cycling genes, particularly in petroleum-contaminated soils. These results are attributing to the fewer impacts of petroleum contamination on the diversity of carbon cycling genes than soil physio-chemical properties, and soil carbon cycling genes are mainly driven by geographic location and petroleum contamination together. Our findings provide deeper insight into the influence of petroleum contamination in soil microbial functions related to carbon cycling.

Accès au document

Effects on soil microbial community after exposure to neonicotinoid insecticides thiamethoxam and dinotefuran

Authors: Yu B, Chen ZY, Lu XX, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 725, 2020, DOI: 10.1016/j.scitotenv.2020.138328

Abstract: The wide application of neonicotinoid insecticides in soil may affect soil microbial community, yet the information is limited. This study first reports the effects of thiamethoxam and dinotefuranon on soil microbial community. Soil from a forest land was collected and spiked

with different nominal levels (0.02 mg kg(-1), 0.2 mg kg(-1) and 2.0 mg kg(-1)) of thiamethoxam and dinotefuran, respectively, and cultivated for 112 days. During the study, concentrations of the two neonicotinoids and their potential degradation products were monitored by LC-MS/MS. At day 112, the soils were analyzed for genetic profile by high-throughput sequencing and carbon metabolic profile by Biolog-ECO plate. The results showed that thiamethoxam and dinotefuran were both attenuated during the study with rate constants being 0.008-0.017 d(-1) and 0.024-0.032 d(-1), respectively, and biodegradation played an important role. As compared to the blank control, the exposure to the studied two neonicotinoids changed the microbial community, and the changes were influenced by both the type of neonicotinoid and the level of exposure. As compared to the blank control, the relative abundances of phyla Gemmatimonadetes and OD1 decreased under most exposed conditions, while the relative abundances of Chloroflexi and Nitrospirae increased under most exposed conditions. The community transition changed the functional potential, particularly carbon metabolism (mostly decreased) and nitrogen metabolism (mostly increased). As compared to the blank control, the utilization of total 31 carbon sources (including six categories) was increased under low exposure to thiamethoxam, but was decreased under all other exposed conditions. Low exposure to dinotefuran stimulated the utilization of three categories of carbon sources (amines, carbohydrates and phenolic compounds). Low exposure to both neonicotinoids increased the community diversity, while middle and high exposure to both neonicotinoids decreased the community diversity. These findings provide new insights into the effects of neonicotinoids on microbial community in soil.

Accès au document

Distribution pattern of antibiotic resistance genes and bacterial community in agricultural soil samples of Wuliangsuhai watershed. China

Authors: Shi W, Liu Y, Li JJ, and more...

Source: AGRICULTURE ECOSYSTEMS & ENVIRONMENT 295, 2020, DOI: 10.1016/j.agee.2020.106884

Abstract: The occurrence and dissemination of antibiotic resistance genes (ARGs) constitute a major concern worldwide, and pose crucial threats to public health. The current study focused on this issue in the agricultural soils of Wuliangsuhai watershed in China. A total of 33 ARGs, belonging to 8 major types, were identified in the soil samples, mexF, bla(TEM), vanD, selI, sulII, and oprJ being the predominant ones. The abundance of ARGs ranged from 2.18 x 10(-6)-1.9 x 10(-2) copies/16S rRNA gene copies. Results of correlation analyses confirmed that intI1 significantly correlated with ARGs (aadA1, aadA2, mphA, adI, and sulII), indicating the potential horizontal transfer capability of these genes in soil. Based on the proximity of different sampling sites with urban areas, we found the abundance of bacterial community and ARGs to significantly increase in the sites proximal to urban area, which indicated the agricultural activities and industrial pollution might alter the bacterial community structure and spatial distribution of ARGs. In addition, the correlation between ARGs and environmental factors confirmed the association of microbial community distribution with environmental factors, such as soil organic matter (SOM), available phosphorus (AP), and total nitrogen (TN). The co-occurrence pattern of ARGs and bacterial taxa indicated the succession of Firmicutes and Proteobacteria to possibly be the potential driver for variation in ARGs in the different sampling sites examined. These findings are expected to improve the current understanding of ARG distribution and their relationship with microbial community succession.

Accès au document

Lignin degradation and nutrient cycling by white rot fungi under the influence of pesticides

Authors: Wali A, Gupta M, Gupta S, and more...

Source: BIOTECH 10, 6, 2020, DOI: 10.1007/s13205-020-02251-z

Abstract: The production of enzymes involved in lignin degradation (laccase, ligninase), carbon

cycling (beta-glucosidase), and phosphorous cycling (phosphomonoesterase) by white rot fungi (*Pleurotus sajor-caju*) was studied. In the presence of chlorpyrifos, carbofuran, and their mixture, laccase activity was highest on the 7th day, i.e., 192.5 +/- 0.31 U ml(- 1), 213.6 +/- 0.31 U ml(- 1), and 164.6 +/- 0.31 U ml(-1), respectively, compared to the control which produced maximum laccase on the 14th day (126.9 +/- 0.15 U ml(-1)). Phosphomonoesterase activity in the presence of chlorpyrifos, carbofuran, and their mixture was 31.5 +/- 0.25, 24.1 +/- 0.15, and 29.2 +/- 0.35 µg PNP min(-1) ml(-1), respectively, which was more than the control on the 21st day (11.63 +/- 0.21 mu g PNP min(-1) ml(-1)). beta-Glucosidase production increased with the days of incubation in the presence of pesticides than in the control. beta-Glucosidase activity on the 21st day in the presence of chlorpyrifos, carbofuran, and their mixture was 32.4 +/- 0.1, 24.2 +/- 0.3, and 28.4 +/- 0.25 µg PNP min(-1) ml(-1), respectively, as compared to control (15.3 +/- 0.6 µg PNP min(-1) ml(-1)). Thus, chlorpyrifos, carbofuran, and their mixture were found to have a positive effect on the production of laccase, beta-glucosidase, and phosphomonoesterase by *P. sajor-caju*, which can use these pesticides as a source of their nutrition, thereby improving the health of pesticide-polluted soils.

Accès au document

Fungi and Arsenic: Tolerance and Bioaccumulation by Soil Saprotrophic Species

Authors: Ceci A, Spinelli V, Massimi L, and more...

Source: APPLIED SCIENCES-BASEL 10, 9, 2020, DOI: 10.3390/app10093218

Abstract: Increasing arsenic environmental concentrations are raising worldwide concern for its impacts on human health and ecosystem functionality. In order to cope with arsenic contamination, bioremediation using fungi can represent an efficient, sustainable, and cost-effective technological solution. Fungi can mitigate arsenic contamination through different mechanisms including bioaccumulation. In this work, four soil saprotrophic fungi *Absidia spinosa*, *Purpureocillium lilacinum*, *Metarhizium marquandii*, and *Cephalotrichum nanum*, isolated from soils with naturally high arsenic concentrations, were tested for their ability to tolerate different sodium arsenite concentrations and accumulate As in different cultural conditions. pH medium after fungal growth was measured to study pH variation and metabolic responses. Arsenic bioaccumulation and its influence on the uptake of other elements were investigated through multi-elemental analysis using hydride generation atomic fluorescence spectrometry (HG-AFS), inductively coupled plasma mass spectrometry (ICP-MS) and inductively coupled plasma optical emission spectroscopy (ICP-OES). Considering the increasing interest in siderophore application for metal bioremediation, the production of siderophores and their affinity for both Fe and As were also evaluated. All species were able to tolerate and accumulate As in their biomass in all of the tested conditions and produced siderophores with different affinities for Fe and As. The results suggest that the tested fungi are attractive potential candidates for the bioremediation of As contaminated soil and worthy of further investigation.

Accès au document

Co-selection of antibiotic-resistant bacteria in a paddy soil exposed to As (III) contamination with an emphasis on potential pathogens

Autors: Cao JY, Yang GQ, Mai QJ, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 725, 2020, DOI: 10.1016/j.scitotenv.2020.138367

Abstract: The increased acquisition of antibiotic resistance by pathogens is a global health concern. The environmental selection of antibiotic resistance can be caused by either antibiotic residues or co-selecting agents such as toxic metal(loid)s. This study explored the potential role of As(III) as a co-selecting driver in the spread of antibiotic resistance in paddy soils. By applying high-throughput sequencing, we found that the diversity and composition of soil microbial communities was significantly altered by As(III) exposure, resulting in an increased proportion of potential pathogens (9.9%) compared to the control soil (0.1%). Meanwhile, a total of 46 As(III)-resistant isolates were

obtained from As(III)-exposure soil, among which potential pathogens accounted for 54.3%. These As(III)-resistant bacteria showed a high incidence of resistance to sulfanilamide (100%) and streptomycin (88-93%). The association between antibiotic and As(III) resistances was further investigated in a potentially pathogenic isolate by whole-genome sequencing and a transcription assay. The results showed that As(III) and antibiotic resistance genes might co-occur in a mobile genomic island and be co-regulated by As(III), implying that antibiotic resistance could be co-selected by As(III) via co-resistance and co-regulationmechanisms. Overall, these results suggest that As(III) exposure provides a strong selective pressure for the expansion of soil bacterial resistome.

Accès au document

Purification and characterization of salvianolic acid B from *Streptomyces* sp. M4 possessing antifungal activity against fungal phytopathogens

Authors: Sharma M, Manhas RK

Source: MICROBIOLOGICAL RESEARCH 237, 2020, DOI: 10.1016/j.micres.2020.126478

Abstract: The emergence of resistance among fungal phytopathogens poses a biggest threat across the world. Streptomyces are a group of spore-forming Gram + ve bacteria and prolific producers of secondary bioactive metabolites which have been used as biocontrol agents against phytopathogens and also known for plant growth promotion. The current study identified a potent isolate M4 from soil with broad spectrum antifungal activity against different fungal phytopathogens. The isolate was identified as a Streptomyces sp. on the basis of cultural, morphological, physiological, biochemical and phylogenetic characteristics. 16S rRNA gene sequence of M4 showed 100 % similarity with three *Streptomyces spp*. i.e. *Streptomyces plicatus* NBRC 13071 T (AB184291), *Streptomyces rochei* NBRC 12908 T AB184237 and *Streptomyces enissocaesilis* NRRL-B-16365 T (DQ026641). However, phenotypic and phylogenetic analysis concluded that M4 represents a novel sp. within the genus Streptomyces. One of the two antifungal compounds purified from Streptomyces M4 was identified as salvianolic acid B. To our knowledge, the present study is the first work reporting purification and characterization of salvianolic acid B from Streptomyces and its broad spectrum antifungal activity against different fungal phytopathogens viz. *Alternaria* spp., *Fusarium* spp., *Colletotrichum* spp., *Cladosporium herbarum* and *Botrytis cineria*. Salvianolic acid B was found to be photostable, thermostable (up to 70 degrees C) and non-mutagenic in nature and might be developed as safe biofungicide to control phytopathogens.

Accès au document

Potential risks of antibiotic resistant bacteria and genes in bioremediation of petroleum hydrocarbon contaminated soils

Authors: Cunningham Colin J, Kuyukina Maria S, Ivshina Irena B, and more...

Source: ENVIRONMENTAL SCIENCE-PROCESSES & IMPACTS 22(5):1110-1124, 2020, DOI: 10.1039/c9em00606k

Abstract: Bioremediation represents a sustainable approach to remediating petroleum hydrocarbon contaminated soils. One aspect of sustainability includes the sourcing of nutrients used to stimulate hydrocarbon-degrading microbial populations. Organic nutrients such as animal manure and sewage sludge may be perceived as more sustainable than conventional inorganic fertilizers. However, organic nutrients often contain antibiotic residues and resistant bacteria (along with resistance genes and mobile genetic elements). This is further exacerbated since antibiotic resistant bacteria may become more abundant in contaminated soils due to co-selection pressures from pollutants such as metals and hydrocarbons. We review the issues surrounding bioremediation of petroleum-hydrocarbon contaminated soils, as an example, and consider the potential human-health risks from antibiotic resistant bacteria. While awareness is coming to light, the relationship between contaminated land and antibiotic

resistance remains largely under-explored. The risk of horizontal gene transfer between soil microorganisms, commensal bacteria and/or human pathogens needs to be further elucidated, and the environmental triggers for gene transfer need to be better understood. Findings of antibiotic resistance from animal manures are emerging, but even fewer bioremediation studies using sewage sludge have made any reference to antibiotic resistance. Resistance mechanisms, including those to antibiotics, have been considered by some authors to be a positive trait associated with resilience in strains intended for bioremediation. Nevertheless, recognition of the potential risks associated with antibiotic resistant bacteria and genes in contaminated soils appears to be increasing and requires further investigation. Careful selection of bacterial candidates for bioremediation possessing minimal antibiotic resistance as well as pre-treatment of organic wastes to reduce selective pressures (e.g., antibiotic residues) are suggested to prevent environmental contamination with antibiotic-resistant bacteria and genes.

Accès au document

Shifts in microbial community, pathogenicity-related genes and antibiotic resistance genes during dairy manure piled up

Authors: Zhang X, Ma CJ, Zhang W, and more...

Source: MICROBIAL BIOTECHNOLOGY 13(4):1039-1053, 2020, DOI: 10.1111/1751-7915.13551

Abstract: The uncomposted faeces of dairy cow are usually stacked on cow breeding farms, dried under natural conditions and then used as cow bedding material or they may be continuously piled up. However, no information is available to evaluate variations in the human and animal pathogen genes and antibiotic resistance during the accumulation of fresh faeces of dairy cow to manure. Here, we present the metagenomic analysis of fresh faeces and manure from a dairy farm in Ning Xia, showing a unique enrichment of human and animal pathogen genes and antibiotic resistance genes (ARGs) in manure. We found that manure accumulation could significantly increase the diversity and abundance of the pathogenic constituents. Furthermore, pathogens from manure could spread to the plant environment and enphytotic pathogens could affect the yield and quality of crops during the use of manure as a fertilizer. Levels of virulence genes and ARGs increased with the enrichment of microbes and pathogens when faeces accumulated to manure. Accumulated manure was also the transfer station of ARGs to enrich the ARGs in the environment, indicating the ubiquitous presence of environmental antibiotic resistance genes. Our results demonstrate that manure accumulation and usage without effective manure management is an unreasonable approach that could enrich pathogenic microorganisms and ARGs in the environment. The manure metagenome structure allows us to appreciate the overall influence and interaction of animal waste on water, soil and other areas impacted by faecal accumulation and the factors that influence pathogen occurrence in products from dairy cows.

Accès au document

Indole-3-acetic acid synthesizing chromium-resistant bacteria can mitigate chromium toxicity in *Helianthus annuus* L.

Authors: Hadia-e-Fatima, Ahmed A

Source: PLANT SOIL AND ENVIRONMENT 66(5):216-221, 2020, DOI: 10.17221/581/2019-PSE

Abstract: Use of microorganisms as heavy metal remediators is an effective approach for chromium reduction in plants. Chromium carcinogenicity (Cr6+) beyond the permissible levels elicits environmental and health problems. To reduce chromium toxicity along with the plant growth improvement, a cost-effective and eco-friendly remediation approach is necessary. In the current study, chromium-resistant bacterial species were evaluated for growth improvement of sunflower. Three auxin-producing bacteria able to tolerate hexavalent chromium, i.e., Sporosarcina saromensis (El) and two species of Bacillus cereus (AR and 3a) were selected for the proposed study. Growth studies along with auxin synthesis potential of bacterial isolates with and without chromium were

conducted. Results revealed a 188% enhancement in plant height under laboratory-grown plants with *B. cereus* (AR) under 500 mg/L chromium stress (Cr6+). B. cereus (3a) also showed an 81% increase in leaf number with 400 mg/L chromium stress in laboratory-grown plants. Similarly, 73% increment in the amount of auxin was reported in the case of inoculation with S. saromensis isolate (El) over respective control treatment. These improvements provide an excellent means of reducing chromium (Cr6+) in the contaminated soils naturally by stimulating plant growth along with bioremediation potential.

Accès au document

Growth enhancement and cadmium uptake efficiency in *Medicago sativa* by endophytic bacteria isolated from *Dathura innoxiad*

Authors: Aurangzeb N, Khan A, Nisa S, Nazish M, and more...

Source: FRESENIUS ENVIRONMENTAL BULLETIN 29(4):2134-2143

Abstract: Application of endophytic bacteria can enhance heavy metal removal efficiency of hyperaccumulator plants. These endophytic bacteria can alter metal solubility and facilitate metal accumulation and plant growth. The present study was aimed to isolate endophytic bacteria from roots of Dathura innoxia, growing in heavy metal (HM) contaminated soils and to evaluate their potential to solubilize cadmium (Cd) and promote phytoextraction. Among the eleven isolates, two strains Bacillus cereus and Pseudomonas azotoformans were able to significantly affect Cd bioleaching. Furthermore, resistance capability of these endophytic bacteria was determined by exposing them to 100 mg/l- 400 mg/l Cd solution for various time intervals. Results of study showed that both *Bacillus cereus* and *Pseudomonas azotoformans* were able to tolerate 100 mg/l and 200 mg/l of Cd concentration in liquid media. Medicago sativa seedlings grown in artificially contaminated soils with 100 mg/kg and 200 mg/kg of Cd concentration were bioaugmented with similar to 10(8) colony-forming units (CFU) per milliliter of bacterial strains to determine their role in growth and uptake of exposed metal. Inoculation of bacterial strains significantly stimulated plant biomass (51 g - 59 g). The study concluded that isolated endophytic bacteria can be utilized effectively for phytoextraction of Cd in non-host plants as well.

Accès au document

Screening of Heavy Metal-Immobilizing Bacteria and Its Effect on Reducing Cd2+ and Pb2+ Concentrations in Water Spinach (*Ipomoea aquatic* Forsk.)

Authors: Wang T, Wang XY, Tian W, and more...

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH 17(9), 2020, DOI: 10.3390/ijerph17093122

Abstract: Microbial immobilization is considered as a novel and environmentally friendly technology that uses microbes to reduce heavy metals accumulation in plants. To explore microbial resources which are useful in these applications, three water spinach rhizosphere soils polluted by different levels of heavy metals (heavy pollution (CQ), medium pollution (JZ), and relative clean (NF)) were collected. The community composition of heavy metal-immobilizing bacteria in rhizosphere soils and its effects on reducing the Cd2+ and Pb2+ concentrations in water spinach were evaluated. Four hundred strains were isolated from the CQ (belonging to 3 phyla and 14 genera), JZ (belonging to 4 phyla and 25 genera) and NF (belonged to 6 phyla and 34 genera) samples, respectively. In the CQ sample, 137 strains showed a strong ability to immobilize Cd2+ and Pb2+, giving Cd2+ and Pb2+ removal rates of greater than 80% in solution; Brevundimonas, Serratia, and Pseudoarthrobacter were the main genera. In total, 62 strains showed a strong ability to immobilize Cd2+ and Pb2+ in the JZ sample and Bacillus and Serratia were the main genera. A total of 22 strains showed a strong ability to immobilize Cd2+ and Pb2+ in the NF sample, and Bacillus was the main genus. Compared to the control, *Enterobacter bugandensis* CQ-7, *Bacillus thuringensis* CQ-33,

and *Klebsiella michiganensis* CQ-169 significantly increased the dry weight (17.16-148%) of water spinach and reduced the contents of Cd2+ (59.78-72.41%) and Pb2+ (43.36-74.21%) in water spinach. Moreover, the soluble protein and Vc contents in the shoots of water spinach were also significantly increased (72.1-193%) in the presence of strains CQ-7, CQ-33 and CQ-169 compared to the control. In addition, the contents of Cd and Pb in the shoots of water spinach meet the standard for limit of Cd2+ and Pb2+ in vegetables in the presence of strains CQ-7, CQ-33 and CQ-169. Thus, the results provide strains as resources and a theoretical basis for the remediation of Cd- and Pb-contaminated farmlands for the safe production of vegetables.

Accès au document

Responses of soil bacterial community and Cd phytoextraction to a *Sedum alfredii*-oilseed rape (*Brassica napus* L. and *Brassica juncea* L.) intercropping system

Authors: Cao X, Luo JP, Wang XZ, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 723, 2020, DOI: 10.1016/j.scitotenv.2020.138152

Abstract: Soil pollution with heavy metals has become a common problem in agricultural ecosystems and poses a threat to food safety and human health, Intercropping is now considered a promising alternative to address this issue. However, our understandings about the influences of intercropping systems on rhizosphere microbiota composition and their association with plant performance are still limited. In this study, rhizobox microcosm experiments were conducted to investigate the influence of cropping regimes (i.e. monoculture and intercropping) on the rhizosphere bacterial microbiota and their linkages with the phytoextraction of cadmium (Cd) by Zhongyouza 19 (*Brassica napus* L.), Xikou Huazi (*Brassica juncea* L.) and *Sedum alfredii* using 16S rRNA gene sequencing. Cadmium accumulation in shoots of *B. napus* and *B. juncea* grown under intercropping were enhanced by 370% and 27.8% respectively, as compared to monoculture. Soil compartmentation as a major determinant explained 57.6% of the rhizosphere bacterial microbiota variation, whereas plant species and cropping regime accounted for 26.4% of the variation. The overall abundance of the taxa was Proteobacteria, Acidobacteria, Bacteroidetes, Chloroflexi, Verrucomicrobia, and Actinobacteria, Intercropping significantly enriched amplicon sequence variants (ASVs) abundance belonging to Actinobacteria, Bacilli, Deltaproteobacteria while depleting that of Acidobacteria in rhizosphere. Intercropping with *S. alfredii* influenced more on microbial composition of B. napus rhizosphere. The change in rhizosphere bacterial communities was related to metal availability, soil properties, and plant parameters. The enriched families of Pedosphaeraceae, Ruminococcaceae, Chitinophagaceae, Gemmatimonadaceae, Nitrosomonadaceae, and Parachlamydiaceae were positively correlated with metal concentration in plants. These results indicate that S. alfredii and oilseed rape intercropping could be a promising approach for enhancing the remediation of Cd contaminated soil. Understanding the complex plant-microbe metal interactions of intercropping system could facilitate the development of remediation strategy for phytoremediation of contaminated soils and sustainable agricultural production.

Accès au document

Dissipation of S-metolachlor and butachlor in agricultural soils and responses of bacterial communities: Insights from compound-specific isotope and biomolecular analyses

Authors: Torabi E, Wiegert C, Guyot B, Vuilleumier S, Imfeld G.

Source: JOURNAL OF ENVIRONMENTAL SCIENCES 92:163-175, 2020, DOI: 10.1016/j.jes.2020.02.009

Abstract The soil dissipation of the widely used herbicides S-metolachlor (SM) and butachlor (BUT) was evaluated in laboratory microcosms at two environmentally relevant doses (15 and 150 mu g/g) and for two agricultural soils (crop and paddy). Over 80% of SM and BUT were dissipated within 60 and 30 days, respectively, except in

experiments with crop soil at 150 mu g/g. Based on compound-specific isotope analysis (CSIA) and observed dissipation, biodegradation was the main process responsible for the observed decrease of SM and BUT in the paddy soil. For SM, biodegradation dominated over other dissipation processes, with changes of carbon isotope ratios (Delta delta C-13) of up to 6.5% after 60 days, and concomitant production of ethane sulfonic acid (ESA) and oxanilic acid (OXA) transformation products. In crop soil experiments, biodegradation of SM occurred to a lesser extent than in paddy soil, and sorption was the main driver of apparent BUT dissipation. Sequencing of the 16S rRNA gene showed that soil type and duration of herbicide exposure were the main determinants of bacterial community variation. In contrast, herbicide identity and spiking dose had no significant effect. In paddy soil experiments, a high (4:1, V/V) ESA to OXA ratio for SM was observed, and phylotypes assigned to anaerobic Clostridiales and sulfur reducers such as Desulfuromonadales and Syntrophobacterales were dominant for both herbicides. Crop soil microcosms, in contrast, were associated with a reverse, low (1:3, V/V) ratio of ESA to OXA for SM, and Alphaproteobacteria, Actinobacteria, and Bacillales dominated regardless of the herbicide. Our results emphasize the variability in the extent and modes of SM and BUT dissipation in agricultural soils, and in associated changes in bacterial communities.

Accès au document

Effect of Indigenous Microbial Consortium on Bioleaching of Arsenic from Contaminated Soil by *Shewanella putrefaciens*

Authors: Tran TM, Han HJ, Ko JI, Lee JU

Source: SUSTAINABILITY 12(8), 2020, DOI: 10.3390/su12083286

Abstract: The effects of indigenous microbial consortium on removal of As from As-contaminated soil using an Fe(III)-reducing bacterium Shewanella putrefaciens were investigated under circumneutral pH condition. Sequential extraction of As revealed that more than 30% of As was associated with Fe(III)-(oxy)hydroxides in the soil. Bioleaching experiments were conducted anaerobically with a supply of lactate as a carbon source. The highest As removal efficiency (57.5%) was obtained when *S. putrefaciens* and indigenous bacterial consortium coexisted in the soil. S. putrefaciens and indigenous bacteria solely removed 30.1% and 16.4% of As from the soil, respectively. The combination of S. putrefaciens and indigenous bacteria led to a higher amount of labile As after microbial dissolution of Fe(III)-(oxy)hydroxides. After microbial treatment, soil quality represented by pH and organic content appeared to be preserved. The results indicated that the ecological and physiological understanding of the indigenous microbiome might be important for the efficient application of bioleaching technology to remove As from contaminated soils.

Accès au document

Enantioselective effects of imazethapyr residues on Arabidopsis thaliana metabolic profile and phyllosphere microbial communities

Authors: Zhao QQ, Liu WY, Li Y, and more...

Source: JOURNAL OF ENVIRONMENTAL SCIENCES 93:57-65, 2020, DOI: 10.1016/j.jes.2020.03.009

Abstract: Imazethapyr (IM) is a widely used acetolactate synthase-inhibiting chiral herbicide. It has long-term residuals that may be absorbed by the human body through the edible parts of plants, such as vegetable leaves or fruits. Here, we selected a model plant, *Arabidopsis thaliana*, to determine the effects of R-IM and S-IM on its leaf structure, photosynthetic efficiency, and metabolites, as well as the structures of microorganisms in the phyllosphere, after 7 days of exposure. Our results indicated enantiomeric differences in plant growth between R-IM and S-IM; 133 mu g/kg R-IM showed heavier inhibition of photosynthetic efficiency and greater changes to subcellular structure than S-IM. R-IM and S-IM also had different effects on metabolism and leaf microorganisms. S-IM mainly increased lipid compounds and decreased amino acids, while R-IM increased sugar accumulation. The relative abundance of Moraxellaceae human pathogenic

bacteria was increased by R-IM treatment, indicating that R-IM treatment may increase leaf surface pathogenic bacteria. Our research provides a new perspective for evaluating the harmfulness of pesticide residues in soil, phyllosphere microbiome changes via the regulation of plant metabolism, and induced pathogenic bacterial accumulation risks

Accès au document

Structural and functional responses of bacterial and fungal communities to multiple heavy metal exposure in arid loess

Authors: Zeng XY, Li SW, Leng Y, Kang XH.

Source: SCIENCE OF THE TOTAL ENVIRONMENT 723:138081, 2020, DOI: 10.1016/j.scitotenv.2020.138081

Abstract Concentration gradients of multiple heavy metals (HMs) in the arid loess region near a smelter were determined. In order to understand the response of soil microbes to multiple HM gradients, bacterial and fungal community structures and functions were analyzed using high-throughput RNA gene sequencing and the PICRUSt method. RDA/PCA analyses revealed that soil pH, HMs, and electrical conductivity (EC) jointly affected the bacterial communities in the soils. The soil microbial community structures responded differently to HMs, EC, and pH. High HMs increased the abundances of the bacterial phyla Actinobacteria, Bacteroidetes, Deinococcus-Thermus, and Chloroflexi, and the genera Blastococcus, Rubrobacter, Quadrisphaera, and Tunicatimonas, whereas they decreased the abundances of the phyla Proteobacteria and Acidobacteria and the genera Streptomyces and Nocardioides. High EC and low pH decreased the abundance of most of the dominant bacterial phyla but increased the abundances of Firmicutes, Deinococcus-Thermus, and Nitrospirae. Furthermore, high HMs and EC reduced the numbers of soil-specific bacterial and fungal groups and drove the succession of certain groups that were highly resistant to increased HMs and EC. In addition, many bacterial and fungal groups exhibited different response patterns to each HM, implying that, in multiple HM-contaminated soils, HMs jointly shaped the microbial communities. PICRUSt analysis suggested that high HMs significantly decreased the total gene abundance and most KEGG modules in the soils. High EC and low pH significantly enhanced the abundances of several two-component system-, electron transfer-, and methanogenesis-related modules. We conclude that excessive multiple HMs and EC principally repressed the microbial activity and severely drove the gradient succession of bacterial and fungal communities in the arid loess region.

Accès au document

A comparative study on the antibiotic resistance pattern of soil bacterial communities in flood affected and unaffected areas of kothamangalam municipality

Authors: Gopal G, John N

Source: MATERIALS TODAY-PROCEEDINGS 25:252-256, 2020, DOI: 10.1016/j.matpr.2020.01.272

Abstract: Floods have remarkable effects on both above- and below-ground ecosystem processes. Soil microorganisms are very sensitive to environmental disturbances, and drastic changes in soil microbial community are expected from water logging conditions. Kothamangalam is one of the seriously flood affected region of Ernakulam district. Different bacterial species were isolated from rhizosphere and non-rhizosphere soils of flood affected and non-affected areas of Kothamangalam Municipality. The isolated bacterial strains were subjected to check their cultural and morphological characteristics, antibiotic sensitivity and pathogenicity pattern. The present study revealed the significant difference among strains, in their morphology, antibiotic sensitivity and pathogenicity pattern.

Accès au document

The Cultivable Bacterial Microbiota Associated to the Medicinal Plant *Origanum vulgare* L.: From Antibiotic

Resistance to Growth-Inhibitory Properties

Authors: Castronovo LM, Calonico C, Ascrizzi R, and More...

Source: FRONTIERS IN MICROBIOLOGY 11:862, 2020, DOI: 10.3389/fmicb.2020.00862

Abstract: The insurgence of antibiotic resistance and emergence of multidrug-resistant (MDR) pathogens prioritize research to discover new antimicrobials. In this context, medicinal plants produce bioactive compounds of pharmacological interest: some extracts have antimicrobial properties that can contrast different pathogens. For such a purpose, *Origanum vulgare* L. (Lamiaceae family) is a medicinal aromatic plant, whose essential oil (EO) is recognized for its antiseptic, antimicrobial and antiviral activities. The cultivable bacteria from different compartments (i.e., flower, leaf, stem and soil) were isolated in order to: (i) characterize the bacterial microbiota associated to the plant, determining the forces responsible for the structuring of its composition (by evaluation of cross inhibition); (ii) investigate if bacterial endophytes demonstrate antimicrobial activities against human pathogens. A pool of plants belonging to *O. vulgare* species was collected and the specimen chemotype was defined by hydrodistillation of its essential oil. The isolation of plant associated bacteria was performed from the four compartments. Microbiota was further characterized through a culture-independent approach and next-generation sequencing analysis, as well. Isolates were molecularly typed by Random Amplified Polymorphic DNA (RAPD) profiling and taxonomically assigned by 16S rRNA gene sequencing. Antibiotic resistance profiles of isolates and pairwise cross-inhibition of isolates on agar plates (i.e., antagonistic interactions) were also assessed. High level of diversity of bacterial isolates was detected at both genus and strain level in all different compartments. Most strains were tolerant against common antibiotics; moreover, they produced antagonistic patterns of interactions mainly with strains from different compartments with respect to that of original isolation. Strains that exhibited high inhibitory properties were further tested against human pathogens, revealing a strong capacity to inhibit the growth of strains resistant to several antibiotics. In conclusion, this study regarded the characterization of O. vulgare L. chemotype and of the bacterial communities associated to this medicinal plant, also allowing the evaluation of antibiotic resistance and antagonistic interactions. This study provided the bases for further analyses on the possible involvement of endophytic bacteria in the production of antimicrobial molecules that could have an important role in clinical and therapeutic applications.

Accès au document

The Impact of Pesticides on the Microbial Community of Agrosoddy-Podzolic Soil

Authors: Astaykina AA, Streletskii RA, Maslov MN, and more...

Source: EURASIAN SOIL SCIENCE, 53(5):696-706, 2020, DOI: 10.1134/S1064229320050038

Abstract: The impact of three types of pesticides (herbicide metribuzin, insecticide imidacloprid, and fungicide benomyl) on the structure of microbial complexes and indicators of biological activity of agrosoddy-podzolic soil (Moscow oblast) has been assessed using the method of next-generation sequencing (NGS). The pesticides have been applied both separately and together at one- and tenfold rates. It has been found that pesticides have a greater impact on the fungal community in comparison with the prokaryotic community; in the latter, only changes in the abundances of the phyla of Actinobacteria and Proteobacteria have been observed. The study of fungal communities with the use of molecular-genetic analysis has revealed two dominant divisions of fungi in all soil samples: Ascomycota (72.6 +/- 8.0%) and Basidiomycota (26.0 +/- 7.7%). Moreover, in the samples treated with tenfold rate of pesticides (both in mixture and separately), the abundances of representatives of the Basidiomycota division have increased. Pesticide application has a short-term stimulating effect on the carbon content of microbial biomass. It has been shown that insecticide imidacloprid stimulates nitrogen fixation, whereas other types of pesticides do not affect this factor.

Accès au document

Monitoring antibiotic resistomes and bacterial

microbiomes in the aerosols from fine, hazy, and dusty weather in Tianjin, China using a developed high-volume tandem liquid impinging sampler

Authors: Zhao Y, Chen Z, Hou J, and more...

Source: SCIENCE OF THE TOTAL ENVIRONMENT 731, 2020, DOI: 10.1016/j.scitotenv.2020.139242

Abstract Accurate quantification of the airborne antibiotic-resistant bacteria (ARB) and antibiotic resistance genes (ARGs) is critically important to assess their health risks. However, the currently widely used high-volume filter sampler (HVFS) often causes the desiccation of the sample, interfering with subsequent bacterial culture. To overcome this limitation, a high-volume tandem liquid impinging sampler (HVTLIS) was developed and optimized to investigate the airborne bacterial microbiomes and antibiotic resistomes under different weathers in Tianjin, China. Results revealed that HVTLIS can capture significantly more diverse culturable bacteria, ARB, and ARGs than HVFS. Compared with fine and hazy weathers, dusty weather had significantly more diverse and abundant airborne bacteria, ARGs, and human opportunistic pathogens with the resistance to last-resort antibiotics of carbapenems and polymyxin B, implicating a potential human health threat of dusty bioaerosols. Intriguingly, we represented the first report of Saccharibacteria predominance in the bioaerosol, demonstrating that the potential advantage of HVTLIS in collecting airborne microbes.

Accès au document

Effects of cadmium perturbation on the microbial community structure and heavy metal resistome of a tropical agricultural soild

Authors: Salam LT, Obayori OS, Ilori MO, Amund, Olukayode O

Source: BIORESOURCES AND BIOPROCESSING 7(1), 2020, DOI: 10.1186/s40643-020-00314-w

Abstract: The effects of cadmium (Cd) contamination on the microbial community structure, soil physicochemistry and heavy metal resistome of a tropical agricultural soil were evaluated in field-moist soil microcosms. A Cd-contaminated agricultural soil (SL5) and an untreated control (SL4) were compared over a period of 5 weeks. Analysis of the physicochemical properties and heavy metals content of the two microcosms revealed a statistically significant decrease in value of the soil physicochemical parameters (P < 0.05) and concentration of heavy metals (Cd, Pb, Cr, Zn, Fe, Cu, Se) content of the agricultural soil in SL5 microcosm. Illumina shotgun sequencing of the DNA extracted from the two microcosms showed the predominance of the phyla, classes, genera and species of Proteobacteria (37.38%), Actinobacteria (35.02%), Prevotella (6.93%), and *Conexibacter woesei* (8.93%) in SL4, and Proteobacteria (50.50%), Alphaproteobacteria (22.28%), Methylobacterium (9.14%), and *Methylobacterium radiotolerans* (12,80%) in SL5, respectively. Statistically significant (P < 0.05) difference between the metagenomes was observed at genus and species delineations. Functional annotation of the two metagenomes revealed diverse heavy metal resistome for the uptake, transport, efflux and detoxification of various heavy metals. It also revealed the exclusive detection in SL5 metagenome of members of RND (resistance nodulation division) protein czcCBA efflux system (czcA, czrA, czrB), CDF (cation diffusion facilitator) transporters (czcD), and genes for enzymes that protect the microbial cells against cadmium stress (sodA, sodB, ahpC). The results obtained in this study showed that Cd contamination significantly affects the soil microbial community structure and function, modifies the heavy metal resistome, alters the soil physicochemistry and results in massive loss of some autochthonous members of the community not adapted to the Cd stress.

Accès au document

New Insights into the Microbial Degradation of D-Cyphenothrin in

Contaminated Water/Soil Environments

Authors: Huang YH, Lin ZQ, Zhang WP, and more...

Source: MICROORGANISMS 8(4), 2020, DOI: 10.3390/microorganisms8040473

Abstract: Persistent use of the insecticide D-cyphenothrin has resulted in heavy environmental contamination and public concern. However, microbial degradation of D-cyphenothrin has never been investigated and the mechanism remains unknown. During this study, for the first time, an efficient D-cyphenothrin-degrading bacterial strain Staphylococcus succinus HLJ-10 was identified. Response surface methodology was successfully employed by using Box-Behnken design to optimize the culture conditions. At optimized conditions, over 90% degradation of D-cyphenothrin (50 mg center dot L-1) was achieved in a mineral salt medium within 7 d. Kinetics analysis revealed that its half-life was reduced by 61.2 d, in comparison with the uninoculated control. Eight intermediate metabolites were detected in the biodegradation pathway of D-cyphenothrin including cis-D-cyphenothrin, trans-D-cyphenothrin, 3-phenoxybenzaldehyde, alpha-hydroxy-3-phenoxy-benzeneacetonitrile, trans-2,2-dimethyl-3-propenyl-cyclopropanol, 2,2-dimethyl-3-propenyl-cyclopropionic acid, trans-2,2-dimethyl-3-propenyl-cyclopropionaldehyde, and 1,2-benzenedicarboxylic acid, dipropyl ester. This is the first report about the degradation of D-cyphenothrin through cleavage of carboxylester linkage and diaryl bond. In addition to degradation of D-cyphenothrin, strain HLJ-10 effectively degraded a wide range of synthetic pyrethroids including permethrin, tetramethrin, bifenthrin, allethrin, and chlorempenthrin, which are also widely used insecticides with environmental contamination problems. Bioaugmentation of D-cyphenothrin-contaminated soils with strain HLJ-10 substantially enhanced its degradation and over 72% of D-cyphenothrin was removed from soils within 40 d. These findings unveil the biochemical basis of a highly efficient D-cyphenothrin-degrading bacterial isolate and provide potent agents for eliminating environmental residues of pyrethroids.

Accès au document

Responses of soil microbial biomass and enzyme activity to herbicides imazethapyr and flumioxazin

Authors: Pertile M, Antunes JEL, Araujo FF, and more...

Source: SCIENTIFIC REPORTS 10(1), 2020, DOI: 10.1038/s41598-020-64648-3

Abstract: The use of herbicides is important for controlling weeds in crops. However, they can present impacts on soil properties, such as biological properties. In this study, we evaluated the responses of soil microbial biomass and enzymes activity to the application of the herbicides imazethapyr and flumioxazin and their mixture in an experiment under laboratory conditions, using soils with a different history of use. Soil microbial biomass C (MBC) decreased, while microbial biomass N (MBN) was not affected after the application of the herbicides as compared to the control. Soil respiration, respiratory quotient, and dehydrogenase (DHA) activity increased significantly after the application of the herbicides compared to the control. The hydrolysis of fluorescein diacetate (FDA) was not significantly different between the control and the herbicide treatments. The principal response curve showed the largest initial effects for the flumioxazin, followed by imazethapyr and their mixture. Flumioxazin had a different influence on soil respiration and respiratory quotient than imazethapyr and their mixture. Finally, the effects of herbicides on soil microbial biomass and enzymes are short-term as we observed recovery in the biological parameters over time.

Accès au document

Effects of Cd on soil microbial biomass depend upon its soil fraction distribution

Authors: Zalaghi R, Masir MN, Moezzi A

Source: TOXICOLOGICAL AND ENVIRONMENTAL CHEMISTRY 101(9-10):486-496, 2019, DOI: 10.1080/02772248.2020.1742715

Abstract: Partitioning between soil fractions of Cd added to agricultural soil at 50 and 100mg kg(-1) and its effects on soil respiration and microbial biomass were studied for up to 60 days. Initially, Cd was distributed mostly into the exchangeable and carbonate fractions but decreased in the former fraction within 60 days. Cd pollution resulted in decreased basal and substrate-induced respiration by about 25%, and of microbial biomass carbon by about 35%. Soil biological properties were improved during the incubation and they were shown the highest correlations with Cd in bounded to Fe-Mn oxid fraction. It could be because of the lower concentration of this fraction and the sharper changes in it during the incubation as compared to the rest of Cd fractions (especially as compared with exchangeable fraction; more toxic fraction of Cd).

Accès au document

Biodegradation of Allethrin by a Novel Fungus *Fusarium proliferatum* Strain CF2, Isolated from Contaminated Soils

Authors: Bhatt P, Zhang WP, Lin ZQ, and more...

Source: MICROORGANISMS 8(4), 2020, DOI: 10.3390/microorganisms8040593

Abstract: Continuous use of allethrin has resulted in heavy environmental contamination and has raised public concern about its impact on human health, yet little is known about the kinetics and microbial degradation of this pesticide. This study reported the degradation kinetics in a novel fungal strain, Fusarium proliferatum CF2, isolated from contaminated agricultural fields. Strain CF2 utilized 50 mg center dot L-1 of allethrin as the sole carbon source for growth in minimal salt medium and tolerated high concentrations of allethrin of up to 1000 mg center dot L-1. The optimum degradation conditions for strain CF2 were determined to be a temperature of 26 degrees C and pH 6.0 using response surface methodology. Under optimum conditions, strain CF2 completely degraded allethrin within 144 hours. The degradation kinetics of allethrin followed first order reaction kinetics. Kinetics analysis showed that its half-life was substantially reduced by 507.1 hours, as compared to the uninoculated control. This study provides new insights into the microbial degradation of allethrin with fungal *F. proliferatum* CF2.

Accès au document

Microbial remediation of a pentachloronitrobenzene-contaminated soil under Panax notoginseng: A field experimentnd

Authors: Zhang N, Guo D, Zhu Y, and more...

Source: PEDOSPHERE 30(4):563-569, 2020, DOI: 10.1016/S1002-0160(17)60476-4

Abstract: Pentachloronitrobenzene (PCNB) is an organochlorine fungicide that is mainly used in the prevention and control of diseases in crop seedlings. Microbial removal is used as a promising method for in-situ removal of many organic pesticides and pesticide residues. A short-term field experiment (1 year) was conducted to explore the potential role of a PCNB-degrading bacterial isolate, Cupriavidus sp. YNS-85, in the remediation of a PCNB-contaminated soil on which Panax notoginseng was grown. The following three treatments were used: i) control soil amended with wheat bran but without YNS-85, ii) soil with 0.15 kg m(-2) of solid bacterial inoculum (A), and iii) soil with 0.30 kg m(-2) of solid bacterial inoculum (B). The removal of soil PCNB during the microbial remediation was monitored using gas chromatography. Soil catalase and fluorescein diacetate (FDA) esterase activities were determined using spectrophotometry. In addition, cultivable bacteria, fungi, and actinomycetes were counted by plating serial dilutions, and the microbial biodiversity of the soil was analyzed using BIOLOG. After 1 year of in-situ remediation, the soil PCNB concentrations decreased significantly by 50.3% and 74.2% in treatments A and B, respectively, when compared with the uninoculated control. The soil catalase activity decreased in the presence of the bacterial isolate, the FDA esterase activity decreased in treatment A, but increased in treatment B. No significant changes in plant

biomass, diversity of the soil microbial community, or physicochemical properties of the soil were observed between the control and inoculated groups (P < 0.05). The results indicate that Cupriavidus sp. YNS-85 is a potential candidate for the remediation of PCNB-contaminated soils under P. notoginseng.

Accès au document

Screening strains for microbial biosorption technology of cadmium

Authors: Huang HJ, Jia QJ, Jing WX, and more...

Source: CHEMOSPHERE 251, 2020, DOI: 10.1016/j.chemosphere.2020.126428

Abstract: Heavy metals contaminate the environment and provide a threat to public health through drinking water and food chain. Microbial biosorption technology provides a more economical and competitive solution for bioremediation of toxicants such as heavy metals, and microbial genetic modification may modify microbes towards optimal sorption. It is very important to screen suitable strains for this purpose. In this study, three different types of microorganisms Escherichia coli, Bacillus subtilis and Saccharomyces cerevisiae were isolated and identified, from uncontaminated soils, and compared their sorption differences with respect to cadmium (Cd2+). We evaluated the effects of contact time and initial concentration on Cd2+ uptake, and found pseudo-second-order kinetic models were more suitable to describe biosorption processes. Adsorption isotherms were used to reflect their biosorption capacity. The maximum biosorption capacities of three strains calculated by the Langmuir model were 37.764, 56.497, and 22.437 mg Cd/g biomass, respectively. In bacteria, Cd2+ biosorption mainly occurred on cell wall, while the difference in biosorption between yeast inside and outside the cell was not significant. We found that due to the structural differences, the removal rate of *E. coli* surface decreased at a high concentration, while S. cerevisiae still had a lower biosorption capacity. FTIR spectroscopy reflected the difference in functional groups involved in biosorption by three strains. SEM-EDS analysis showed the binding of Cd2+ to microorganisms mainly relied on ion exchange mechanism. Based on the above results, we suggested that B. subtilis is more suitable to get genetically modified for heavy metal biosorption.

Accès au document

Sulfamethoxazole affects the microbial composition and antibiotic resistance gene abundance in soil and accumulates in lettuce

Authors: Cheng S, Shi MM, Xing LJ, Wang X, and more...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-08902-1

Abstract: Pot experiments were set up to simulate the soil contamination by three initial concentrations of sulfamethoxazole (SMX) (S1, 100 mg/kg; S2, 200 mg/kg; S3, 300 mg/kg). The content of SMX in soil and its accumulation in lettuce were analysed. Additionally, the effects of SMX on soil microorganisms and antibiotic resistance genes were studied by Illumina high-throughput sequencing and droplet digital polymerase chain reaction (ddPCR). The results demonstrated that the SMX content in soil reduced by 97%, 86% and 75% in the S1, S2 and S3 treatment groups after 120 days, respectively. The accumulated SMX in lettuce was positively correlated with the initial concentration of SMX in soil. SMX contamination significantly reduced the bacterial diversity and altered the composition of bacterial and fungal communities in soil. The dominant bacterial and fungal genera in the SMX-contaminated soil were obviously different from those in the control soil. The relative abundance of sul1 (sulfonamide resistance gene) remarkably increased in the SMX-contaminated soil, while that of other ARGs, such as sul2 and tetracycline and quinolone resistance genes, showed no significant change.

Accès au document

Effect of multiple heavy metals pollution to bacterial diversity and community structure in farmland soils

Authors: Li CZ, Wang XF, Huang H, and more...

Source: HUMAN AND ECOLOGICAL RISK ASSESSMENT, 2020, DOI: 10.1080/10807039.2020.1752143

Abstract: Heavy metal pollution poses a serious hazard to the soil bacterial community. In this study, the 16 s rRNA high-throughput sequencing technology was used to analyze bacterial diversity and structure of dry field soil at different levels of heavy metal pollution. Further, the relationships between soil parameters and bacterial community were analyzed. Based on the study findings, we classified the levels of heavy metal pollution in soil samples from the study area could be divided into four grades: high risk (HR), considerable risk (CR), moderate risk (MR) and low risk (LR). In this study, heavy metal concentrations and pH showed significant effect on bacterial community structure. The distribution of bacterial community richness and diversity was MR > LR > CR > HR. Bacterial communities such as Acidobacteria, Chloroflexi and Gemmatimonadetes were highly resistant to the lower pH (pH < 6.5) and the high levels of heavy metal pollution compared with other bacterial community, which were abundant in HR samples. However, Proteobacteria, Actinobacteria, Bacteroidetes and Latescibacteria were more abundant in alkaline soils (pH > 7.5). Further, available Cd, Pb and Zn concentrations were lower in alkaline soils than acidic soils, which reduced the impact of heavy metals on bacterial community diversity and structure.

Accès au document

Designing of dual biosensor system for detection of zinc and chromium from contaminated soil using saponin biosurfactant and bioluminescence bacteriaind

Authors: Hajimohammadi R, Ahar MJ, Ahmadpour S

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY, 2020, DOI: 10.1080/03067319.2020.1760858

Abstract: In this study, a dual biosensor system for detecting chromium (VI) and zinc (II) in contaminated soil including toxic metals has been successfully designed using two strains of immobilised bioluminescent (BL) Escherichia coli Gap and Gfp. Saponinbiosurfactant was used to extract the chromium (Cr6+) and zinc (Zn2+) from soil to the aqueous phase. From obtained results when extracted metals ions were injected into the dual biosensor system, the luminescence level of biosensor decreased dramatically for both zinc and chromium. The concentrations of extracted chromium and zinc are well correlated with metals ions toxicity data achieved by biosensor system. The optimum aeration rate of biosensor system was obtained 30 ml/min. Dual biosensor system may be applied as an in-situ biosensor to detect the toxicity of chromium and zinc in contaminated soil including toxic metals. Therefore, this system can be proposed as a potential alternative to detection of toxic metals in soils.

Accès au document

The influence on biosorption potentials of metal-resistant bacteria Enterobacter sp. EG16 and *Bacillus subtilis* DBM by typical red soil minerals

Authors: Feng WL, Li YY, Lin ZY, and more...

Source: JOURNAL OF SOILS AND SEDIMENTS, 2020, DOI: 10.1007/s11368-020-02650-y

Abstract: Purpose Due to the inevitable interaction between bacteria and soil minerals, whether bacteria could exert the excepted functions in the soil is yet to be confirmed and how minerals affect biosorption potential is needed to be investigated. The purposes of this study were to explore the adsorption behavior and mechanism of metal-resistant bacteria attaching to typical red soil minerals under different conditions and to discuss whether biosorption potential would be altered after the addition of functional bacteria to soil. Materials and methods Here, we tested equilibrium adsorption along with zeta potential analysis, scanning electron microscopy (SEM), Fourier transform infrared spectra (FTIR), and desorption to investigate the adsorption of two metal-

resistant bacteria (Gram-negative *Enterobacter* sp. EG16 and Gram-positive *Bacillus subtilis* DBM) onto typical red soil minerals including goethite, kaolinite, and gibbsite under different environmental factors. Results and discussion We found that the minerals adsorbed more EG16 cells than DBM, and the adsorption capacities followed the sequence of goethite > kaolinite > gibbsite. Both the surfaces of bacteria and mineral were pH-dependent in our tested pH range (4.0-7.0), and the maximum adsorption was at pH 4.0. Increasing ionic strength resulted in less adsorption of bacteria onto goethite, whereas bacterial adsorption onto kaolinite was the opposite. These observations elucidated that electrostatic interaction was the dominant contributor. The adsorption conformed to the Langmuir and pseudo-second-order kinetic model implying chemical adsorption, and the result of FTIR also supported that. Desorption experiment has suggested the significant contribution of electrostatic force and the minor dominator of functional groups for bacteria-mineral combination. Conclusions The results of this study indicated that electrostatic interaction was the dominant contributor to bacteria-mineral combination and functional groups coordination contributed less than 10%. This finding suggested most adhered bacteria could still provide active sites for heavy metal biosorption. Thus, although 50-90% of added functional bacteria has adhered to minerals, the bacteria-mineral combination had a limited impact on biosorption.

Accès au document

Heavy metals-resistant bacteria (HM-RB): Potential bioremediators of heavy metals-stressed *Spinacia oleracea* plantd

Authors: Desoky EM, Merwad ARM, Semida WM, and more...

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 198, 2020, DOI: 10.1016/j.ecoenv.2020.110685

Abstract: Microorganism technologies can provide a potential alternative to traditional methods of removing heavy metals to conserve agricultural soils. This study aimed to identify and characterize heavy metals-resistant bacteria (HMRB) isolated from industry-affected soil and their desired impact as bioremediators of heavy metals-stressed spinach plants. Three of 135 isolates were selected based on a high level of resistance to heavy metals. Based on morphological and biochemical characteristics, the selected isolates were identified as Bacillus subtilis subsp. spizizenii DSM 15029 T DSM (MA3), Paenibacillus jamilae DSM 13815 T DSM (LA22), or *Pseudomonas aeruginosa* DSM 1117 DSM (SN36). Experiments were implemented to investigate the three isolated HM-RB ability on improving attributes of growth, physio-biochemistry, and components of the antioxidant defense system of spinach plant exposed to the stress of cadmium (Cd2+; 2 mM), lead (Pb2+; 2 mM) or 2 mM Cd2++2 mM Pb2+. Compared to control, Cd2+ or Pb2+ stress markedly lowered plant fresh and dry weights, leaf contents of chlorophylls and carotenoids, rates of transpiration (Tr), net photosynthesis (Pn) and stomatal conductance (gs), relative water content (RWC), and membrane stability index (MSI). In contrast, contents of a.tochopherol (alpha.TOC), ascorbic acid (AsA), glutathione (GSH), proline, soluble sugars, Cd2+, and Pb2+, as well as activities of enzymatic and non-enzymatic antioxidants were markedly elevated. The application of HM-RB promoted the tolerance to heavy metal stress in spinach plants by improving Tr, Pn, gs, RWC, and MSI, while activities of enzymatic and non-enzymatic antioxidants were suppressed. These results reflected positively in promoting plant growth under heavy metal stress. Therefore, the application of HM-RB as potential bioremediators may be a promising strategy for promoting plant growth and productivity under heavy metal stress.

Accès au document

Suppression treatment differentially influences the microbial community and the occurrence of broad host range plasmids in the rhizosphere of the model cover crop *Avena sativa* L.

Authors: Allegrini M, Gomez ED, Smalla K, Zabaloy MC

Source: PLOS ONE 14(10), 2019, DOI: 10.1371/journal.pone.0223600

Abstract: Cover crop suppression with glyphosate-based herbicides (GBHs) represents a common agricultural practice. The objective of this study was to compare rhizospheric microbial communities of A. sativa plants treated with a GBH relative to the mechanical suppression (mowing) in order to assess their differences and the potential implications for soil processes. Samples were obtained at 4, 10, 17 and 26 days post-suppression. Soil catabolic profiling and DNA-based methods were applied. At 26 days, higher respiration responses and functional diversity indices (Shannon index and catabolic evenness) were observed under glyphosate suppression and a neat separation of catabolic profiles was detected in multivariate analysis. Sarcosine and Tween 20 showed the highest contribution to this separation. Metabarcoding revealed a non-significant effect of suppression method on either alpha-diversity metrics or beta-diversity. Conversely, differences were detected in the relative abundance of specific bacterial taxa. Mesorhizobium sequences were detected in higher relative abundance in glyphosate-treated plants at the end of the experiment while the opposite trend was observed for Gaiella. Quantitative PCR of amoA gene from ammonia-oxidizing archaea showed a lower abundance under GBH suppression again at 26 days, while ammonia-oxidizing bacteria remained lower at all sampling times. Broad host range plasmids IncP-1 beta and IncP-1 epsilon were exclusively detected in the rhizosphere of glyphosate-treated plants at 10 days and at 26 days, respectively. Overall, our study demonstrates differential effects of suppression methods on the abundance of specific bacterial taxa, on the physiology and mobile genetic elements of microbial communities while no differences were detected in taxonomic diversity.

Accès au document

Development and performance evaluation of native microbial consortium for multi metal removal in lab scale aerobic and anaerobic bioreactor

Authors: Gola D, Chawla P, Malik A, Ahammad SZ

Source: ENVIRONMENTAL TECHNOLOGY & INNOVATION 18, 2020, DOI: 10.1016/j.eti.2020.100714

Abstract: Shortage of freshwater force farmers to use untreated wastewater for irrigation which leads to the accumulation of contaminants like heavy metals in the food chain and deteriorate the quality of produce and soil. Present study focused on bioremediation of multiple heavy metals (Cd, Cu, Cr, Zn. Pb and Ni) from wastewater used for irrigation of food crops using four continuous Stirred Tank Reactor (CSTR), two aerobic and two anaerobic. One set of bioreactor (aerobic and anaerobic) was fed with actual wastewater, showed heavy metal removal up to 30%-100%. Whereas other set fed with spiked with metal ion concentration showed removal up to 70%-100%, indicating the improvement in removal efficiency due to acclimatization of microbial consortia at higher metal concentration. Present study clearly shows the ability of native microbial consortia in removing even higher concentrations of heavy metals from actual wastewater under ambient conditions. The present bioreactors configuration can be scale up for the onsite wastewater treatment with further optimization of the removal process. It was recommended that after using the present treatment process, treated water is safe for irrational purposes.

Accès au document

Taxonomic and functional analysis of soil microbial communities in a mining site across a metal(loid) contamination gradient

Authors: Navas M, Perez-Esteban J, Torres Mi-A, and more…

Source: EUROPEAN JOURNAL OF SOIL SCIENCE, 2020, DOI: 10.1111/ejss.12979

Abstract: Soil microorganisms surviving in mining sites have developed metal-resistance mechanisms to biotransform metals. Their use as biofertilizers can improve phytoremediation efficiency in contaminated soils by reducing metal toxicity while promoting plant growth. We analysed through whole-metagenome shotgun sequencing the composition, diversity and function of microbial communities present in a contaminated mine soil along a gradient of metals (As, Cu, Fe, Mn, Pb, Zn) to identify tolerant species carrying metal-resistance functional genes that can be used in association with plants for phytoremediation. Soil samples were collected from an abandoned copper mine, across three areas with different levels of metal contamination (unaffected, moderately contaminated and highly contaminated). The relative abundance of Proteobacteria, especially genus Bradyrhizobium, increased in the highly contaminated area, whereas Actinobacteria dominated in the unaffected area. Archaea (Euryarchaeota) predominated in the moderately contaminated area, Haloarcula, Halobacterium and Halorubrum being the most abundant genera. The fungi Basidiomycota did not exhibit differences among the areas, whereas Ascomycota, especially the genus Aspergillus, increased in areas with low metal concentrations. Metal-resistance genes associated with Fe (acn, furA, dpsA), Cu (cop-unnamed, copF, actP, copA, mmco, cutO) and As (arsT, arsC, aioA/aoxB) metabolism were the most abundant and were affected by the gradient of soil contamination. Those associated with Cu predominated in the most contaminated area, whereas As and Fe genes were more abundant in the least contaminated. Among the carriers of these metal-resistance genes, Bradyrhizobium diazoefficiens, *Pseudomonas aeruginosa, Halorubrum trapanicum, Aspergillus fumigatus* and *A. fischeri* were dominant in the most contaminated area. These species could give rise to promising biofertilizers to be used in association with suitable plants for the phytoremediation of contaminated mining sites.

Accès au document

Effects of Cd and Pb on diversity of microbial community and enzyme activity in soil

Authors: Xiao L, Yu Z, Liu H, and more...

Source: ECOTOXICOLOGY, 2020, DOI: 10.1007/s10646-020-02205-4

Abstract: Pollution due to heavy metals is a serious global environmental problem, particularly in China. It is thus important to study the effects of heavy metal pollution, especially in mining areas. Cadmium (Cd) and lead(Pb) severely damage the microbial life in soil. The concentration of heavy metals and their toxic effects on microbes and enzymes in soil were examined in this study using contaminated soil samples. The Biolog method was used to analyze the characteristics of the microbial community. The results showed that the addition of Cd2+ and Pb2+ in different concentrations has a significant impact on microbial and enzyme activity in soil. With an increase in their concentrations, activities of the microbial community and enzymes decreased gradually. Each index related to the structure of the microbial community in soil decreased, indicating that pollution due to Cd and Pb reduced its size and functional activity. This study provides a reference for future research on the functional diversity of the microbial community in soil and plays its role in their environmental management.

Accès au document

Adaptation of soil fungi to heavy metal contamination in paddy fields-a case study in eastern China

Authors: Lin Y, Xiao W, Ye Y, and more...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-09049-9

Abstract: Soil fungi have been widely studied, but the effects of heavy metal contamination at various levels as well as the abundance and diversity of heavy metal tolerant fungi in the contaminated paddy soils are still unknown. The

purpose of this study is to analyze the adaptability of fungi at different levels of heavy metal contamination to identify species that have strong adaptability to heavy metals. In this research, the technology of high-throughput sequencing was applied to study fungal communities in severe level (SL), moderate level (ML), light level (LL), and clean level (CL) for soil samples polluted by heavy metal, as well as to analyze the relations between environmental variables and fungal communities. The spearman analysis showed that 6 dominant fungal phyla and 18 dominant fungal genera were significantly correlated with these environmental variables. The alpha-diversity indexes of the soil fungal community from SL, ML, and CL were, mostly, drastically higher than the LL samples (p < 0.05). Meanwhile, Ascomycota, the main fungal phylum, was spotted to yield a strong tolerance towards heavy metals, especially in ML. The most dominant genera of tolerant fungi in this area, which are Aspergillus, Penicillium, and Fusarium, could absorb and transport the heavy metals with the help of nutrients under certain heavy metal contamination levels. Therefore, this study indicated that some fungi, which have strong biodegradability on heavy metals, can reduce toxicity of heavy metals and create a proper soil environment to grow food crops.

Accès au document

Response of microbial community composition in soils affected by coal mine exploitation

Authors: Hamidovic S, Cvijoviic GG, Waisi H, Zivotic L, and more...

Source: ENVIRONMENTAL MONITORING AND ASSESSMENT 192(6), 2020, DOI: 10.1007/s10661-020-08305-2

Abstract: Surface mining activities, despite their benefits, lead to the deterioration of local and regional environmental quality and play a role in global ecosystem pollution. This research aimed to estimate the culturable microbial population structure at five locations near the opencast coal mine "Kakanj" (Bosnia and Herzegovina) via agar plate and phospholipid fatty acids (PLFA) method and to establish its relationship to the physical and chemical properties of soil. Using the ICP-OES method, the heavy metal pollution of all examined locations (overburden, former grass yard, forest, arable soil, and greenhouse) was observed. Substantial variations among the sites regarding the most expressed indicators of heavy metal pollution were noted; Cr, Pb, Ni, and Cu content ranged from 63.17 to 524.47, 20.57 to 349.47, 139.13 to 2785.67, and 25.97 to 458.73 mg/kg, respectively. In the overburden sample, considerable low microbial activity was detected; the bacterial count was approximately 6- to 18-fold lower in comparison with the other samples. PLFA analysis showed the reduction of microbial diversity, reflected through the prevalence of normal and branched saturated fatty acids, their ratio (ranged from 0.92 to 7.13), and the absence of fungal marker 18:2 omega 6 fatty acid. The principal component analysis showed a strong negative impact of heavy metals Na and B on main microbial and PLFA profiles. In contrast, stock of main chemical parameters, including Ca, K, Fe, and pH, was positively correlated with the microbial community structure.

Accès au document

Biodegradation of diazinon by fungal strain *Apergillus niger* MK640786 using response surface methodology

Author: Hamad MTMH

Source: ENVIRONMENTAL TECHNOLOGY & INNOVATION, 18, 2020, DOI: 10.1016/j.eti.2020.100691

Abstract: The Lake Burullus is one of most important lakes in north Delta of Egypt. It is exposed to huge amounts of contaminated drainage water contain serious pollutants especially Organophosphours. Diazinon is an organophosphorus pesticide widely used in agriculture. Evidence of diazinon residues in water has generated an urgent need to develop treatment systems for protected human health and the environment from damage. The aim of this work was the optimization of diazinon biodegradation from aqueous solutions by Aspergillus niger MK640786 using the response surface methodology. Aspergillus niger MK640786 was succeeded to reduce the diazinon at optimal conditions were as follows: temperature 30

degrees C, initial concentration 25 mg/l, pH 5 and within 7 days of incubation. Under these conditions, the degradation rate of diazinon was 82%. The half-life values of diazinon with strain Aspergillus niger were,3.8, 3.9,7.2,10.9 and 15.8 d(-1) respectively. In contrast, the t1/2 values of diazinon in the non-inoculated were 14.36549, 17.71808, 34.83199, 40.65586 and 47.8675 d(-1) respectively. We can conclude that Aspergillus niger has able to remove diazinon with the lowest cost and a high efficiency.

Accès au document

Effects of di-n-butyl phthalate and di-2-ethylhexyl phthalate on pollutant removal and microbial community during wastewater treatment

Auhors: Wang Q, Liang L, Fang C, Chen L

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY, 198, 2020, DOI: 10.1016/j.ecoenv.2020.110665

Abstract: Due to the wide use of plastic products and the releasability of plasticizer into surrounding environment, the hazards, residues and effects of phthalic acid esters (PAEs) in ecosystems have been paid more and more attention. Little information is available about the effects of PAEs on the normal wastewater treatment, although the distribution of PAEs in soil and other ecosystems is closely related to the discharge of sewage. In this study, the effects of high concentrations of di-n-butyl phthalate (DBP) and di-2-ethylhexyl phthalate (DEHP) on pollutant removal and the microbial community during landfill leachate treatment was investigated. After domestication, the activated sludge was used in the co-treatment of landfill leachate and simulated domestic wastewater. We verified that this process reduced the toxicity of landfill leachate. However, high concentrations of added DBP and DEHP were removed first, while the removal of these pollutants from raw landfill leachate was limited. The results of high-throughput sequencing revealed that the bacterial diversity was diminished and the microbial community structure was significantly affected by the addition of DBP and DEHP. The DBP and DEHP samples had 79.05% and 82.25% operational taxonomic units (OTU), respectively, in common with the raw activated sludge. Many genera of PAE-degrading bacteria that had no significant evolutionary relationship were found in the raw activated sludge. And the widespread presence of PAE-degrading bacteria could effectively keep the concentrations of PAEs low during the wastewater treatment.

Accès au document

Removal and biomineralization of Pb2+ in water by fungus *Phanerochaete chrysoporium*

Authors: Zhao WW, Zhu G, Daugulis AJ, and more...

Source: JOURNAL OF CLEANER PRODUCTION, 260, 2020, DOI :10.1016/j.jclepro.2020.120980

Abstract: The removal and biomineralization of Pb2+ (200 mg/L) in water were investigated utilizing mature mycelia of *Phanerochaete chrysoporium*. Mycelial dosage, initial Pb2+ concentration, solution pH and treatment time all were shown to have an influence on Pb2+ removal. Granular, lead-containing precipitation was formed on the fungal hyphae upon exposure to lead nitrate, which was confirmed from scanning electron micrograph/Energy Dispersive Spectrometer (SEM/EDS). Energy dispersive X-ray spectroscopic analysis revealed the presence of lead (48.5% by weight) along with phosphorus in the precipitate. This extracellular precipitate was further identified as pyromorphite lead hydroxyphosphate [Pb-5(PO4)(3)OH] by X-ray powder diffraction (XRD) analysis. During Pb2+ removal, size-enlarged mineral precipitation, and clustered nanospherical particles formed on the hyphae were revealed by SEM/XRD. A remarkable increase of mycelial phosphatase activity of 1.5 times that of the control and decreased phosphate concentration in solution (16.76 mg/L to 1.39 mg/L) initially upon exposure to Pb2+ suggested that phosphatase may hydrolyze organic phosphorus into inorganic phosphate and release it into solution, participating in the biomineralization of Pb2+. Toxicity tests showed that the toxicity of Pb2+ polluted water decreased after treatment. The results clearly demonstrate previously unknown

lead biomineralization as pyromorphite through fungal phosphatase.

Accès au document

Remedial potential of bacterial and fungal strains (*Bacillus subtilis*, *Aspergillus niger*, *Aspergillus flavus and Penicillium chrysogenum*) against organochlorine insecticide Endosulfan

Author: Ahmad KS

Source: FOLIA MICROBIOLOGICA, 2020, DOI: 10.1007/s12223-020-00792-7

Abstract: Endosulfan, an organochlorine insecticide, is known to cause detrimental effects to the environment and human health due to its excessive usage. Its highly toxic nature calls for an environmental-friendly approach for its detoxification. Environmental transformation of Endosulfan was assessed through biodegradation by isolated and cultured soil microbes (*Bacillus subtilis* (BS), *Aspergillus niger* (AN), *Aspergillus flavus* (AF) and *Penicillium chrysogenum* (PC)). Degradation of 10 mg/L Endosulfan was determined in aqueous solution at regular time intervals and analysed by gas chromatography-mass spectrometry for 35 days. BS and AN displayed substantial potential to degrade Endosulfan and subsequently transform it into its daughter products (95 and 77%, respectively). Endosulfan transformation followed first-order reaction kinetics. Chromatogram peaks revealed less toxic metabolites by Endosulfan transformation (Endosulfan diol, Endosulfan ether, Endosulfan hydroxyether and Endosulfan lactone). Half-life of Endosulfan obtained by various strains utilised in the experiments was in the order, PC (69) > AF (34.6) > AN (17.3) > BS (11.5) days. Statistical analysis was performed in MINITAB to evaluate the significance of results. Bioaugmentation of contaminated sites with such efficient microbes can facilitate rapid pesticide transformation and decontamination of the environment.

Accès au document

Microbial degradation of two highly persistent fluorinated fungicides - epoxiconazole and fludioxonil

Authors: Alexandrino DAM, Mucha AP, Almeida CMR, Carvalho MF

Source: JOURNAL OF HAZARDOUS MATERIALS 394, 2020, DOI: 0.1016/j.jhazmat.2020.122545

Abstract: Biodegradation of two highly persistent fluorinated fungicides, epoxiconazole (EPO) and fludioxonil (FLU), by microbial consortia enriched from estuarine sediment and agricultural soil is reported. After an enrichment period of 6 months, four microbial consortia were able to completely remove and defluorinate the fungicides in co-metabolic conditions. Defluorination was biologically mediated and results suggest it is not a primary catabolic step, as fungicide removal was always faster than its defluorination. Three of the four enriched consortia had similar biodegradation performances in the absence of a co-substrate. Biodegradation kinetics revealed that microbial degradation followed a first-order kinetics, with cultures being capable of biodegrading concentrations up to 10 mg L-1 of EPO or FLU, in a maximum of 21 days. Estimated half-life values for these compounds were significantly lower than those reported in literature, highlighting the unique metabolic performance of the obtained consortia. Analysis of their microbial composition revealed that they integrate several bacterial species belonging to the Proteobacteria phylum, with the most common genera being Pseudomonas, Ochrobactrum and Comamonas. This is the first study providing clear evidence on the biodegradation of EPO and FLU, opening doors for the design of bioremediation technologies for the recovery of ecosystems polluted with such recalcitrant compounds.

Accès au document

The bacterial microbiota in florfenicol contaminated soils: The antibiotic

resistome and the nitrogen cycle

Authors: Wang M, Xie X, Wang M and more...

Source: ENVIRONMENTAL POLLUTION 259, 2020, DOI: 10.1016/j.envpol.2019.113901

Abstract: Soil antibiotic resistome and the nitrogen cycle are affected by florfenicol addition to manured soils but their interactions have not been fully described. In the present study, antibiotic resistance genes (ARGs) and nitrogen cycle genes possessed by soil bacteria were characterized using real-time fluorescence quantification PCR (qPCR) and metagenomic sequencing in a short-term (30 d) soil model experiment. Florfenicol significantly changed in the abundance of genes conferring resistance to aminoglycosides, beta-lactams, tetracyclines and macrolides. And the abundance of Sphingomonadaceae, the protein metabolic and nitrogen metabolic functions, as well as NO reductase, nitrate reductase, nitrite reductase and N2O reductase can also be affected by florfenicol. In this way, ARG types of genes conferring resistance to aminoglycosides, beta-lactamases, tetracyclines, colistin, fosfomycin, phenicols and trimethoprim were closely associated with multiple nitrogen cycle genes. Actinobacteria, Chlorobi, Firmicutes, Gemmatimo-nadetes, Nitrospirae, Proteobacteria and Verrucomicrobia played an important role in spreading of ARGs. Moreover, soil physicochemical properties were important factors affecting the distribution of soil flora. This study provides a theoretical basis for further exploration of the transmission regularity and interference mechanism of ARGs in soil bacteria responsible for nitrogen cycle.

Accès au document

Effect of Long-Term Pesticides and Chemical Fertilizers Application on the Microbial Community Specifically Anammox and Denitrifying Bacteria in Rice Field Soil of Jhenaidah and Kushtia District, Bangladesh

Authors: Rahman MM, Nahar K, Ali MM, and more...

Source: BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY 104(6):828-833, 2020, DOI: 10.1007/s00128-020-02870-5

Abstract: In this study, we investigated the effect of long-term pesticides and chemical fertilizers application on the microbial communities specifically anammox and denitrification bacteria in rice field soils. The abundances of microbial communities (16S rDNA), anammox (hszB), and denitrification (narG, nirK, nirS, and nosZ) genes were quantified by q-PCR. 10 pesticides (5 insecticides, 3 fungicides and 2 herbicides) and chemical fertilizers urea, potassium, phosphate, DAP (di-ammonium phosphate), gypsum, and boric acid were used by local farmers. Nitrate, SOC (ammonia, soil organic carbon), N and C content significantly ($p < 0.05$) decreased in the rice field soils as compared to the upland soils. Abundance of 16S rDNA, hszB, narG, nirK, nirS, and nosZ genes significantly (p < 0.05) decreased in the rice field soils and positively correlated with chemical properties of soils. Our results provide useful information and further maintenance should be instilled to the potential of chemical and biological factors decreased in rice field soils.

Accès au document

Characterization and Identification of Naphthalene Degrading Bacteria Isolated from Petroleum Contaminated Sites and Their Possible Use in Bioremediation

Authors: Rabani MS, Sharma R, Singh R, Gupta M

Source: POLYCYCLIC AROMATIC COMPOUNDS, 2020, DOI: 10.1080/10406638.2020.1759663

Abstract: Naphthalene is a simple polycyclic aromatic hydrocarbon (PAH) regarded as a common environmental pollutant. A total number of 16 bacterial isolates obtained from various petroleum contaminated sites of Gwalior (MP), India were screened for their naphthalene degradation potential. Enrichment method was used for the isolation of bacteria by amending the medium with 100 mg l(-1) naphthalene dissolved in acetone. Out of 16 bacterial isolates, only two isolates designated as RS2(3) and GS2 have shown a good naphthalene degradation potential based on maximum tolerance level at 1000 mg l(-1) and growth of the isolates as 0.536 and 0.133, respectively measured in terms of optical density (OD) at 600 nm. The degradation was determined by GC analysis, GS2 showed 73% and 48% degradation, while RS2(3) showed 52% and 29% at 100 and 200 mg l(-1) naphthalene concentration, respectively. The isolates were also characterized for their heavy metal tolerance against four selected heavy metals (Cadmium, Chromium, Copper and Zinc) at different concentrations (0.1%, 0.5% and 1.0%). Out of total 16 bacterial isolates only twelve were found resistant to one percent concentration of any one of the four heavy metals. Moreover, the antibiotic sensitivity of the isolates was also determined against four different antibiotics. These isolates were characterized morphologically, biochemically and identified as strain Bacillus licheniformis JUG GS2 (MK106145) and Bacillus sonorensis JUG (RS2(3)) (MK156710) by 16S rRNA gene sequencing. The study infers that Bacillus licheniformis and Bacillus sonorensis strains can be helpful to remediate contaminations attributed to naphthalene and heavy metals as well.

Accès au document

World within world: Intestinal bacteria combining physiological parameters to investigate the response of *Metaphire guillelmi* to tetracycline stress

Authors: Chao H, Sun M, Ye M, and more...

Source: ENVIRONMENTAL POLLUTION, 261, 2020, DOI: 10.1016/j.envpol.2020.114174

Abstract: Due to the abusive usage of antibiotics in animal husbandry, a large amount of residual antibiotics has been released into the environment, therein posing great threat against both environment security and public health. Therefore, it is of great significance to investigate the toxicity of antibiotics on the widely-applied bioindicator-earthworm. In this work, the physiological parameters and the intestinal bacteria community of Metaphire guillelmi were monitored simultaneously to evaluate their sensitivity to the tetracycline (TC) exposure. As expected, the antioxidant enzyme activity and coelomocyte apoptosis acted fairly well as biomarkers for the TC toxicity. In contrast, the intestinal bacteria of Metaphire guillelmi responded varyingly to different TC doses. When TC concentration increased from 0 to 35.7 mu g cm(-2), the percentage of the Proteobacteria phylum declined significantly from 85.5% to 34.4%, while the proportions of the Firmicutes, Planctomycetes and Atinomycete phyla clearly increased (p < 0.05). Meanwhile, the levels of TC resistance genes tetA, tetC, and tetW increased with the increasing TC concentration, in contrast to the declined abundance in denitrifying genes nirS and nosZ (p < 0.05). By analyzing the correlation between the antioxidant enzyme activity and the dominant intestinal bacteria in the worm gut, it is interesting to found that the four dominant bacteria genera Mesorhizobium, Aliihoeflea, Romboutsia, and Nitrospira are the promising bioindicator of TC stress due to their sensitive response. This work shed novel light on evaluating the ecotoxicological risks posed by residual TC in environment by using a combination of physiological parameters and intestinal bacterial activity in earthworms.

Accès au document

Longitudinal screening of antibiotic residues, antibiotic resistance genes and

zoonotic bacteria in soils fertilized with pig manure

Authors: Van den Meersche T, Rasschaert G, Vanden Nest T, and more...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-09119-y**Abstract:**
Fertilization with animal manure is one of the main routes responsible for the introduction of antibiotic residues, antibiotic resistance genes, and zoonotic bacteria into the environment. The aim of this study was to assess the effect of the use of pig (swine) manure as a fertilizer on the presence and fate of six antibiotic residues, nine antibiotic resistance genes, and bacteria (zoonotic bacteria *Salmonella* spp. and *Campylobacter* spp. and *E. coli* as indicator for Gram-negative bacterial species of the microbiota of livestock) on five fields. To the best of our knowledge, the present study is the first to assess a multitude of antibiotic residues and resistance to several classes of antibiotics in pig manure and in fertilized soil over time in a region with an intensive pig industry (Flanders, Belgium). The fields were sampled at five consecutive time points, starting before fertilization up to harvest. Low concentrations of antibiotic residues could be observed in the soils until harvest. The antibiotic resistance genes studied were already present at background levels in the soil environment prior to fertilization, but after fertilization with pig manure, an increase in relative abundance was observed for most of them, followed by a decline back to background levels by harvest-time on all of the fields studied. No apparent differences regarding the presence of antibiotic resistance genes in soils were observed between those fertilized with manure that either contained antibiotic residues or not. With regard to dissemination of resistance, the results presented in this study confirm that fertilization with animal manure directly adds resistance genes to the soil. In addition, it shows that this direct mechanism may be more important than possible selective pressure in soil-dwelling bacteria exerted by antibiotic residues present in the manure. These results also indicate that zoonotic bacteria detected in the manure could be detected in the soil environment directly after fertilization, but not after 1 month. In conclusion, although some antibiotic residues may be present in both manure and soil at concentrations to exert selective pressure, it seems that antibiotic resistance is mostly introduced directly to soil through fertilization with animal manure.

Accès au document

Dissolved organic matter does not promote glyphosate degradation in auto-heterotrophic aquatic microbial communities

Authors: Artigas J, Batisson I, Carles L

Source: ENVIRONMENTAL POLLUTION 259, 2020, DOI:10.1016/j.envpol.2020.113951

Abstract: Environmental dissolved organic matter (DOM) has been proved to increase microbial population sizes and stimulate the degradation of some pesticide molecules. Among these molecules, the present study investigated the biodegradation of the herbicide glyphosate depending on photoautotrophs DOM supply in a microbial consortium isolated from river biofilms. Degradation experiments in the laboratory were performed in dark and light conditions, as well as after antibiotic supply, in order to characterize the eventual interactions between photoautotrophs and heterotrophs activity during glyphosate degradation. Fifty percent of the initial concentration of glyphosate (0.6 mM) was transformed into aminomethyl phosphonic acid (AMPA) after 9 days in presence or absence of light. Accordingly, the photoautotrophic DOM supply was not stimulating glyphosate degradation by microbial heterotrophs. This lack of response was probably explained by the low net primary production values and weak dissolved organic carbon production recorded in light treatments. The supply of the antibiotic drastically stopped glyphosate transformation demonstrating the central role of bacteria in the biodegradation of the herbicide. Glyphosate also modified the structure of prokaryotes assemblages in the consortium by increasing the relative abundances of Alphaproteobacteria and slightly decreasing those of Gammaproteobacteria. The chemoorganotrophic bacteria *Phenylobacterium* sp. (Alphaproteobacteria) was related to the transformation of glyphosate in our microbial consortium. The present study highlights the complexity of microbial interactions between

photoautotrophs and heterotrophs in microbial assemblages that can contribute to the degradation of pesticides present in aquatic environments.

Accès au document

Destruction of Cell Topography, Morphology, Membrane, Inhibition of Respiration, Biofilm Formation, and Bioactive Molecule Production by Nanoparticles of Ag, ZnO, CuO, TiO2, and Al2O3 toward Beneficial Soil Bacteria

Authors: Ahmed B, Ameen F, Rizvi A, and more...

Source: ACS OMEGA, 5(14):7861-7876, 2020, DOI: 10.1021/acsomega.9b04084

Abstract: The unregulated discharge of nanoparticles (NPs) from various nanotechnology industries into the environment is expected to alter the composition and physiological functions of soil microbiota. Considering this knowledge gap, the impact of five NPs (Ag, ZnO, CuO, Al2O3, and TiO2) differing in size and morphology on growth behavior and physiological activity of Azotobacter chroococcum, Bacillus thuringiensis, Pseudomonas mosselii, and Sinorhizobium meliloti were investigated. Various biochemical and microscopic approaches were adopted. Interestingly, all bacterial strains were found sensitive to Ag-NPs and ZnO-NPs but showed tolerance toward CuO, Al2O3, and TiO2-NPs. The loss of cellular respiration due to NPs was coupled with a reduction in population size. ZnO-NPs at 387.5 erg mL (-1) had a maximum inhibitory impact on A. chroococcum and reduced its population by 72%. Under Ag-NP stress, the reduction in IAA secretion by bacterial strains followed the order *S. meliloti* (74%) > *P. mosselii* (63%) > *A. chroococcum* (49%). The surface of bacterial cells had small- or large-sized aggregates of NPs. Also, numerous gaps, pits, fragmented, and disorganized cell envelopes were visible. Additionally, a treated cell surface appeared corrugated with depressions and alteration in cell length and a strong heterogeneity was noticed under atomic force microscopy (AFM). For instance, NPs induced cell roughness for *P. mosselii* followed the order 12.6 nm (control) > 58 nm (Ag-NPs) > 41 nm (ZnO-NPs). TEM analysis showed aberrant morphology, cracking, and disruption of the cell envelope with extracellular electrondense materials. Increased permeability of the inner cell membrane caused cell death and lowered EPS production. Ag-NPs and ZnO-NPs also disrupted the surface adhering ability of bacteria, which varied with time and concentration of NPs. Conclusively, a plausible mechanism of NP toxicity to bacteria has been proposed to understand the mechanistic basis of ecological interaction between NPs and resourceful bacteria. These results also emphasize to develop strategies for the safe disposal of NPs.

Accès au document

Study of Arsenic-Contaminated Soil Bacterial Community Using Biochip Technology

Authors: Bunin E, Khatisashvili G, Varazi T, and more...

Source: WATER AIR AND SOIL POLLUTION, 231(5), 2020, DOI: 10.1007/s11270-020-04575-1

Abstract: The ecosystems near arsenic mining industrial areas are characterized with an elevated level of pollutants. In Caucasus region, such a hotspot is presented in Western Georgia: Uravi and Tsana abandoned arsenic production facilities and nearby mining tailings stored in deteriorating conditions that pose a threat to the population. The research presents a study of the local bacteria community of highly arsenic-contaminated soils (from 400 mg/kg at Uravi arsenic sulfide mineral processing facility to 11.3 g/kg at arsenic oxide storage area in Tsana) using an innovative, multitasking microscale bioanalytical method for environmental enquiries - DNA biochip (microarray). The detected *Shewanella* spp., *Bacillus* spp., and sulfate-reducing bacteria were considered as promising objects for future projects on in situ recovery of vast arsenic-contaminated areas applying remediation methods.

Accès au document

Probing the single and combined toxicity of PFOS and Cr(VI) to soil bacteria and the interaction mechanisms

Authors: Li Ji, Zheng T, Yuan D, and more...

Source: CHEMOSPHERE, 249, 2020, DOI :10.1016/j.chemosphere.2020.126039

Abstract: Many research focused on the removal of perfluorooctane sulfonic acid (PFOS) and hexavalent chromium (Cr(VI)) in some industrial wastewater (e.g. electroplating wastewater), but few research reported the combined toxicity of PFOS and Cr(VI) to soil bacteria. Therefore, the toxicity and mechanisms of the combined PFOS and Cr(VI) to bacteria (with *Bacillus subtilis* as a model) are explored. The results show that the combined PFOS and Cr(VI) exhibits much higher toxicity to the bacteria than that of Cr(VI) alone. The growth profile of Bacillus subtilis exposed by the combined pollution decreased by 18% and 56%, respectively, compared with that of single Cr(VI) and the control, indicating the combined toxicity to Bacillus subtilis is synergistic. Moreover, the changes of EPSs in Bacillus subtilis, such as decreased potential, increased extracellular polysaccharides, decreased extracellular proteins and irregular morphology, also confirmed that the combined PFOS and Cr(VI) caused greater toxicity. The increase of intracellular ROS and permeability of dye 4', 6-diamidino-2-phenylindoledihydrochloride (DAPI) suggest that oxidative damage and increased membrane permeability are the main mechanisms of toxicity induced by the combined PFOS and Cr(VI). This work could provide useful information for the risk assessment of co-exposure to PFOS and heavy metals in the natural environment.

Accès au document

Ecological responses of soil microbial abundance and diversity to cadmium and soil properties in farmland around an enterprise-intensive region

Authors: Liu H, Wang C, Xie Y, Luo Y, and more...

Source: JOURNAL OF HAZARDOUS MATERIALS, 392, 2020, DOI: 10.1016/j.jhazmat.2020.122476

Abstract: Microorganisms play a vital role in soil biochemical process in contaminated managed ecosystems. In the present study, a field investigation was conducted in farmland around an industrial intensive region contaminated with cadmium, and the changes of microbial assemblages in contaminated soils were assessed by 16S rRNA sequencing and the further statistical analysis. The results revealed obvious variations in microbial richness between referenced and contaminated soils, with Proteobacteri, Chloroflexi, Actinobacteria, Acidobacteria and Nitrospirae dominating the studied communities around the industrial intensive region. Redundancy analysis and Spearman correlation heatmap revealed that about 68.95 % of overall variation in microbial community composition was explained by soil physiochemical properties and Cd existence, among which pH, soil total phosphorus, total nitrogen, organic carbon (OC) and available Cd were identified as dominant factors. No significant difference was found in the similarities and Beta-diversity analysis among different groups. In conclusion, this study revealed the ecological effects of physiochemical parameters and Cd stress on the diversity and abundance of microbial communities, and these findings provided the detailed and integrated correlation between the main factors and microbial indexes in Cd contaminated farmland around the industrial intensive region.

Accès au document

Microbial strategies in non-target invasive *Spartina densiflora* for heavy metal clean up in polluted saltmarshes

Authors: Mesa-Marin J, Redondo-Gomez S, Rodriguez-Llorente I, Pajuelo E, Mateos-Naranjo E

Source: ESTUARINE COASTAL AND SHELF SCIENCE, 238, 2020, DOI: 10.1016/j.ecss.2020.106730

Abstract: Rhizoremediation is the use of microorganisms from the rhizosphere to assist plant phytoremediation. Optimistic results have been obtained these years for this biotool, but its effects in non-target cohabiting species has never been studied. This concern, in principle pointless, gains importance when the non-target species is an invasive plant. It is the case of highly polluted saltmarshes in SW Spain, where the native cordgrass *Spartina maritima*, proposed for heavy metal rhizoremediation, cohabitates with the invasive Spartina densiflora. In this work, we designed a greenhouse experiment where S. densiflora was placed in pots with natural metal polluted soil from Tinto marsh and inoculated with a bacterial consortium designed for rhizoremediation purposes with S. *maritima*. After 30 days of treatment, our data revealed that inoculated S. *densiflora* showed better fitness and metal accumulation capacity than non-inoculated control plants. This enhancement was demonstrated by increased S. densiflora biomass (58% for belowground tissues), amelioration of photosynthetic parameters (i.e., 48% for net photosynthetic rate (A(N)) and stomatal conductance (g(s)) and 17% for intrinsic water-use efficiency (iWUE)), and finally by an increase of inoculated S. densiflora root metal uptake, reaching around 40% in case of cadmium and lead. Within this scenario, the rhizoremediation strategy proposed using S. maritima should be managed cautiously, and if would be entitled to determine to which extent its practical implementation may boost invasive capability of S. densiflora.

Accès au document

Co-presence of the anionic surfactant sodium lauryl ether sulphate and the pesticide chlorpyrifos and effects on a natural soil microbial community

Authors: Pescatore T, Patrolecco L, Rolando L and more...

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, DOI: 10.1007/s11356-020-08840-y

Abstract: There is a growing concern about the simultaneous presence in the environment of different kinds of pollutants, because of the possible synergic or additive effects of chemical mixtures on ecosystems. Chlorpyrifos (CPF) is an organophosphate insecticide extensively used in agricultural practices. The anionic surfactant sodium lauryl ether sulphate (SLES) is the main component of several commercial products, including foaming agents used in underground mechanised excavation. Both compounds are produced and sold in high amounts worldwide and can be found in the environment as soil contaminants. The persistence of SLES and CPF in agricultural soils and their possible effects on the natural microbial community was evaluated in microcosms. The experimental set consisted of soil samples containing the autochthonous microbial community and treated with only SLES (70 mg/kg), only CPF (2 mg/kg) or with a mix of both compounds. Control microcosms (without the contaminants) were also performed. Soil samples were collected over the experimental period (0, 7, 14, 21 and 28 days) and analysed for CPF, SLES and the main metabolite of CPF (3, 5, 6-trichloropyridinol, TCP). The half-life time (DT50) of each parent compound was estimated in all experimental conditions. At the same time, the abundance, activity and structure of the microbial community were also evaluated. The results showed that the co-presence of SLES and CPF did not substantially affect their persistence in soil (DT50 of 11 and 9 days with co-presence and 13 and 10 days, respectively, when alone); however, in the presence of SLES, a higher amount of the metabolite TCP was found. Interestingly, some differences were found in the bacterial community structure, abundance and activity among the various conditions.

Accès au document

Bioaugmentation assisted mycoremediation of heavy metal and/metalloid landfill contaminated soil using

consortia of filamentous fungi

Authors: Hassan A, Pariatamby A, Ossai IC, Hamid F

Source: BIOCHEMICAL ENGINEERING JOURNAL, 157, 2020, DOI: 10.1016/j.bej.2020.107550

Abstract: This research aimed to demonstrate the significance of bioaugmentation in the mycoremediation of metals and metalloid (Cr, Cu, As, Fe, Mn) polluted landfill soil using consortia of autochthonous filamentous fungi. The fungal consortia used were Ascomycota, all isolated fungi, and Basidiomycota. Bioremediation was monitored for pH, redox potential, electrical conductivity, residual heavy metal/metalloid content, fungal population and enzyme activity at day 0 (initial day), day 20, day 60 and day 100. Results have shown a decreasing trend for all the monitored physicochemical parameters. Fungal organisms have a maximum tolerance index of 1.0 on Fe, Cu and Cr supplemented Agar medium. Highest colony count of 1.17 x 10(10) CFU/g soil was recorded in Basidiomycota treated soil. On the other hand, a consortium of all isolated fungi proved efficient in the removal of As (77 %), Mn(71 %), Cr(60 %), and Cu(52 %). Meanwhile, Fe removal of 56 % was prioritized by the Ascomycota consortium. Acid phosphatase had the weakest activity (0.03 - 0.72 mu mol PNPg (-1) dry soil h(-1)) for all the treatments. FTIR results have shown the appearance of absorption peaks at 1485 - 1445 cm (-1) only in soil amended with fungal consortia. Fungi bioaugmented soil had the maximum metal bio removal efficiency than the untreated control soil (P < 0.05).

Accès au document

Sequential microbial-photocatalytic degradation of imidacloprid

Authors: Sharma T, Kaur M, Sobti A, and more...

Source: ENVIRONMENTAL ENGINEERING RESEARCH, 25(4):597-604, 2020, DOI: 10.4491/eer.2019.150

Abstract: In the present study, the application of sequential biological and photocatalytic process was evaluated as a feasible process for the degradation of imidacloprid (IMI) in soil. Photocatalysis was carried out as a post and pre-treatment to the biological process as Microbial Photocatalytic (MP) and Photocatalytic Microbial (PM), respectively, to enhance the degradation and mineralization of IMI in soil. By both the processes, there was an enhancement in the percentage degradation of IMI i.e 86.2% for PM and 94.6% for MP process. The obtained results indicate that MP process is apparently more efficient in degradation of IMI which was observed with 15 days of biological treatment followed by 18 h of photocatalytic degradation (15 d + 18 h). The present work also reveals that though the difference in terms of the degradation of IMI after 5 d + 18 h, 10 d + 18 h & 15 d + 18 h of MP process is not drastic, yet significant variation has been observed in terms of mineralization that truly signifies the removal of IMI from the soil. The LC analysis has shown that the intermediates formed during MP process are more and smaller in comparison to PM process, which further provides evidence that MP process is better than PM process for effective degradation of IMI in soil.

Accès au document

Metagenomic applications in microbial diversity, bioremediation, pollution monitoring, enzyme and drug discovery. A review

Authors: Datta S, Rajnish KN, Samuel M, and more...

Source: ENVIRONMENTAL CHEMISTRY LETTERS, DOI: 0.1007/s10311-020-01010-z

Abstract: Metagenomics is a technology employed to study genetic material directly isolated from environmental samples. Metagenomics thus reveals knowledge on microbial communities of uncultivable organisms in environmental niches, using screening technologies based on sequence and function. Applications include the identification of novel bacteria or gene clusters encoding for enzymes that degrade pollutants. Metagenomics also help to diagnose and monitor pathogens. Here, we

review application of metagenomics for bioremediation, pollution monitoring, enzyme, and drug discovery.

Accès au document

Effects of biodegradable plastic film mulching on soil microbial communities in two agroecosystems

Authors: Bandopadhyay S, Sintim H Y, DeBruyn JM

Source: PEERJ, 8, 2020, DOI: 10.7717/peerj.9015

Abstract: Plastic mulch films are used globally in crop production but incur considerable disposal and environmental pollution issues. Biodegradable plastic mulch films (BDMs), an alternative to polyethylene (PE)-based films, are designed to be tilled into the soil where they are expected to be mineralized to carbon dioxide, water and microbial biomass. However, insufficient research regarding the impacts of repeated soil incorporation of BDMs on soil microbial communities has partly contributed to limited adoption of BDMs. In this study, we evaluated the effects of BDM incorporation on soil microbial community structure and function over two years in two geographical locations: Knoxville, TN, and in Mount Vernon, WA, USA. Treatments included four plastic BDMs (three commercially available and one experimental film), a biodegradable cellulose paper mulch, a non-biodegradable PE mulch and a no mulch plot. Bacterial community structure determined using 16S rRNA gene amplicon sequencing revealed significant differences by location and season. Differences in bacterial communities by mulch treatment were not significant for any season in either location, except for Fall 2015 in WA where differences were observed between BDMs and no-mulch plots. Extracellular enzyme assays were used to characterize communities functionally, revealing significant differences by location and sampling season in both TN and WA but minimal differences between BDMs and PE treatments. Overall, BDMs had comparable influences on soil microbial communities to PE mulch films.

Accès au document

Bacterial community diversity in the rhizosphere of nickel hyperaccumulator plant species from Borneo Island (Malaysia)

Authors: Lopez S, van der Ent A, Sumail S, and more...

Source: ENVIRONMENTAL MICROBIOLOGY, 22(4):1649-1665, 2020, DOI: 10.1111/1462-2920.14970

Abstract: The Island of Borneo is a major biodiversity hotspot, and in the Malaysian state of Sabah, ultramafic soils are extensive and home to more than 31 endemic nickel hyperaccumulator plants. The aim of this study was to characterize the structure and the diversity of the rhizosphere bacterial communities of several of these nickel hyperaccumulator plants and factors that affect these bacterial communities in Sabah. The most abundant phyla were Proteobacteria, Acidobacteria and Actinobacteria. At family level, Burkholderiaceae and Xanthobacteraceae (Proteobacteria phylum) were the most abundant families in the hyperaccumulator rhizospheres. Redundancy analysis based on soil chemical analyses and relative abundances of the major bacterial phyla showed that abiotic factors of the studied sites drove the bacterial diversity. For all *R. aff. bengalensis* rhizosphere soil samples, irrespective of studied site, the bacterial diversity was similar. Moreover, the Saprospiraceae family showed a high representativeness in the *R. aff. bengalensis* rhizosphere soils and was linked with the nickel availability in soils. The ability of *R. aff. bengalensis* to concentrate nickel in its rhizosphere appears to be the major factor driving the rhizobacterial community diversity unlike for other hyperaccumulator species.

Accès au document

Cadmium influences the litter decomposition of *Solidago canadensis* L. and soil N-fixing bacterial communities

Authors: Wang C, Wei M, Wang S, and more...

Source: CHEMOSPHERE, 246, 2020, DOI: 10.1016/j.chemosphere.2019.125717

Abstract: It is important to illuminate the effects of litter decomposition of invasive alien species on soil N-fixing bacterial communities (SoNiBa), especially under heavy metal pollution to better outline the mechanisms for invasion success of invasive alien species. This study attempts to identify the effects of litter decomposition of *Solidago canadensis* L. on SoNiBa under cadmium (Cd) pollution with different concentrations (i.e., low concentration, 7.5 mg/kg soil; high concentration, 15 mg/kg soil) via a polyethylene litterbags-experiment. Electrical conductivity and total N of soil were the most important environmental factors for determining the variations of SoNiBa composition. *S. canadensis* did not significantly affect the alpha diversity of SoNiBa but significantly affect the beta diversity of SoNiBa and SoNiBa composition. Thus, SoNiBa composition, rather than alpha diversity of SoNiBa, was the most important determinant of the invasion success of S. canadensis. Cd with 15 mg/kg soil did not address distinct effects on alpha diversity of SoNiBa, but Cd with 7.5 mg/kg soil noticeably raised the number of species and species richness of SoNiBa mainly due to the hormonal effects. The combined S. canadensis and Cd with 15 mg/kg soil obviously decreased cumulative mass losses and the rate of litter decomposition (k) of S. canadensis, but the combined S. canadensis and Cd with 7.5 mg/kg soil evidently accelerated cumulative mass losses and k of S. canadensis. Thus, Cd with 7.5 mg/kg soil can accelerate litter decomposition of S. canadensis, but Cd with 15 mg/kg soil can decline litter decomposition of *S. canadensis*.

Accès au document

Characterization of a high cadmium accumulating soil bacterium, *Cupriavidus* sp. WS2

Authors: Shi Z, Zhang Z, Yuan M., and more...

Source: CHEMOSPHERE, 247, 2020, DOI: 10.1016/j.chemosphere.2020.125834

Abstract: Cadmium (Cd) is one of the most harmful heavy-metals, its accumulation in crops can lead to severe ecological and healthy problems. Bioremediation using microbes to remove Cd or reduce the bioavailability of Cd is considered as a promising approach for Cd pollution control. Here, we described the isolation and characterization of a high Cd-accumulating bacterial strain, Cupriavidus sp. WS2, from the heavy-metals contained soil at the Wuhan Iron and Steel Company area. WS2 can survive under the high Cd conditions and immobilize Cd by biosynthesizing intracellular Cd-containing nanoparticle inclusions. In the co-inoculation test WS2 also significantly decreased the accumulation of Cd in rice seedlings. All our results suggested that Cupriavidus sp. WS2 may harbor a great potential for the bioremediation applications of Cd pollution.

Accès au document

Lead toxicity induced phytotoxic impacts on rapeseed and clover can be lowered by biofilm forming lead tolerant bacteria

Authors: Shah T, Munsif F, D'amato R, Nie L

Source: CHEMOSPHERE, 246, 2020, DOI: 10.1016/j.chemosphere.2019.125766

Abstract: Lead (Pb+2) is a heavy metal and one of the main environmental pollutant, toxic to plants, animals and humans. Present study was conducted to evaluate ten plant growth promoting bacteria strains (B1-10) for biofilm production and their effect on growth indices, physiology, yield, antioxidant profile and lead uptake in rapeseed (Brassica napus) and clover (*Trifolium repens*) in lead polluted soil under nutrient broth medium and pot condition. Three pre-characterized biofilm forming lead tolerant growth promoting strains (B3: *Pseudomonas fluorescens*), B6: *Pseudomonas putida* and (B8: *Bacillus safensis*) were used to inoculate rapeseed and clover growing in the soil polluted with different levels (400, 800 and 1200 mg kg(-1)) of Pb arranged in completely randomized design with factorial arrangement. Results from screening experiment exhibited that more biofilm was produced by B3, B6 and B8 under highest level of lead contamination (1200 mg

kg(-1)). Further, lead contamination decreased rapeseed and clover growth, physiology and yield at all levels of lead stress. But biofilm forming lead tolerant growth promoting bacteria application in lead contaminated soil enhanced rapeseed and clover growth, physiology, yield, antioxidant profile, proline and decreased malanodialdehyde content (which was decreased by different strains application under lead stress) of rapeseed and clover over no inoculation. Inoculation with all strains also increased the lead uptake in roots, shoots and decreased lead uptake in seeds of rapeseed and clover than plants in lead stress without inoculation.

Accès au document

The metolachlor degradation kinetics and bacterial community evolution in the soil bioelectrochemical remediation

Authors: Li X, Li Y, Zhang X, and more...

Source: CHEMOSPHERE, 248, 2020, DOI: 10.1016/j.chemosphere.2020.125915

Abstract: Herbicide-polluted soils have posed a threat to the crop growth and agro-product quality and safety. Even worse, the low-content of residue is still appreciable for a long time in subsurface soils. The soil bioelectrochemical remediation system (BERS) provides an inexhaustible electron acceptor to cause in situ indigenous microorganisms to generate biocurrent and accelerate the removal of metolachlor (ML). As a result of carbon fiber amendment, the highest current density (637 +/- 19 mA/m(2)) to date has been generated in a soil BERS. The ML half-life and complete removal time decreased from 21 to 3 d and from 245 to 109 d, respectively. Importantly, the soil BERS was verified to be an effective treatment method for low-polluted sediments/soils, whether by ML or by its degradates. The quantitative degradates of ML showed that the first step was dechlorination based on the bioelectrochemical degradation pathway. The biocurrent selectively enriched special species, e.g., Geobacter and Thermincola for bioelectricity generation and Ralstonia, Phyllobacterium and Stenotrophomonas for degradation in soils. Meanwhile, Flavi-solibacter and Gemmatimonas occupied the core niche in strengthening interspecific relationships by the biocurrent. This study firstly revealed the explicit abundance of Geobacter in agricultural soils and laid a foundation for the function design of mixed bacteria in the sediment/soil BERS.

Accès au document

Carbon and nitrogen cycling in a lead polluted grassland evaluated using stable isotopes (delta C-13 and delta N-15) and microbial, plant and soil parameters

Authors: Rijk IJC, Ekblad A

PLANT AND SOIL, 449(1-2):249-266, 2020, DOI: 10.1007/s11104-020-04467-7

Abstract: Aims Carbon (C) and nitrogen (N) cycling are key ecosystem functions potentially altered by heavy metal pollution. We used an ecosystem approach to study the long-term effect of lead (Pb) on C and N cycles in a natural grassland in a former shooting range. Methods Microbial activity was evaluated by substrate-induced respiration (SIR) in situ, adding isotopically labelled C-4-sugar to the soil. C and N contents and natural abundance of isotopes were measured in grass leaves, soil and microbial biomass together with root biomass. Results A reduced microbial activity and microbial biomass per area, together with a higher soil C stock and C:N ratio suggested a lower microbial decomposition in high Pb compared to low Pb areas. A more closed N cycle in the high Pb area was indicated by 2-3 parts per thousand lower delta N-15 in leaves and soil compared to low Pb areas. Higher delta C-13 in leaves and higher root biomass but similar leaf nutrient contents indicated plant responses and adaptions to the high Pb. Conclusions The applied ecosystem approach revealed that Pb slowed down the C and N cycles, possibly by indirect effects rather than by direct toxicity. The ecosystem seems to have adapted to altered conditions.

Accès au document

Inoculation of Cd-contaminated paddy soil with biochar-supported microbial cell composite: A novel approach to reducing cadmium accumulation in rice grains

Authors: Liu Y, Tie B, Peng O, and More...

Source: CHEMOSPHERE, 247, 2020, DOI: 10.1016/j.chemosphere.2020.125850

Abstract: Bioremediation of heavy metal-contaminated soil using metal-resistant microbes is a promising remediation technology. However, as exogenous bacteria sometimes struggle to survive and grow when introduced to new soils, it is important to develop appropriate carriers for microbial populations. In this study, we report a novel approach to remediating Cd-contaminated rice paddy soil using biochar-supported microbial cell composites (BMCs) produced from agricultural waste (cornstalks). Pot experiments showed that amendment with BMC was more efficient at reducing root and grain Cd content than pure bacteria, while improving soil Cd fractionation toward more stabilized and less labile forms. Bacteria in the BMC medium grew more readily with more abundant metabolites than those raised in free cells, probably because biochar provides shelter via porous structures (as confirmed by scanning electron microscopy) as well as additional nutrients. Overall, the improved long-term production of microbial biomass caused by BMC inoculation results in a higher remediation efficiency. Our results demonstrate the feasibility of using biochar as an appropriate carrier for metal-tolerant bacteria to remediate Cd-contaminated paddy fields.

Accès au document

Zeolite-supported nanoscale zero-valent iron for immobilization of cadmium, lead, and arsenic in farmland soils: Encapsulation mechanisms and indigenous microbial responses

Authors: Li Z, Wang L, Wu J, and More...

Source: ENVIRONMENTAL POLLUTION, 260, 2020, DOI: 10.1016/j.envpol.2020.114098

Abstract: Zeolite-supported nanoscale zero-valent iron (Z-NZVI) has great potential for metal(loid) removal, but its encapsulation mechanisms and ecological risks in real soil systems are not completely clear. We conducted long-term incubation experiments to gain new insights into the interactions between metal(loid) s (Cd, Pb, As) and Z-NZVI in naturally contaminated farmland soils, as well as the alteration of indigenous bacterial communities during soil remediation. With the pH-adjusting and adsorption capacities, 30 g kg(-1) Z-NZVI amendment significantly decreased the available metal(loid) concentrations by 10.2-96.8% and transformed them into strongly-bound fractions in acidic and alkaline soils after 180 d. An innovative magnetic separation of Z-NZVI from soils followed by XRD and XPS characterizations revealed that B-type ternary complexation, heterogeneous coprecipitation, and/or concurrent redox reactions of metal(loid)s, especially the formation of Cd-3(AsO4)(2), PbFe2(AsO4)2(OH)(2), and As-0, occurred only under specific soil conditions. Sequencing of 16S rDNA using Illumina MiSeq platform indicated that temporary shifts in iron-resistant/sensitive, pH-sensitive, denitrifying, and metal-resistant bacteria after Z-NZVI addition were ultimately eliminated because soil characteristics drove the re-establishment of indigenous bacterial community. Meanwhile, Z-NZVI recovered the basic activities of bacterial DNA replication and denitrification functions in soils. These results confirm that Z-NZVI is promising for the long-term remediation of metal(loid)s contaminated farmland soil without significant ecotoxicity.

Accès au document

Assessing microbial degradation degree and bioavailability of BDE-153 in natural wetland soils: Implication by compound-specific stable isotope analysis

Authors: Wang G, Liu Y, Tao W, and more...

Source: ENVIRONMENTAL POLLUTION, 260, DOI: 10.1016/j.envpol.2020.114014

Abstract: Microbial degradation is an important pathway for the attenuation of polybrominated diphenyl ethers (PBDEs) in natural soils. In this study, the compound-specific stable isotope analysis (CSIA) was applied to characterize microbial degradation of BDE-153, one of the prevailing and toxic PBDE congeners, in natural wetland soils. During the 45-day incubation, the residual percentages of BDE-153 decreased to 67.9% and 73.6% in non-sterilized soils spiked with 1.0 and 5.0 μg/g, respectively, which were both much lower than those in sterilized soils (96.0% and 97.2%). This result indicated that microbial degradation could accelerate BDE-153 elimination in wetland soils. Meanwhile, the significant carbon isotope fractionation was observed in non-sterilized soils, with delta C-13 of BDE-153 shifting from -29.4 parts per thousand to -26.7 parts per thousand for 1.0 μg/g and to -27.2 parts per thousand for 5.0 μg/g, respectively, whilst not in sterilized soils. This phenomenon indicated microbial degradation could induce stable carbon isotope fractionation of BDE-153. The carbon isotope enrichment factor (epsilon(c)) for BDE-153 microbial degradation was first determined as -7.58 parts per thousand, which could be used to assess the microbial degradation and bioavailability of BDE-153 in wetland soils. Based on delta C-13 and epsilon(c), the new methods were developed to dynamically and quantitatively estimate degradation degree and bioavailability of BDE-153 during degradation process, respectively, which could exclude interference of physical processes. This work revealed that CSIA was a promising method to investigate in situ microbial degradation of PBDEs in field studies.

Accès au document

Comparative characterization of microbial communities that inhabit arsenic-rich and antimony-rich contaminated sites: Responses to two different contamination conditions

Authors: Sun X, Kong T, Xu R, Li B, Sun W

Source: ENVIRONMENTAL POLLUTION, 260, 2020, DOI: 10.1016/j.envpol.2020.114052

Abstract: Due to extensive mining and industrial activities, arsenic (As) and antimony (Sb) contaminations are becoming a global environmental concern. Both As and Sb are toxic and carcinogenic metalloids from the group 15 in the periodic table. Since As and Sb share many similar geochemical properties, it is often assumed that they exert similar environmental pressure on the native microbial communities. This hypothesis, however, still requires further confirmation. In the current study, a systematic comparison of microbial responses to As and Sb contamination were conducted. The results suggested that regular geochemical parameters, such as pH, nitrate, and TOC, were the driving forces for shaping the microbial community. In correspondence, two heavily contaminated groups showed similar microbial community compositions and the same microbial populations were enriched. The interactions between the contaminant fractions (As and Sb related fractions) and the individual OTUs, however, suggested the different and more diverse impacts of As comparing to Sb fractions, with more taxa significantly impacted by As species comparing to Sb species. The identification of the keystone taxa in the heavily contaminated samples revealed a group of microbial populations that could survive in both As and Sb heavily contaminated conditions and may providing critical environmental services to the community. Further investigation of these key microbial populations may provide valuable insights on employing these microorganisms for remediation applications.

Accès au document

Transcriptome profiling of the fungus *Aspergillus nidulans* exposed to a commercial glyphosate-based herbicide under conditions of apparent herbicide tolerance

Authors: Mesnage R, Oestreicher N, Poirier F, Nicolas V, Boursier C, Velot C

Source: ENVIRONMENTAL RESEARCH, 182, 2020, DOI: 10.1016/j.envres.2020.109116

Abstract: Glyphosate-based herbicides, such as Roundup (R), are the most widely used non-selective, broad-spectrum herbicides. The release of these compounds in large amounts into the environment is susceptible to affect soil quality and health, especially because of the non-target effects on a large range of organisms including soil microorganisms. The soil filamentous fungus Aspergillus nidulans, a well-characterized experimental model organism that can be used as a bio-indicator for agricultural soil health, has been previously shown to be highly affected by Roundup GT Plus (R450: 450 g/L of glyphosate) at concentrations far below recommended agricultural application rate, including at a dose that does not cause any macroscopic effect. In this study, we determined alterations in the transcriptome of A. nidulans when exposed to R450 at a dose corresponding to the no-observed-adverse-effect level (NOAEL) for macroscopic parameters. A total of 1816 distinct genes had their expression altered. The most affected biological functions were protein synthesis, amino acids and secondary metabolisms, stress response, as well as detoxification pathways through cytochromes P450, glutathione-S-transferases, and ABC transporters. These results partly explain the molecular mechanisms underlying alterations in growth parameters detected at higher concentrations for this ascomycete fungus. In conclusion, our results highlight molecular disturbances in a soil fungus under conditions of apparent tolerance to the herbicide, and thus confirm the need to question the principle of "substantial equivalence" when applied to plants made tolerant to herbicides.

Accès au document

Resistant fungi isolated from contaminated uranium mine in Brazil shows a high capacity to uptake uranium from water

Authors: Coelho E, Reis TA, Cotrim M, Mullan TK, Correa B

Source: CHEMOSPHERE, 248, 2020, DOI: 10.1016/j.chemosphere.2020.126068

Abstract: The Osamu Utsumi uranium mine occupies a 20 km(2) area in the city of Caldas, which is located in the state of Minas Gerais, Brazil. Since mining activities ended at Osamu Utsumi 24 years ago, the surrounding area has become contaminated by acid effluents containing high concentrations of uranium. Thus, the aim of this study was to assess the uranium bioremediation capacity of 57 fungi isolated from the mine area. In tolerance tests, 38% (22) of the fungal isolates were considered tolerant to uranium, including 10 Penicillium species. At a uranium concentration of 2000 mg L-1 48 fungi did not exhibit mycelial growth index inhibition. Minimal inhibitory concentration (MIC) analysis showed growth of 25 fungi above a uranium concentration of 8000 mg L-1. At high uranium concentrations, some fungi (i.e., Talaromyces amestolkiae and Penicillium citrinum) showed morphological changes and pigment (melanin) production. Among the fungal isolates, those considered to be more tolerant to uranium were isolated from soil and sediment samples containing higher concentrations of heavy metal. When comparing the results of resistance/tolerance tests with those for uranium biosorption capacity, we concluded that the fungi isolated from the Osamu Utsumi mine with the best potential for uranium bioremediation were Gongronella butleri, Penicillium piscarium, Penicillium citrinum, Penicillium ludwigii, and Talaromyces amestolkiae. Biosorption tests with live fungal biomass showed that 11 species had a high potential for uranium uptake from contaminated water.

Accès au document

New insights into the microbial degradation and catalytic mechanism of synthetic pyrethroids

Authors: Zhan H, Huang Y, Lin Zi, Bhatt P, Chen S

Source: ENVIRONMENTAL RESEARCH, 182, 2020, DOI: 10.1016/j.envres.2020.109138

Abstract: The significant applications of pyrethroid insecticides in agro-ecosystem and household environments have raised serious

environmental concerns. Environmental bioremediation has emerged as an effective and eco-friendly approach to remove or neutralize hazardous compounds. Bioaugmentation accelerates pyrethroid degradation in liquid cultures and soil. Pyrethroid-degrading microorganisms have been extensively studied to cope with pyrethroid residues. Microorganisms primarily hydrolyze the ester bonds of pyrethroids, and their degradation pathways have been elaborated. The functional genes and enzymes involved in microbial degradation have also been screened and studied. Carboxylesterase plays a key role in pyrethroid degradation by cleaving its carboxylester linkage. The catalytic mechanism is dependent on a specific catalytic triad, consisting of three amino acid residues (glutamine, histidine, and serine) within the active site of the carboxylesterase enzyme. Pyrethroid-degrading strains and enzymes have proven to be effective for the bioremediation of pyrethroid-contaminated environments. In this review, we have summarized newly isolated pyrethroid-degrading strains and proposed the degradation pathways along with key functional genes/enzymes. To develop an efficient bioremediation strategy, pyrethroid-degrading microorganisms should be comprehensively explored.

Accès au document

Algae-based heavy metal remediation in acid mine drainage: a review

Author: Mang KC, Ntushelo K

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH, 18(2):2499-2512, 2020, DOI: 10.15666/aeer/1802_24992512

Abstract: The production of acid mine drainage (AMD) is among the factors responsible for much of the degradation of water and soil resources and the disruption of biodiversity in the environment. Several studies have shown that organisms (either macro or micro) present at sites contaminated with AMD have the potential to bioaccumulate heavy metals and hence stimulate their application in bioremediation processes. Algal strains are not an exception to those organisms found in AMD. This review was aimed at examining the heavy metal remediation of AMD using algae, remediation properties of algae and different algal-based methods used in heavy metal remediation of AMD. Algal strains such as Spirulina sp., Chlorella spp., Scenedesmus spp., Cladophora spp., Oscillatoria spp., Anabaena spp. and Phaeodactylum tricornutum act as "hyper-accumulators" and "hyper-adsorbents" with a high selectivity for different elements from AMD. However, algae-based methods of abating AMD are not the ultimate solution to the problem and there is room for more studies. The current study suggests further attention to phycoremediation individually and synergistically with sulphate-reducing bacteria.

Accès au document

Bacterial abundance along a gradient of heavy metal contaminated soils in the region of Zlatitsa-Pirdop valley, western Bulgaria

Source: Aleksova M, Palov D, Dinev N, and more...

Source: COMPTES RENDUS DE L ACADEMIE BULGARE DES SCIENCES, 73(3):433-440, 2020, DOI: 10.7546/CRABS.2020.03.18

Abstract: This study presents the distribution of bacterial abundance in the soil from three sites along the gradient of Cu (53-860 mg kg (-1)), Zn and Pb, located in the region of Zlatitsa-Pirdop valley, Western Bulgaria. The bacterial abundance was determined by the use of colony forming units and quantitative PCR techniques in five soil samples, collected at 0-20 cm depth. Our results showed that the number of cultivable heterotrophic bacteria and 16S rRNA gene copies decreased in long-term heavy metals contaminated soils. The distribution of 16S rRNA gene copies was mainly affected by the concentration of heavy metals, as well as by the land use. The principal component analysis was used to visualize the relationships between

bacterial abundance, soil physico-chemical properties and sampling sites. The results showed that the less polluted sites were grouped in a single cluster with the highest number of 16S r RNA gene copies, whereas the most polluted site was clustered separately. This study highlights that heavy metal contamination and the land use have significant impact on soil bacteria.

Accès au document

Complete genome sequencing and comparative genomic analyses of *Bacillus* sp. S3, a novel hyper Sb(III)-oxidizing bacterium

Authors: Li JK, Gu TY, Li LZ, and more...

Source: BMC MICROBIOLOGY, 20(1), 2020, DOI: 10.1186/s12866-020-01737-3

Abstract: Background Antimonite [Sb(III)]-oxidizing bacterium has great potential in the environmental bioremediation of Sb-polluted sites. *Bacillus* sp. S3 that was previously isolated from antimony-contaminated soil displayed high Sb(III) resistance and Sb(III) oxidation efficiency. However, the genomic information and evolutionary feature of Bacillus sp. S3 are very scarce. Results Here, we identified a 5,436,472 bp chromosome with 40.30% GC content and a 241,339 bp plasmid with 36.74% GC content in the complete genome of Bacillus sp. S3. Genomic annotation showed that Bacillus sp. S3 contained a key aioB gene potentially encoding As (III)/Sb(III) oxidase, which was not shared with other Bacillus strains. Furthermore, a wide variety of genes associated with Sb(III) and other heavy metal (loid) s were also ascertained in Bacillus sp. S3, reflecting its adaptive advantage for growth in the harsh eco-environment. Based on the analysis of phylogenetic relationship and the average nucleotide identities (ANI), Bacillus sp. S3 was proved to a novel species within the Bacillus genus. The majority of mobile genetic elements (MGEs) mainly distributed on chromosomes within the Bacillus genus. Pan-genome analysis showed that...

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Kinetic Study of the Biodegradation of Acephate by Indigenous Soil Bacterial Isolates in the Presence of Humic Acid and Metal Ions

Authors: Singh S, Kumar V, Singla S and more...

Source: BIOMOLECULES, 10(3), 2020, DOI: 10.3390/biom10030433

Abstract: Many bacteria have the potential to use specific pesticides as a source of carbon, phosphorous, nitrogen and sulphur. Acephate degradation by microbes is considered to be a safe and effective method. The overall aim of the present study was to identify acephate biodegrading microorganisms and to investigate the degradation rates of acephate under the stress of humic acid and most common metal ions Fe(III) and copper Cu(II). *Pseudomonas azotoformanss* strain ACP1, *Pseudomonas aeruginosa* strain ACP2, and *Pseudomonas putida* ACP3 were isolated from acephate contaminated soils. Acephate of concentration 100 ppm was incubated with separate strain inoculums and periodic samples were drawn for UV-visible, FTIR (Fourier-transform infrared spectroscopy) and MS (Mass Spectrometry) analysis. Methamidophos, S-methyl O-hydrogen phosphorothioamidate, phosphenothioic S-acid, and phosphenamide were the major metabolites formed during the degradation of acephate. The rate of degradation was applied using pseudo-first-order kinetics to calculate the half-life (t(1/2)) values, which were 14.33-16.72 d(-1) (strain(s) + acephate), 18.81-21.50 d(-1) (strain(s) + acephate + Cu(II)), 20.06 -23.15 d(-1) (strain(s) + acephate + Fe(II)), and 15.05-17.70 d(-1) (strains + acephate + HA). The biodegradation efficiency of the three bacterial strains can be ordered as *P. aeruginosa* > *P. putida* > *P. azotoformans*. The present study illustrated the decomposition mechanism of acephate under different conditions, and the same may be applied to the removal of other xenobiotic compounds.

Accès au document

Modulations in growth, structure, cell viability and antioxidant enzyme of a

nodule bacterium *Mesorhizobium ciceri* induced by pesticides

Authors: Shahid M, Zaidi A, Saghir KM

Source: ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY, DOI: 10.1007/s10668-020-00758-2

Abstract: A rapid increase in the application of synthetic pesticides in agricultural practices causes a severe hazard to agro-sustainability and soil microflora. Considering these threatening problems, the present study aimed to investigate the impact of different groups of pesticides on growth, cellular morphostructure, permeability and antioxidant enzyme of a symbiotic Gram-negative bacterium recovered from chickpea nodules. Pesticide-tolerant strain BRM5 was characterized and phylogenetically (accession no. KY013481) identified as *Mesorhizobium ciceri*. Strain BRM5 tolerated up to the level of 1200, 1600, 1600, 2400, 2400, 1800, 2400, 2400 and 3200 mu g mL (-1) of glyphosate, quizalofop, atrazine, kitazin, metalaxyl, hexaconazole, fipronil, monocrotophos and imidacloprid, respectively. Among all concentrations, 3X concentrations of each pesticide had most fatal to bacterial cells. The growth pattern of strain BRM5 was decreased linearly with increasing incubation times. Scanning electron micrograph (SEM) images of pesticide-treated bacterial cells revealed the distorted, broken, irregular, misshaped and larger-sized cell as compared to untreated cells. Upon staining with acridine orange (AO)/propidium iodide (PI), active/living cells appeared as green colour, whereas dead cells appeared as red colour under confocal microscope (CLSM). This is the clear indication of ...

Accès au document

Effect of Fe-Mn-Ce modified biochar composite on microbial diversity and properties of arsenic-contaminated paddy soils

Authors: Zhang G, Liu X, Gao M, Song Z

Source: CHEMOSPHERE, 50, 2020, DOI: 10.1016/j.chemosphere.2020.126249

Abstract: In this study, we investigated the mechanism of decrease in arsenic (As) bioavailability after addition of biochar (BC) supplemented with iron (Fe)- manganese (Mn)-cerium (Ce) oxide (FMCBC) to As-contaminated paddy soil. We explored the effects of these composites on the oxidation, reduction, microbial community, and soil enzyme activity of As-contaminated paddy soil. Results showed that FMCBCs improve soil pH, significantly improve the redox capacity of soil, and reduce bioavailable forms of As. FMCBCs can convert As from a specifically or non-specifically bound form into amorphous hydrous oxide bound- and crystalline hydrous oxide bound form. The application of FMCBCs increased soil enzyme activity (urease, catalase, alkaline phosphatase, and peroxidase), and greatly influenced the relative abundance of certain microorganisms (Proteobacteria, Acidobacteria, and Gemmatimonadetes), which improved soil enzyme heavy metal tolerance and prevented their denaturation. Thus, FMCBCs can not only change the form and distribution of As in soil but also create an environment suitable for microbial growth, consequently affecting the geochemical cycling of As in soil.

Accès au document

Ecotoxicological effect of mesotrione on enzyme activity and microbial community in agricultural soils

Authors: Sun Y B, Wang L, Xu YM, Liang XF, Zheng SN

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH, 18(2):3525-3541, 2020, DOI: 10.15666/aeer/1802_35253541

Abstract: Multiple experiments were performed to evaluate the ecotoxicological effect of mesotrione on soil enzymatic activity, functional diversity, and genetic microbial biodiversity. The

results showed that catalase and invertase activity initially increased with higher mesotrione concentration and then declined slightly. However, urease activity experienced a 11.9-23.2% reduction in comparison to control soil. The average well-color development (AWCD) was positively affected by the mesotrione treatment, the amount of carbohydrate, amino acid, and phenolic acid increased by 1.7-2.1, 1.1-1.6, and 1.7-2.5 times, respectively, when compared with the blank treatment. However, the utilization of carboxylic and acid amine was prohibited after applying 50-100 mg kg (-1) and 20-100 mg kg(-1) mesotrione. Denaturing gradient gel electrophoresis (DGGE) analysis showed that the shift in the bacterial community structure for different mesotrione treatments can be mainly attributed to an increment in band intensity, while the dissimilarity in the bacterial genetic structure decreased with increasing mesotrione content in the soil. Sequencing and phylogenetic analyses showed that the four bands in the denaturing gradient gel electrophoresis results were closely related to Bacillus subterraneus, Clostridium sp., and Bacillus sp. Obtained results show that abuse of mesotrione may pose a potential risk for soil microbial functioning.

Accès au document

Ecological remediation of petroleum-contaminated soil based on microbial degradation

Authors: Wang C, Li Z, Geng X, Zhang H

Source: APPLIED ECOLOGY AND ENVIRONMENTAL RESEARCH, 18(2):2727-2746, 2020, DOI: 10.15666/aeer/1802_27272746

Abstract: In the process of oil exploitation, refining, storage, transportation and use, due to the limitations of technological level and treatment technology, a large amount of petroleum-containing wastewater and waste residue are inevitably discharged into the soil, thus affecting the whole soil ecosystem. In this paper, an ecological remediation method for petroleum contaminated soil based on microbial degradation is proposed. The natural biodegradation of petroleum contaminants in soil is discussed. The types of degrading microorganisms and their degradation mechanisms for saturated hydrocarbons and aromatic hydrocarbons are introduced, and the chemical composition of petroleum and the number of microorganisms in the soil are analyzed. The effects of nutrients, oxygen supply, temperature, humidity and pH on the degradation efficiency of petroleum are studied, and the in-situ soil ecological remediation is carried out after the degradation of pollutants. Experiments show that the ecological remediation of petroleum contaminated soil based on microbial degradation can be more thorough in essence. This method has the advantages of requiring only a low time investment, being, low cost, simple and effective, and having a good remediation effect and no secondary pollution.

Accès au document

Atrazine Bioremediation and Its Influence on Soil Microbial Diversity by Metagenomics Analysis

Authors: Bhardwaj P, Singh KR, Jadeja NB, Phale PS, Kapley A

Source: INDIAN JOURNAL OF MICROBIOLOGY, DOI: 10.1007/s12088-020-00877-4

Abstract: Pesticide accumulation in agricultural soils is an environmental concern, often addressed through distinct bioremediation strategies. This study has tried to analyze various soil bioremediation options viz., biostimulation, bioaugmentation, and natural attenuation in terms of efficiency and the response of autochthonous microbial flora by using atrazine as a model contaminant. Soil mesocosms were established with 100 kg of soil simulating the field conditions. The soil previously exposed to the herbicide was used for the bioaugmentation strategy undertaken in this study. We have tried to analyze how the microbial community responds to a foreign compound, both in terms of taxonomic and functional capacities? To answer this, we have analyzed metagenome of the mesocosms at a time point when 90% atrazine was degraded. Bioaugmentation for

bioremediation proved to be efficient with a DT90 value of 15.48 +/- 0.79 days, in comparison to the natural attenuation where the DT90 value was observed to be 41.20 +/- 1.95 days. Metagenomic analysis revealed the abundance of orders Erysipelotrichales, Selemonadales, Clostridiales, and Thermoanaerobacterales exclusively in SBS mesocosm. Besides Pseudomonas, bacterial genera such as Achromobacter, Xanthomonas, Stenotrophomonas, and Cupriavidus have emerged as the dominant members in various bioremediation strategies tested in this study. Inclusive results suggest that inherent microbial flora adjust their community and metabolic machinery upon exposure to the pollutant. The site under pollutant stress showed efficient microbial communities to bio-remediate the newly polluted terrestrial ecologies in relatively less time and by economic means.

Accès au document

Responses of Bacterial and Fungal Community Structure to Different Rates of 1,3-Dichloropropene Fumigation

Authors: Zeng Y, Abdo Z, Charkowski A, Stewart JE, Frost K

Source: PHYTOBIOMES JOURNAL 3(3):212-223, 2019, DOI: 10.1094/PBIOMES-11-18-0055-R

Abstract: 1,3-Dichloropropene (1,3-D) is a well-known nematicidal soil fumigant on many crop species. Currently, little is known about its impact on soil microbial communities using culture-free methods. In this study, we investigated changes in soil bacterial and fungal diversity and composition at two depths (30.5 and 61 cm) in response to management practices of applying 1,3-D at four different rates (103, 122, 140, and 187 liters/ha) relative to an untreated control in potato production fields using 16S rRNA and internal transcribed spacer (ITS) amplicon sequencing. A total of 12,783 operational taxonomic units (OTUs) for 16S and 1,706 OTUs for ITS were obtained. Sequencing revealed that Proteobacteria, Firmicutes, Actinobactena, and Ascomycota were dominant phyla in soils. Comparing alpha diversity of microbial communities at the different chemical rates with untreated plots showed that bacterial communities in plots treated with 1,3-D fumigation at 140 liters/ha were richer, which was supported by higher richness indices. Other diversity indices and overall soil microbial community structure were not significantly influenced by any rates of 1,3-D fumigation, although higher bacterial and fungal richness and diversity were observed in posttreatment soils and/or at 30.5 cm. Of the identified microbial families, the differential abundance of 45 bacterial and 24 fungal families was affected by sample depth, 1,3-D rate, or the interaction of sample depth and 1,3-D. The bacterial family Enterobacteriaceae, which includes species that specialize in decay of complex carbohydrates, increased in abundance post-1,3-D fumigation, and the fungal family Ophiocordycipitaceae, which includes nematode and insect pathogens, decreased, suggesting that the nematode and soil insect death caused by fumigation may selectively impact specific fungal and bacterial families.

Accès au document

Co-occurrence of antibiotic, biocide, and heavy metal resistance genes in bacteria from metal and radionuclide contaminated soils at the Savannah River Site

Authors: Thomas JC, Oladeinde A, Kieran TJ, and More…

Source: MICROBIAL BIOTECHNOLOGY, DOI: 10.1111/1751-7915.13578

Abstract: Contaminants such as heavy metals may contribute to the dissemination of antimicrobial resistance (AMR) by enriching resistance gene determinants via co-selection mechanisms. In the present study, a survey was performed on soils collected from four areas at the Savannah River Site (SRS), South Carolina, USA, with varying contaminant profiles: relatively pristine (Upper Three Runs), heavy metals (Ash Basins), radionuclides (Pond B) and heavy metal and radionuclides (Tim's Branch). Using 16S rRNA gene amplicon sequencing, we explored the structure and diversity of soil bacterial communities. Sites with legacies of metal and/or radionuclide contamination displayed significantly lower bacterial diversity compared to the reference site. Metagenomic

analysis indicated that multidrug and vancomycin antibiotic resistance genes (ARGs) and metal resistance genes (MRGs) including those associated with copper, arsenic, iron, nickel and zinc were prominent in all soils including the reference site. However, significant differences were found in the relative abundance and diversity of certain ARGs and MRGs in soils with metal/radionuclide contaminated soils compared to the reference site. Co-occurrence patterns revealed significant ARG/MRG subtypes in predominant soil taxa including Acidobacteriaceae, Bradyrhizobium, Mycobacterium, Streptomyces, Verrumicrobium, Actinomadura and Solirubacterales. Overall, the study emphasizes the potential risk of human activities on the dissemination of AMR in the environment.

Accès au document

The Arsenic Methylation Cycle: How Microbial Communities Adapted Methylarsenicals for Use as Weapons in the Continuing War for Dominance

Authors: Chen J, Rosen BP

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE, 8, DOI: 10.3389/fenvs.2020.00043

Abstract: Arsenic is toxic and widely distributed in the environment. Most microorganisms have evolved mechanisms to use methylarsenicals as weapons in microbial warfare. This has created cycles of arsenic methylation and demethylation, which constitutes an important part of arsenic biogeochemical cycles and environmental health. Arsenic methylation forms methylarsenite [MAs(III)], arsenobetaine, arsenosugars and the new identified methylarsenical antibiotic, arsinothricin (AST). Bacteria use MAs(III) and AST as antibiotic to obtain a competitive advantage over other bacteria. Microbes produce toxic MAs(III) by (1) methylation of arsenite [As(III)] or (2) reduction of methylarsenate [MAs(V)]. In air, MAs(III) is oxidized to MAs(V) by oxygen, which conferring methylation to be considered as a detoxification pathway in aerobes. MAs(V) also can be re-reduced to MAs(III) by other bacteria, which can enable its survival and dominance with more competitive advantage than other sensitive bacteria. The different composition and diversity of microbial community could generate the sustained pool of MAs(III). These complex interactions have an emergent property., that is, overall scheme of arsenic-containing antibiotics emerges from interaction of multiple species. In response to production of the antibiotic MAs(III), other members of microbial communities have evolved at least four mechanisms for MAs(III) resistance: (1) ArsH detoxifies MAs(III) by oxidation to less toxic MAs(V); (2) ArsI degrades MAs(III) by cleavage of the C-As bond to form less toxic As(III); (3) the ArsP efflux permease confers selective resistance to MAs(III); and (4) the unrelated ArsK efflux permease confers resistance to both trivalent inorganic and organoarsenicals. Environmental application of anthropogenic aromatic arsenicals further fuels bacterial warfare and selection for novel resistance mechanisms. In another microbial adaptation to use environmental arsenic as a weapon, some soil bacteria synthesize a methylarsenate analog of the amino acid glutamic acid termed AST; AST shows a broad-spectrum antibiotic action against both Gram-negative and Gram-positive bacteria. In response to the environmental challenge presented by AST, arsN genes evolved to detoxify it by acetylation of the alpha-amino group. Thus, to battle for surviving and thriving in the microbial community, life has to adapted and use environmental arsenic as a weapon. Both MAs(III) and AST are natural products with antibiotic-like properties, both are toxic methylarsenicals produced by some microbe and further kill off its competitors, and resistances have arisen for both.

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / MICROBIOLOGIE et BIOCONTROLE

Methyl t-butyl ether-degrading bacteria for bioremediation and biocontrol purposes

Authors: d'Errico G, Aloj V, Ventorino V, Bottiglieri A, and more...

Source: PLOS ONE 15(2), 2020, DOI: 10.1371/journal.pone.0228936

Abstract: A total of fifteen potential methyl t-butyl ether (MtBE)-degrading bacterial strains were isolated from contaminated soil. They have been identified as belonging to the genera Bacillus, Pseudomonas, Kocuria, Janibacter, Starkeya, Bosea, Mycolicibacterium, and Rhodovarius. *Bacillus aryabhattai* R1B, *S. novella* R8b, and *M. mucogenicum* R8i were able to grow using MtBE as carbon source, exhibiting different growth behavior and contaminant degradation ability. Their biocontrol ability was tested against various fungal pathogens. Both *S. novella* R8b and *B. aryabhattai* were effective in reducing the development of necrotic areas on leaves within 48 hours from *Botritys cinerea* and Alternaria alternata inoculation. Whereas, M. mucogenicum effectively controlled B. cinerea after 72 hours. Similar results were achieved using *Pythium ultimum*, in which the application of isolated bacteria increased seed germination. Only M. mucogenicum elicited tomato plants resistance against *B. cinerea*. This is the first report describing the occurrence of bioremediation and biocontrol activities in M. mucogenicum, B. aryabhattai and *S. novella* species. The production of maculosin and its antibiotic activity against *Rhizoctonia solani* has been reported for first time from S. novella. Our results highlight the importance of multidisciplinary approaches to achieve a consistent selection of bacterial strains useful for plant protection and bioremediation purposes.

Accès au document

Determinations of in vitro Antagonistic Effects of Microbiomes Isolated from Vermicompost Against Major Plant Fungal Disease Agents of Vegetables

Authors: Soylu EM, Soylu S, Kara M, Kurt S

Source: KSU TARIM VE DOGA DERGISI-KSU JOURNAL OF AGRICULTURE AND NATURE, 23(1):7-18, 2020, DOI: 10.18016/ksutarimdoga.vi.601936

Abstract: In this study, in vitro antagonistic potentials of bacterial microbiomes, obtained from earthworm fertiliser, vermicompost, were investigated on inhibitions of mycelial growth of major foliar and soilborne fungal disease agents *Sclerotinia sclerotiorum*, *Macrophomina phaseolina*, *Botrytis cinerea*, *Verticilium dahliae*. Total of 69 putative bacterial biocontrol agent (BCA) isolates were obtained from commercial vermicompost lots. Among them, 28 bacterial isolates (49.12% of total isolates) were inhibited mycelial growth of *S. sclerotiorum* by 1.72-75.43%, M. phaseolina by 1.67-65.83%, B. cinerea by 3.44-57.18%, V dahliae by 2.28-58.74%, respectively. Majorities of bacterial isolates were identified as Bacillus spp. Certain isolates of Bacillus spp. have caused noticeable morphological changes on mycelia of *S. sclerotiorum*. Antagonistic potentials of bacterial isolates were found to increase by pre-incubation time prior the fungal inoculation. Due to high antagonistic properties, efficient isolates of *Bacillus* spp. may be used as biocontrol agent against soilborne diseases as an alternative to pesticides to promote organic and sustainable agriculture.

Accès au document

ERA / PUBLICATIONS SCIENTIFIQUES / PESTICIDES ET FAUNE SAUVAGE

Nest-boxes for raptors as a biological control system of vole pests: High local success with moderate negative consequences for non-target species - ScienceDirect

Authors: Paz Luna A, Bintanel H, Viñuela J, Villanúa D

Source: Biological Control 146, 2020, DOI: 10.1016/j.biocontrol.2020.104267.

Abstract: Biological control of rodents in agricultural areas, increasing avian predator abundance by nest-box provisioning, has been

proposed during the last decades in several regions around the world as an alternative to the widespread use of anticoagulant rodenticides (AR) to protect crops. (...) Here we test the effectiveness of providing nest-boxes to common kestrels (Falco tinnunculus) and barn owls (*Tyto alba*) in reducing the abundance of two different vole species using indirect index methods to estimate rodent abundance in late spring (May). We monitored the abundance of both vole species in a treatment (with nest boxes) and control (without nest boxes) areas during three years in alfalfa fields, using a BACI design.

Our results showed a clear-cut reduction in the abundance of the two vole species, the common vole (*Microtus arvalis*) and the mediterranean-pine vole (*Microtus duodecimcostatus*) in the experimental area after applying the treatment (nest box installation) in alfalfa crops. We also found a significant decrease in the presence of both species of voles on fruit-tree plantations and alfalfa crops but we did not find significant effects in the cereal fields, where voles were in general very scarce. These results suggest higher efficacy of biological control in this study area than in some areas of NW Spain, what could be explained by several non-exclusive hypotheses presented in the discussion.

Accès au document

Mediation of Oxidative Stress Toxicity Induced by Pyrethroid Pesticides in Fish

Authors: Yang C, Lim W, Song G

Source: Comp Biochem Physiol C Toxicol Pharmacol 234:108758, 2020, DOI: 10.1016/j.cbpc.2020.108758

Abstract: In this review, we examine the occurrence of pyrethroid pesticides in the aquatic environment and oxidative stress-induced toxicity in fish exposed to pyrethroids. Organophosphate and organochlorine pesticides are banned in most countries because they cause high toxicity and bioaccumulation in non-target organisms. However, pyrethroids are approximately 1000 times more toxic to fish than to mammals and birds. Fish-specific organs such as the gills and their late metabolic action against this type of pesticide make fish highly susceptible to the toxicity of pyrethroid pesticides. Oxidative stress plays an important role in the neurological, reproductive, and developmental toxicity caused by pyrethroids. Deltamethrin, cypermethrin, and lambda-cyhalothrin are representative pyrethroid pesticides (...)

Accès au document

Toxic Elements in Blood of Red-Necked Nightjars (*Caprimulgus Ruficollis*) Inhabiting Differently Polluted Environments

Authors: Espín S, Sánchez-Virosta P, Zamora-Marín JM, et al.

Source: Environ Pollut 262:114334,2020, DOI: 10.1016/j.envpol.2020.114334

Abstract: (...) rare earth elements (REE) and other minor elements (ME) are becoming a new threat due to their use in modern technology. (...) The order Caprimulgiformes is among the most understudied groups of birds (...) we sampled 48 red-necked nightjars (*Caprimulgus ruficollis*) inhabiting three different scenarios of contaminant exposure (agricultural-urban area, n = 15; mining area, n = 17; and control area, n = 16) in southeastern Spain, and report for the first time concentrations of 50 elements (i.e. trace elements, ATSDR's list toxic elements, REE and ME) (...). Concentrations of As, Cd, Pb and Mn were significantly higher in individuals captured at the mining area compared to the other sites. Lead levels in the mine site were of particular concern since it was in the range of blood concentrations related to subclinical/clinical effects in other species, (...) Moreover, additive effects related to metal cocktail exposure in the mining area could be expected. (...) most REE and ME concentrations were close to the LOQ, (...).

Accès au document

Longitudinally Monitored Lifetime Changes in Blood Heavy Metal Concentrations and Their Health Effects in Urban Birds

Authors: Bauerová P, Krajzingrová T, Těšický M, et al.

Source: Sci Total Environ 723:138002, 2020, DOI: 10.1016/j.scitotenv.2020.138002

Abstract: Urban heavy metal pollution can impair the health of humans and other organisms inhabiting cities. While birds are suggested as one of the appropriate bioindicators for essential and non-essential trace element monitoring, the process of particular elements' accumulation in blood and its possible adverse health effects during ageing of individuals remain unexplored. We have investigated lifetime changes in blood lead (Pb), cadmium (Cd), arsenic (As) and zinc (Zn) concentrations and searched for links to health-related traits in sub-urban free-living great tit (Parus major) population (...) This study demonstrates the suitability of avian blood for actual heavy metal spatial and temporal biomonitoring even in situations when the precise age of the individuals remains unknown.

Accès au document

From seeds to plasma: Confirmed exposure of multiple farmland bird species to clothianidin during sowing of winter cereals

Authors: Lennon Rosie J, Peach Will J, Dunn Jenny C, Shore Richard F... Brown Colin D

Source: Science of The Total Environment 723, 2020, DOI: 10.1016/j.scitotenv.2020.138056

Abstract: (...)little is known about the extent to which farmland birds are exposed to the neonicotinoid compounds during standard agricultural practices. This study uses winter cereal, treated with the neonicotinoid clothianidin, as a test system to examine patterns of exposure in farmland birds during a typical sowing period. The availability of neonicotinoid-treated seed was recorded post-sowing at 39 fields (25 farms) (...) avian blood samples were collected from 11 species of farmland bird from a further six capture sites to quantify the prevalence and level of clothianidin exposure associated with seed treatments. (...) Exposure was confirmed in 32% of bird species observed in treated fields and 50% of individual birds post-sowing; the median concentration recorded in positive samples was 12 ng/mL. Results here provide clear evidence that a variety of farmland birds are subject to neonicotinoid exposure following normal agricultural sowing of neonicotinoid-treated cereal seed. Furthermore, the widespread availability of seeds at the soil surface was identified as a primary source of exposure.

Accès au document

Assessment of the effects of early life exposure to triphenyl phosphate on fear, boldness, aggression, and activity in Japanese quail (*Coturnix japonica*) chicks

Authors: Hanas AK, Guigueno MF, Fernie KJ, Letcher RJ, Chamberland FSM, Head JA

Source: Environmental Pollution, 258, 2020, DOI: 10.1016/j.envpol.2019.113695.

Abstract: Triphenyl phosphate (TPHP) is an organophosphate ester (OPE) used as a flame retardant (FR) and plasticizer. (...) this is the first study on the behavioural effects of TPHP in birds. Early life stage Japanese quail (Coturnix japonica) were exposed to nominal doses of 0 ng/g (vehicle-control), 5 ng/g (low dose), 50 ng/g (mid dose), and 100 ng/g (high dose) TPHP, both as embryos (via air cell injection prior to incubation) and as chicks (via daily gavage until 5 days post-hatch). The low dose reflects TPHP levels recorded in wild avian eggs, but actual environmental exposure levels may be higher given that TPHP is known to be rapidly metabolized in birds. (...) high-TPHP chicks exhibited less neophobia than vehicle-controls, and low-TPHP chicks exhibited more aggression towards conspecifics. No differences were observed in the responses of Japanese quail chicks to activity or tonic immobility (fear response) tests.

Accès au document

Organochlorine pesticides in feathers of three raptor species in southern Brazil

Authors: Aver GF, Espín S, Dal Corno RDB *et al.*

Source: Environ Sci Pollut Res **27:**5971–5980, 2020, DOI:10.1007/s11356-019-07370-6

Abstract: In this study, we determined the presence of organochlorine pesticides (OCPs) in back feathers from three raptor species, Phalcoboenus chimango, Milvago chimachima and Caracara plancus. Samples were obtained from live animals and ten OCPs were detected: alpha-HCH, beta-HCH and gamma-HCH (lindane), heptachlor, heptachlor epoxide, aldrin, endosulfan I, endosulfan II, endosulfan sulfate and p,p'-DDE. The concentrations found were higher than those reported in other raptor species, and C. plancus showed greater values (...) This is the first study reporting OCPs in back feathers of these species in Brazil, (...).

Accès au document

Trace element distribution in tissues and risk of exposure of ruddy shelduck wintering in Nanhaizi Wetland, Baotou, China

Authors: Liu L, Du C, Sun Y *et al.*

Source: Environ Sci Pollut Res **27:**6429–6437, 2020, DOI: 10.1007/s11356-019-07132-4

Abstract: (...) The Yellow River receives a significant amount of industrial and agricultural wastewater. Therefore, the environmental quality of NHZW directly affects the survival of migratory birds in the Baotou region. We aimed to determine the trace element distribution in tissues and risk of exposure in ruddy shelduck (...) Trace element concentration was greatest in feathers, followed by the kidneys, liver, and muscle, in descending. There was no significant difference in trace element accumulation between sexes. Exposure doses of Hg in water; Cr, Pb, and Cu in soil; and Pb, Cu, and Hg in corn were higher than the tolerable daily intake and may adversely affect ruddy shelduck. The calculated hazard quotients (HQ) for trace elements were ranked as follows: Hg Cr Pb Zn Cu As, where Hg and Cr were at high risk levels (HQ 1).

Accès au document

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

Authors: Michael S Gross, Thomas G Bean, Michelle L Hladik, Barnett A Rattner, and Kathryn M Kuivila

Source: Journal of Agricultural and Food Chemistry 68(6):1514-1524, 2020, DOI: 10.1021/acs.jafc.9b05668

Abstract: Pesticides coated to the seed surface potentially pose an ecological risk to granivorous birds (...). To assess the toxicokinetics of seeds treated, Japanese quail (*Coturnix japonica*) were orally dosed with commercially coated wheat seeds. (...) The high detection frequencies observed in fecal samples potentially offer a non-invasive matrix to monitor pesticide exposure. With the summation of total body burden across plasma, tissue, and fecal samples, less than 9% of the administered dose was identified as the parent fungicide, demonstrating the importance to monitor both active ingredients and their metabolites in biological samples.

Accès au document

Oxidative state of the frugivorous bat *Sturnira lilium* (Chiroptera: Phyllostomidae) in agricultural and urban areas of southern Brazil

Authors: Oliveira FW, Schindler MSZ, Corá DH *et al.*

Source: Environ Sci Pollut Res 2020, DOI: 10.1007/s11356-020-09552-z

Abstract: (...) bats have been used to indicate environmental contaminants in urban and agricultural environments, since they are extremely sensitive to changes in the ecosystem and easily accumulate waste in their body tissues. (...) In this study, we aimed to evaluate the oxidative state of *S. lilium* individuals in

agricultural and urban areas in southern Brazil. (...) Parameters of the superoxide dismutase (SOD) and catalase (CAT) enzyme activity, non-protein thiols (NPSH), and lipid peroxidation (TBARS) were determined based on liver tissue. (...) The present findings suggest that the species *S. lilium*, which are widely distributed and abundant in Brazil in urban and agricultural areas, can usefully be employed in biomonitoring programs. (...)

Accès au document

Crop protection and biodiversity in agro-ecosystems

Authors: Niggli U, Riedel J, Brühl C, Liess M, Schulz R, Altenburger R, Märländer B, Bokelmann W, Heß J, Reinek A, Gerowitt B

Source: Pflanzenschutz und Biodiversität in Agrarökosystemen 2020, DOI: 10.12767/buel.v98i1.

Abstract: The Scientific Advisory Board for the National Action Plan on the Sustainable Use of Plant Protection Products (NAP) advises the German Federal Ministry of Food and Agriculture (BMEL). The Board has provided its opinion on the impact of crop protection on biodiversity in agro-ecosystems. These losses are reduced through the use of direct chemical, biological or physical crop protection, and by means of indirect, systematic, preventative measures. Out of the many effects of crop pesticides, their impact on biodiversity is difficult to grasp. Current intensive farming is geared towards efficiency and global competitiveness. It is bringing about multicausal changes in landscapes and ecosystems, reducing the diversity of natural habitats and agroecosystems, and is thus adversely impacting on the biodiversity of numerous groups of species. ...

Accès au document

Mercury in fish from streams and rivers in New York State: Spatial patterns, temporal changes, and environmental drivers

Authors: Riva-Murray K, Richter W, Roxanna Razavi N. *et al.*

Source: Ecotoxicomic 2020, DOI: 10.1007/s10646-020-02225-0

Abstract: Mercury (Hg) concentrations in freshwater fish across the state of New York frequently exceed guidelines considered harmful to humans and wildlife,... We analyzed existing data to describe recent spatial patterns, identify key environmental drivers, and assess temporal changes. Size classes within sportfishes and prey fishes formed 'functional taxa' (FT), and standardized scores were generated from 2007–2016 data for 218 sites. Muscle Hg in ≥1 sportfish FT exceeded human-health guidelines of 50 ng/g (sensitive populations) and 300 ng/g (general population, GP) at 93 and 56% of sites, respectively, but exceeded 1000 ng/g (a state threshold) at only 10% of sites. Whole-body Hg in ≥1 prey fish FT exceeded wildlife thresholds of 40 ng/g and 100 ng/g at 91 and 51% of sites, respectively. ...Comparisons of 2010–2015 sportfish Hg concentrations with those of 1998 and 2000–2005 showed inconsistent temporal changes both among and within eight sites examined. ...

Accès au document

Anthropogenic factors affecting wildlife species status outcomes: why the fixation on pesticides?

Authors: Brain RA, Anderson JC

Source: Environ Sci Pollut Res 2020, DOI: 10.1007/s11356-020-08980-1

Abstract: ...the implication of conventional agriculture in the broader narrative of wildlife species status outcomes (SSOs) lacks context and relativity... Moreover, in addition to the land use challenge, there are multiple other factors affecting wildlife SSOs, including a figurative plague of invasive species, a literal plague of disease, a barrage of buildings, bumpers, grilles, and windshields to collide with, light pollution to confuse cues with, poachers to contend with, and even more complicated factors such as

climate change. ... Based on the available evidence, this manuscript attempts to address these questions from a holistic and relative perspective within the context of land use change, economic development, population growth, and associated implications of global connectivity and commerce.

Accès au document

Pesticides and conservation of large ungulates: Health risk to European bison from plant protection products as a result of crop depredation

Authors: Klich D, Łopucki R, Stachniuk A, Sporek M, Fornal E, Wojciechowska M, et al.

Source: PLoS ONE 15(1):e0228243, 2020, DOI: 10.1371/journal.pone.0228243

Abstract: The coexistence of large mammals and humans in the contemporary landscape is a big challenge for conservationists. Wild ungulates that forage on arable fields are exposed to the negative effects of pesticides, ... In this paper we assessed the threat posed by pesticides to the European bison ... LC-QTOF-MS/MS two-step analysis of pesticide residues in liver samples, which included MS and targeted MS/MS scans, was conducted. It was found that European bison are exposed to pesticides as a result of crop depredation: the presence of tetraconazole, fluopyram and diazinon residues...The concentration levels of the detected substances were quite low, but ... potential health risk to European bison may result from the synergistic interaction of these substances...

Accès au document

Evaluation of Mercury Contamination in Iranian Wild Cats Through Hair Analysis

Authors: Dahmardeh BR, Poma G

Source: Biol Trace Elem Res 2020, DOI: 10.1007/s12011-020-02148-1

Abstract: The present study aimed to investigate the total mercury (Hg) concentrations in hair samples of 40 wild cats belonging to eight different species collected from various provinces of Iran and to characterize their risk of Hg exposure. Total Hg levels in Iranian wild cats ranged from 62 to 3670 ng/g dw hair, with a median value of 488 ng/g dw hair. The lowest median Hg concentration was found in west Iran (251 ng/g dw hair), while the highest median level was measured in the north-east of the country (736 ng/g dw hair), likely related to potential contamination of industrial effluents. The overall contamination of Iranian wild cats with mercury can be considered generally low, but 20% of the samples reached levels above 1100 ng/g dw hair, set as indicative of an environmental Hg concern according to the U.S. Fish and Wildlife Service. (...)

Accès au document

Mercury bioaccumulation in tropical bats from a region of active artisanal and small-scale gold mining

Authors: Carrasco-Rueda F, Loiselle BA & Frederick PC

Source: Ecotoxicology 2020,DOI: 10.1007/s10646-020-02195-3

Abstract: (...) Animals associated with mercury-contaminated aquatic systems are at high risk of experiencing effects of this heavy metal, but it is not clear how far the effects may extend into nearby terrestrial systems. We report mercury contamination levels in bats in agricultural areas at increasing distances from gold mining (~3–89 km of distance). (...) We collected 112 fur samples from 30 bat species and eight guilds, and provide the first reports of concentrations in 12 species.

All mercury concentrations were below the level at which health is likely to be affected (10 ppm). We found guild-influenced differences among mercury concentration levels, with the highest concentrations in aerial insectivores and carnivores, and the lowest in canopy frugivores. (...)

https://doi.org/10.15454/BGEP-SC64

Accès au document

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

Acute toxicity, oxidative stress and DNA damage of chlorpyrifos to earthworms (*Eisenia fetida*): The difference between artificial and natural soils

Pesticides can damage the soil environment, including damage to sentinel organisms such as earthworms. When assessing the toxicity of pesticides towards earthworms, assays are usually performed using standardized artificial soil, however, soil physicochemical properties may affect pesticide toxicity. In the present study, the toxicity of a commonly used insecticide (chlorpyrifos) to earthworms (Eisenia fetida) was determined in artificial soil and three typical natural soils (fluvo-aquic soil, black soil and red clay) by measuring acute and subchronic toxicity. (...)

Accès au document

Metal oxide nanoparticles facilitate the accumulation of bifenthrin in earthworms by causing damage to body cavity

In this study, we explored the influence of two metal oxide nanoparticles, nano CuO and nano ZnO (10, 50, 250 mg/kg), on accumulation of bifenthrin (100 mg/kg) in earthworms (Eisenia fetida) and its mechanism. (...)

Accès au document

Acute and chronic toxicity of the fungicide carbendazim to the earthworm *Eisenia fetida* under tropical versus temperate laboratory conditions

Research efforts into the potential side-effects of pesticides on beneficial organisms have focused on temperate test species and conditions. There is thus a need for studies into the ecotoxicity of a vaster range of pesticides under tropical conditions. The present study therefore aimed to compare the acute and chronic toxicity of the fungicide carbendazim to the earthworm *Eisenia fetida* under tropical and temperate conditions. (...)

Accès au document

Do Long-Term Continuous Cropping and Pesticides Affect Earthworm Communities?

Earthworm species composition, the density of individuals, and their biomass were investigated in spring barley and faba bean fields in a long-term (52-year) experiment conducted at the Production and Experimental Station in Bałcyny, in north-eastern Poland (...)

Accès au document

Effects of ciprofloxacin exposure on the earthworm *Eisenia fetida*

https://doi.org/10.15454/BGEP-SC64

The widespread use of the antibiotic ciprofloxacin (CIP) poses a serious risk to soil organisms. Here, earthworms (*Eisenia fetida*) were used to explore the effect of CIP exposure on growth, reproduction, mortality, antioxidant enzyme activity, DNA damage, and mRNA levels. (...)

Accès au document

Towards a spatiotemporally explicit toxicokinetic-toxicodynamic model for earthworm toxicity

(...) While for the exposure assessment, advanced exposure models can take the spatial and temporal scale of substances into account, the effect assessment in the lower tiers considers only a limited temporal and spatial variability. However, for soil organisms, such as earthworms, those scales play a significant role as species move through the soil in response to environmental factors. To overcome this gap, we propose a conceptual integration of pesticide exposure, ecology, and toxicological effects on earthworms using a modular modeling approach.

Accès au document

Synthesis of earthworm trace metal uptake and bioaccumulation data: Role of soil concentration, earthworm ecophysiology, and experimental design

(...) The uptake of trace metals by earthworms can cause transfer from immobilized pools in the soil to predators within terrestrial food chains. We report a synthesis and evaluation of uptake and bioaccumulation empirical data across different metals, earthworm genera, ecophysiological groups, soil properties, and experimental conditions (metal source, uptake duration, soil extraction method).

Accès au document

Environmental risk for aquatic and terrestrial organisms associated with drift from pesticides used in soybean crops

Several countries included the assessment of environmental drift contamination risk for the registration of pesticides. This practice is not yet totality effective in Brazil; however, due to the large number of pesticides in use, it is important to identify the real contamination risk during pesticide spraying. Therefore, this study determined the indices of environmental risks for exposure to drift from terrestrial applications of fungicides, herbicides, and insecticides that are used in soybean crops under Brazilian climate conditions and established buffer zones for the application of these products.

Accès au document

Wormcasts produced by three earthworm species (*Alma millsoni*, *Eudrilus eugeniae and Libyodrilus violaceus*) exposed to a glyphosate-based herbicide reduce growth, fruit yield and quality of tomato (*Lycopersicon esculentum*)

It remains unknown if casts produced by earthworms exposed to a glyphosate-based herbicide (GBH) will retain their agricultural benefit. This study investigated the agricultural importance of surface casts produced by three earthworm species (*Alma millsoni, Eudrilus eugeniae* and *Libyodrilus violaceus*) exposed to a GBH on growth, fruit yield and quality of tomato (*Lycopersicon esculentum*). (...)

Accès au document

Is nano ZnO/chlorpyrifos mixture more harmful to

https://doi.org/10.15454/BGEP-SC64

earthworms than bulk ZnO? A multigeneration approach

As chlorpyrifos is one of the most widely used organophosphorus insecticides and ZnO-NPs are identified as NPs of the highest concern due to their negative effects on aquatic and soil organisms the objective of this study was to evaluate mixture toxicity of CHP and ZnO (bulk and nanoparticles (20 nm)) on two types of soil, artificial (AS) and natural (NS), and over two generations of earthworms. (...)

Accès au document

Residue and toxicity of cyantraniliprole and its main metabolite J9Z38 in soil-earthworm microcosms

As part of a new generation of diamide insecticides, cyantraniliprole has broad application prospects. In the present study, a QuEChERS-UPLC-MS/MS method was established to determine the residues of cyantraniliprole and its main metabolite J9Z38 in soil and earthworms. (...)

Accès au document

The Toxic Effects of Sulfoxaflor Induced in Earthworms (*Eisenia fetida*) under Effective Concentrations

Sulfoxaflor is a new kind of neonicotinoid insecticide that is used to control sap-feeding insect pests. In this study, a hazard assessment of sulfoxaflor on soil invertebrate earthworms was performed under effective concentrations. The ...

Accès au document

DROIT ET POLITIQUE DE L'ENVIRONNEMENT

Aquatic Pollutants - Transfer Project

ANR 12/06/20

Aquatic Pollutants Transfer Project : Appel Additionnel pour financer des projets de recherche de transfert des résultats.

Les initiatives de programmation conjointe dédiées à l'eau (Water JPI), à l'Océan (JPI Ocean) et à la résistance antimicrobienne (JPI AMR) ont lancé un Appel additionnel afin de financer des projets de recherche qui valorisent le transfert des résultats. Seul la France (ANR), l'Allemagne (Jülich/BMBF) et la Suède (SRC) y participent.

Cet appel additionnel s'inscrit en complément du premier appel conjoint pour financer des projets de recherche et innovation transnationaux sur les risques pour la santé humaine et l'environnement posés par la présence de polluants et de pathogènes dans l'eau. Cet appel additionnel vise plus particulièrement à optimiser et valoriser le transfert de connaissances de la recherche vers la société. Les propositions doivent se concentrer sur la communication de la recherche, l'utilisation des résultats de la recherche par les utilisateurs finaux et responsables politiques. Il s'agit également d'améliorer l'impact des projets recherches. Les dossiers doivent être soumis en ligne sur le site de soumission (Ce lien est accessible sur le site des trois Initiatives de programmation conjointe.) Les participants français doivent également s'enregistrer sur la plateforme de l'ANR. [et si possible y déposer une copie de dossier scientifique]

Accès au document

Le réseau d'épidémiosurveillance financé par le plan Ecophyto - Réorientations à opérer

La mission conjointe CGEDD-CGAAER d'expertise relative aux réorientations à opérer du réseau d'épidémiosurveillance est intervenue dans un contexte où les moyens alloués à cette action du plan Ecophyto ont été réduits de 23 % pour l'année 2019. Mis en en place en 2009 dans le cadre du plan Ecophyto, le réseau d'épidémiosurveillance est une des composantes

de la surveillance biologique du territoire et s'inscrit dans le cadre de la directive 2009/128/CE du Parlement européen et du Conseil du 21 octobre 2009 instaurant un cadre d'action communautaire pour parvenir à une utilisation des pesticides compatible avec le développement durable. Ce réseau fonctionne de manière relativement autonome au sein du plan Ecophyto et par rapport aux plans officiels de surveillance des organismes nuisibles réglementés. La gouvernance du réseau d'épidémiosurveillance distincte de celle de la surveillance des organismes réglementés et autonome par rapport à celle du plan Ecophyto, doit être repensée dans le cadre d'une stratégie sanitaire intégrée nationale, cohérente avec le nouveau règlement européen 2016/2031 en santé des végétaux, en veillant à la cohérence entre les échelons national et régional. Les moyens financiers du réseau d'épidémiosurveilllance proviennent uniquement de subventions attribuées par l'Agence française pour la biodiversité à partir du produit des redevances pour pollution diffuse. Gérés par les chambres régionales d'agriculture, ils sont répartis en totalité entre les régions sans qu'il soit suffisamment tenu compte de la complexité des systèmes de culture, des plans de relance et des besoins de financement des actions qui pourraient être mutualisées. Il est proposé à court terme de réserver une part de l'enveloppe de crédits Ecophyto dédiée à l'épidémiosurveillance pour financer les actions d'ampleur nationale et de revoir les critères de répartition entre régions de la part régionale de l'enveloppe. A plus long terme, il serait justifié de diversifier les ressources pour financer la surveillance sanitaire du territoire en complétant les crédits du budget de l'État et ceux du plan Ecophyto notamment par des redevances sanitaires, des subventions des conseils régionaux et des contributions professionnelles. Le réseau de surveillance biologique du territoire trop cloisonné avec un partage supra régional insuffisant requiert une dynamique collective d'ensemble. Le contenu, la forme et les modes de diffusion des bulletins de santé du végétal, produit principal et visible du réseau d'épidémiosurveillance, doivent évoluer en fonction des attentes des différents publics cibles qu'il faut mieux définir. Si le réseau d'épidémiosurveillance ne contribue pas directement à la baisse d'usage des produits phytopharmaceutiques, il est indispensable pour surveiller les évolutions des bioagresseurs favorisées par le changement climatique, ainsi que pour l'agriculture biologique. Un schéma national des données de la surveillance biologique du territoire doit être élaboré précisant les modalités de production des données, l'organisation du système d'information pour leur gestion, la politique de leur diffusion, ainsi que la gouvernance de l'ensemble. […]

Les diverses améliorations suggérées et la rationalisation proposée de la mise en œuvre du réseau d'épidémiosurveillance devraient permettre de le conforter à court terme. Elles ne doivent pas dispenser d'une réflexion stratégique de plus long terme sur l'ensemble de la surveillance sanitaire du végétal et sur le rôle des différents acteurs.

Auteurs : LAVARDE Patrick, MALEZIEUX Sylvie, BELLEMAIN Véronique

Publié le 22 avril 2020

Accès au rapport (PDF)

REGLEMENTATION / DROIT

Acide perfluorooctanoïque (PFOA), ses sels et les composés apparentés au PFOA

RÈGLEMENT DÉLÉGUÉ (UE) 2020/784 DE LA COMMISSION du 8 avril 2020 modifiant l'annexe I du règlement (UE) 2019/1021 du Parlement européen et du Conseil aux fins d'y inscrire l'acide perfluorooctanoïque (PFOA), ses sels et les composés apparentés au PFOA

Numéro officiel : UE/2020/784
Date de signature : 08/04/2020
Liens juridiques : Modification le 04/07/2020 Règlement UE/2019/1021 20/06/2019

Accès au document

Substances actives beflubutamide, bénalaxyl, benthiavalicarb, bifénazate, boscalid, bromoxynil, captane, cyazofamid, diméthomorphe,

https://doi.org/10.15454/BGEP-SC64

éthéphon, étoxazole, famoxadone, fenamiphos, flumioxazine, fluoxastrobine, folpet, formétanate, métribuzine, milbémectine, Paecilomyces lilacinus - souche 251, phenmedipham, phosmet, pirimiphos-méthyl, propamocarbe, prothioconazole et S-métolachlore : prolongation de la validité de l'approbation

RÈGLEMENT D'EXÉCUTION (UE) 2020/869 DE LA COMMISSION du 24 juin 2020 modifiant le règlement d'exécution (UE) n° 540/2011 en ce qui concerne la prolongation de la validité de l'approbation des substances actives beflubutamide, bénalaxyl, benthiavalicarb, bifénazate, boscalid, bromoxynil, captane, cyazofamid, diméthomorphe, éthéphon, étoxazole, famoxadone, fenamiphos, flumioxazine, fluoxastrobine, folpet, formétanate, métribuzine, milbémectine, Paecilomyces lilacinus - souche 251, phenmedipham, phosmet, pirimiphos-méthyl, propamocarbe, prothioconazole et S-métolachlore

Numéro officiel : UE/2020/869
Date de signature : 24/06/2020
Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Enregistrement, l'évaluation et l'autorisation des substances chimiques, ainsi que les restrictions applicables à ces substances (REACH)

RÈGLEMENT (UE) 2020/878 DE LA COMMISSION du 18 juin 2020 modifiant l'annexe II du règlement (CE) n° 1907/2006 du Parlement européen et du Conseil concernant l'enregistrement, l'évaluation et l'autorisation des substances chimiques, ainsi que les restrictions applicables à ces substances (REACH)

Numéro officiel : UE/2020/878
Date de signature : 18/06/2020
Liens juridiques : Modification le 01/01/2021 Règlement CE/1907/2006 18/12/2006

Accès au document

Mise sur le marché des produits phytopharmaceutiques : approbation renouvelée de la substance active «carvone»

RÈGLEMENT D'EXÉCUTION (UE) 2019/706 DE LA COMMISSION du 7 mai 2019 renouvelant l'approbation de la substance active «carvone» 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/2019/706
Date de signature : 07/05/2019
Historique : Rectification par Règlement d'exécution UE/2020/653 14/05/2020

Accès au document

Mise sur le marché des produits phytopharmaceutiques : non-approbation de l'extrait de propolis en tant que substance de base

RÈGLEMENT D'EXÉCUTION (UE) 2020/640 DE LA COMMISSION du 12 mai 2020 portant non-approbation de l'extrait de propolis en tant que substance de base conformément au règlement (CE) n° 1107/2009 du Parlement européen et du Conseil concernant la mise sur le marché des produits phytopharmaceutiques

Numéro officiel : UE/2020/640
Date de signature : 12/05/2020

Accès au document

https://doi.org/10.15454/BGEP-SC64

Mise sur le marché des produits phytopharmaceutiques : approbation de la substance de base «L-cystéine»

RÈGLEMENT D'EXÉCUTION (UE) 2020/642 DE LA COMMISSION du 12 mai 2020 portant approbation de la substance de base «L-cystéine» 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/2020/642
Date de signature : 12/05/2020
Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Mise sur le marché des produits phytopharmaceutiques : non-approbation des racines de *Saponaria officinalis* L. en tant que substance de base

RÈGLEMENT D'EXÉCUTION (UE) 2020/643 DE LA COMMISSION du 12 mai 2020 portant non-approbation des racines de Saponaria officinalis L. en tant que substance de base conformément au règlement (CE) n° 1107/2009 du Parlement européen et du Conseil concernant la mise sur le marché des produits phytopharmaceutiques

Numéro officiel : UE/2020/643
Date de signature : 12/05/2020

Accès au document

Mise sur le marché des produits phytopharmaceutiques : approbation de la substance active «sénécioate de lavandulyle» en tant que substance à faible risque

RÈGLEMENT D'EXÉCUTION (UE) 2020/646 DE LA COMMISSION du 13 mai 2020 portant approbation de la substance active «sénécioate de lavandulyle» 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/2020/646
Date de signature : 13/05/2020
Liens juridiques : Modification Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Dérogation temporaire d'épandage par voie aérienne de produits phytopharmaceutiques pour les vignes dans les départements de l'Aude et de l'Hérault

Arrêté du 22 mai 2020 établissant une dérogation temporaire d'épandage par voie aérienne de produits phytopharmaceutiques pour les vignes dans les départements de l'Aude et de l'Hérault

Numéro officiel : AGRG2012554A
Date de signature : 22/05/2020

Accès au document

Modalités d'épandage des boues issues du traitement des eaux usées urbaines pendant la période de covid-19

Arrêté du 30 avril 2020 précisant les modalités d'épandage des boues issues du traitement des

https://doi.org/10.15454/BGEP-SC64

eaux usées urbaines pendant la période de covid-19

Numéro officiel : TREL2011136A

Date de signature : 30/04/2020

Accès au document

Mise sur le marché des produits phytopharmaceutiques : approbation de la substance active «foramsulfuron» renouvelée

RÈGLEMENT D'EXÉCUTION (UE) 2020/616 DE LA COMMISSION du 5 mai 2020 renouvelant l'approbation de la substance active «foramsulfuron» 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/2020/616
Date de signature : 05/05/2020
Liens juridiques : Modification le 01/06/2020 Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Approbation de la substance active « métalaxyl-M » et restreignant l'utilisation de semences traitées avec des produits phytopharmaceutiques contenant cette substance

RÈGLEMENT D'EXÉCUTION (UE) 2020/617 DE LA COMMISSION du 5 mai 2020 renouvelant l'approbation de la substance active «métalaxyl-M» et restreignant l'utilisation de semences traitées avec des produits phytopharmaceutiques contenant cette substance, 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/2020/617
Date de signature : 05/05/2020
Liens juridiques : Modification le 01/06/2020 Règlement d'exécution UE/540/2011 25/05/2011

Accès au document

Produits biocides «HYPRED's octanoic acid based products» : règlement d'autorisation de l'Union

REGLEMENT D'EXÉCUTION (UE) 2020/579 DE LA COMMISSION du 27 avril 2020 accordant une autorisation de l'Union pour la famille de produits biocides «HYPRED's octanoic acid based products»

Numéro officiel : UE/2020/579

Date de signature : 27/04/2020

Accès au document

Famille de produits biocides «SOPURCLEAN» : réglement d'autorisation de l'Union

REGLEMENT D'EXÉCUTION (UE) 2020/580 DE LA COMMISSION du 27 avril 2020 accordant une autorisation de l'Union pour la famille de produits biocides «SOPURCLEAN»

Numéro officiel : UE/2020/580
Date de signature : 27/04/2020

Accès au document

https://doi.org/10.15454/BGEP-SC64

PUBLICATIONS DU RESEAU ECOTOX

New insights into methylmercury induced behavioral and energy-related gene transcriptional responses in European glass eel (*Anguilla anguilla*)

Authors: Liu HT, Lamarins A, Labonne J, Monperrus M, Coste P, Huchet E, Rives J, Seiliez I, Bolliet V

Source: CHEMOSPHERE 255:127020, 2020, DOI: 10.1016/j.chemosphere.2020.127020

Abstract: The effect of methylmercury (MeHg) was investigated in glass eel migration behavior and metabolism. To migrate up estuary, glass eels synchronize their swimming activity to the flood tide and remain on or in the substratum during ebb tide. Following seven days of exposure to MeHg (100 ng L-1), glass eels migration behavior was expressed by their swimming synchronization to the water current reversal every 6.2 h (mimicking the alternation of flood and ebb tides) and their swimming activity level. In relation to their behavior, we then analyzed the energy-related gene expression levels in individual head, viscera and muscle. Results showed that MeHg decreased the number of glass eels synchronized to the change in water current direction and their swimming activity level. This last effect was more pronounced in non-synchronized fish than in synchronized ones, supporting the idea that non-synchronized glass eels could be more vulnerable to stress. As regard the expression of energy-related genes, no significant difference was observed between control and MeHg-exposed fish. In contrast, when the swimming activity levels were plotted against transcriptional responses, positive correlations were evidenced in viscera and especially in the head of exposed glass eels but not in control. Finally, it is noteworthy that non-synchronized glass eels displayed lower expression level of metabolism genes than their synchronized counterpart, but only in the head. Altogether, these results support the interest of focusing on the head to investigate the facultative migration behavior in glass eels and the effect of environmental stressors on this rhythmic behavior.

Field measurement and modelling of chlorotoluron and flufenacet persistence in unamended and amended soils

Authors: Marin-Benito JM, Carpio MJ, Mamy L, Andrades MS, Sanchez-Martin MJ, Rodriguez-Cruz MS

Source: SCIENCE OF THE TOTAL ENVIRONMENT 725:138374, 2020, DOI: 10.1016/j.scitotenv.2020.138374

Abstract: The dissipation and persistence of two cereals herbicides, chlorotoluron and flufenacet, were studied in a field experiment including three replicated plots of unamended soil (S), soil amended with spent mushroom substrate (S+ SMS), and soil amended with green compost (S+ GC), during the winter wheat cultivation campaign. The SMS and GC organic residues were applied to the soil at rates of 140 or 85 t residue ha(-1), and herbicides were sprayed as Erturon (R) and Herold (R) formulations for chlorotoluron and flufenacet, respectively. Concentrations of both herbicides and of their metabolites were regularly measured in the three soil treatments (0-10 cm) from 0 to 339 days. The dissipation kinetics fitted well the single first order (SFO) model, except that of chlorotoluron that fitted the first ordermulti-compartment (FOMC) model better in the unamended soil. The dissipation rates of herbicides were lower in amended than in unamended soils. The results also showed that the DT50 of chlorotoluron (66.2-88.0 days) and flufenacet (117-145 days) under field conditions were higher than those previously obtained at laboratory scale highlighting the importance of the changing environmental conditions on the dissipation process. Similarly, the formation of chlorotoluron and flufenacet metabolites under field conditions was different from that previously observed in the laboratory. The performance of the MACRO pesticide fate model, parameterized with laboratory data, was then tested against field data. There was a very good agreement between measured and simulated chlorotoluron residue levels in the three soil treatments, while the ability of the model to reproduce the dissipation of flufenacet was good

in the unamended soil and very good in S + SMS and S + GC soils. MACRO might be used to estimate the remaining amounts of herbicides in amended soils from degradation data previously obtained at laboratory scale. This would help to manage herbicide doses in different environmental conditions to preserve the sustainability of agricultural systems.

Combined thermal and insecticidal stresses on the generalist predator Macrolophus pygmaeus

Authors: Ricupero M, Abbes K, Haddi K, Kurtulus A, Desneux N, Russo A, Siscaro G, Biondi A, Zappala L

Source: SCIENCE OF THE TOTAL ENVIRONMENT 729:138922, 2020, DOI: 10.1016/j.scitotenv.2020.138922

Abstract: Ecotoxicological risk assessments of pesticides on non-target arthropods are often carried out under constant and optimal temperature regimes. However, living organisms rarely experience these conditions in real field situations. Understanding the impact of pesticides on non-target beneficial arthropods under temperature stresses is especially important in terms of global warming. We assessed the lethal and sublethal effects of four modern insecticides (chlorantraniliprole, cyantraniliprole, spinetoram, spinosad), on the generalist predatorMacrolophus pygmaeus (Hemiptera: Miridae) under a range of temperatures (from 10 to 40 degrees C) frequently experienced in a real field scenario. A reduction coefficient (E-x) was calculated by summarizing the mortality and predator reproductive capacity and, the chemicals were classified according to the International Organization for Biological Control (IOBC) toxicity classes. The insecticides showed a marked synergistic effect with temperature, as the predator mortality and reproductive outputs were significantly correlated with increasing temperatures. Spinosyns interacted significantly with temperature causing the highest mortality and lowest fertility rates. Anthranilic diamides showed a safer ecotoxicological profile compared to spinosyns, with cyantraniliprole being more harmful than chlorantraniliprole. These results suggest that temperature should be taken into account in pesticide ecotoxicology studies within the framework of integrated pest management and the recent climate changes.

Plants in the Light of Ionizing Radiation: What Have We Learned From Chernobyl, Fukushima, and Other "Hot" Places?

Authors: Mousseau TA, Moller AP

Source: FRONTIERS IN PLANT SCIENCE 11:552, 2020, DOI: 10.3389/fpls.2020.00552

Abstract: Perhaps the main factor determining success of space travel will be the ability to control effects of ionizing radiation for humans, but also for other living organisms. Manned space travel will require the cultivation of food plants under conditions of prolonged exposure to ionizing radiation. Although there is a significant literature concerning the effects of acute high dose rate exposures on plant genetics, growth, and development, much less is known concerning the effects of chronic low dose irradiation especially those related to the impacts of the high energy protons and heavy ions that are encountered in the space environment. Here, we make the argument that in situ studies of the effects of radionuclides at nuclear accident sites (e.g., Chernobyl and Fukushima), atomic bomb test sites, and areas of naturally high radiation levels, could provide insights concerning the mechanisms of radiation effects on living systems that cannot be assessed short of conducting research in space, which is not yet feasible for large scale, long term, multigenerational experiments. In this article we review the literature concerning the effects of chronic low-dose rate radiation exposure from studies conducted in Chernobyl, Fukushima, and other regions of the world with high ambient radiation levels (parts of India in particular). In general, mutation rates and other measures of genetic damage are considerably elevated, pollen and seed viability are reduced, growth rates are slower, and the frequency of developmental abnormalities is increased, although there is considerable variation among taxa for these effects. In addition, there are interactions between radiation and other environmental stressors (e.g., temperature, drought, heavy metals) that may play important roles in

determining susceptibility to radiation induced stress.

Assessment of residential exposures to agricultural pesticides: A scoping review

Authors: Teysseire R, Manangama G, Baldi I, Carles C, Brochard P, Bedos C, Delva F

Source: PLOS ONE 15(4):e0232258, 2020, DOI: 10.1371/journal.pone.0232258

Abstract: The assessment of residential exposure to agricultural pesticides is a major issue for public health, regulatory and management purposes. In recent years, research into this field has developed considerably. The purpose of this scoping review is to provide an overview of scientific literature characterizing residential exposure to agricultural pesticides and to identify potential gaps in this research area. This work was conducted according to the JBI and PRISMA guidelines. Three databases were consulted. At least two experts selected the eligible studies. Our scoping review enabled us to identify 151 articles published between 1988 and 2019 dealing with the assessment of residential exposure to agricultural pesticides. Of these, 98 (64.9%) were epidemiological studies investigating possible links between pesticide exposure and the onset of adverse health effects, principally cancers and reproductive outcomes. They predominantly used Geographic Information Systems and sometimes surveys or interviews to calculate surrogate exposure metrics, the most common being the amounts of pesticides applied or the surface area of crops around the dwelling. Twenty-six (17.2%) were observational measurement studies conducted to quantify levels of pesticide exposure and identify their possible determinants. These studies assessed exposure by measuring pesticides in biological and environmental matrices, mostly in urines and house dust. Finally, we found only eight publications (5.3%) that quantified the risk to human health due to residential exposure for management purposes, in which exposure was mainly determined using probabilistic models. Pesticide exposure appears to be largely correlated with the spatial organization of agriculture activities in a territory. The determinants and routes of exposure remain to be explored to improve the conduct of epidemiological and risk assessment studies and to help prevent future exposures. Improvement could be expected from small-scale studies combining different methods of exposure assessment.

Spatio-temporal assessment of the polychlorinated biphenyl (PCB) sediment contamination in four major French river corridors (1945-2018)

Authors: Dendievel AM, Mourier B, Coynel A, Evrard O, Labadie P, Ayrault S, Debret M, Koltalo F, Copard Y, Faivre Q, Gardes T, Vauclin S, Budzinski H, Grosbois C, Winiarski T, Desmet M

Source: EARTH SYSTEM SCIENCE DATA 12(2):1153-1170, 2020, DOI: 10.5194/essd-12-1153-2020

Abstract: Environmental pollution by polychlorinated biphenyls (PCBs) is a key cause for concern about river quality because of their low degradation rates leading to their accumulation in sediments and living organisms. An original interdisciplinary work was conducted along the four main French rivers (Seine, Rhone, Loire and Garonne rivers), which flow into major European seas. We completed a dataset based on sediment analyses provided by monitoring agencies, port authorities and research teams on different solid matrices (sediment cores, bed and flood deposits, suspended particulate matter and dredged sediments). This dataset focused on the seven indicator PCBs and their sum (Sigma PCBi) from 1945 to 2018 (n Sigma PCBi = 1416). Special effort was put into the quality control to provide robust spatio-temporal information. Taking into account hydrological and human drivers, we outlined two main pollution trends: (1) from 1945 to 1975, a quick increase in Sigma PCBi (up to 4 mg kg(-1) dry weight, dw) and a sharp decrease in the 1980s on the Seine and Loire rivers and (2) increasing but moderate Sigma PCBi levels (50 to 150 mu g kg(-1) dw) followed by a decline after the 1990s on the Rhone and Garonne rivers. In addition to these patterns, PCB emissions from urban and industrial areas or accidental events were significant in each river. Finally, when calculating specific flux, the Rhone exhibited the uppermost Sigma PCBi load (up to 12 mu g m(-2) yr(-1) in 1977-1987), at least 25 %

higher than those of the Seine and Loire rivers, while the Garonne showed a very low flux. In western Europe, we confirmed that the Rhone, Seine and Loire rivers contribute significantly to the PCB contamination of the seas, while French specific Sigma PCBi fluxes are 2 orders of magnitude lower than those found in American or Asian rivers. The dataset is available at https://doi.org/10.1594/PANGAEA.904277 (Dendievel et al., 2019).

Seasonal monitoring of cellular energy metabolism in a sentinel species, *Dreissena polymorpha* (bivalve): Effect of global change?

Authors: Louis F, Rocher B, Barjhoux I, Bultelle F, Dedourge-Geffard O, Gaillet V, Bonnard I, Delahaut L, Pain-Devin S, Geffard A, Paris-Palacios S, David E

Source: SCIENCE OF THE TOTAL ENVIRONMENT 725:138450, 2020, DOI: 10.1016/j.scitotenv.2020.138450

Abstract: Aquatic organisms such as bivalves are particularly sensitive to seasonal fluctuations associated with climate changes. Energy metabolism management is also closely related to environmental fluctuations. Changes in both biotic and abiotic conditions, such as the reproduction status and temperature respectively, may affect the organismenergy status. A bivalve sentinel species, *Dreissena polymorpha* was sampled along its one-year reproduction cycle in situ (2018-2019) to study naturalmodulations on severalmarkers of energy metabolismregarding seasonal variations in situ. A panel of different processes involved in energymetabolism was monitored through different functions such as energy balance regulation, mitochondrial density, and aerobic/anaerobic metabolism. The typical schema expected was observed in amajor part of measured responses. However, themonitored population of *D. polymorpha* showed signs of metabolism disturbances caused by an external stressor from April 2019. Targeting a major part of energymetabolismfunctions, a global analysis of responses suggested a putative impact on the mitochondrial respiratory chain due to potential pollution. This study highlighted also the particular relevance of in situ monitoring to investigate the impacts of environmental change on sentinel species.

Dissipation of S-metolachlor and butachlor in agricultural soils and responses of bacterial communities: Insights from compound-specific isotope and biomolecular analyses

Authors: Torabi E, Wiegert C, Guyot B, Vuilleumier S, Imfeld G

Source: JOURNAL OF ENVIRONMENTAL SCIENCES 92:163-175, 2020, DOI: 10.1016/j.jes.2020.02.009

Abstract: The soil dissipation of the widely used herbicides S-metolachlor (SM) and butachlor (BUT) was evaluated in laboratory microcosms at two environmentally relevant doses (15 and 150 mu g/g) and for two agricultural soils (crop and paddy). Over 80% of SM and BUT were dissipated within 60 and 30 days, respectively, except in experiments with crop soil at 150 mu g/g. Based on compound-specific isotope analysis (CSIA) and observed dissipation, biodegradation was the main process responsible for the observed decrease of SM and BUT in the paddy soil. For SM, biodegradation dominated over other dissipation processes, with changes of carbon isotope ratios (Delta delta C-13) of up to 6.5% after 60 days, and concomitant production of ethane sulfonic acid (ESA) and oxanilic acid (OXA) transformation products. In crop soil experiments, biodegradation of SM occurred to a lesser extent than in paddy soil, and sorption was the main driver of apparent BUT dissipation. Sequencing of the 16S rRNA gene showed that soil type and duration of herbicide exposure were the main determinants of bacterial community variation. In contrast, herbicide identity and spiking dose had no significant effect. In paddy soil experiments, a high (4:1, V/V) ESA to OXA ratio for SM was observed, and phylotypes assigned to anaerobic Clostridiales and sulfur reducers such as Desulfuromonadales and Syntrophobacterales were dominant for both herbicides. Crop soil microcosms, in contrast, were associated with a reverse, low (1:3, V/V) ratio of ESA to OXA for SM, and Alphaproteobacteria, Actinobacteria, and

Bacillales dominated regardless of the herbicide. Our results emphasize the variability in the extent and modes of SM and BUT dissipation in agricultural soils, and in associated changes in bacterial communities.

Towards a spatiotemporally explicit toxicokinetic-toxicodynamic model for earthworm toxicity

Authors: Roeben V, Oberdoerster S, Rakel KJ, Liesy D, Capowiez Y, Ernst G, Preuss TG, Gergs A, Oberdoerster C

Source: SCIENCE OF THE TOTAL ENVIRONMENT 722:137673, 2020, DOI: 10.1016/j.scitotenv.2020.137673

Abstract: The aim of the environmental risk assessment of chemicals is the prevention of unacceptable adverse effects on the environment. Therefore, the risk assessment for in-soil organisms, such as earthworms, is based on two key elements: the exposure assessment and the effect assessment. In the current risk assessment scheme, these two elements are not linked. While for the exposure assessment, advanced exposure models can take the spatial and temporal scale of substances into account, the effect assessment in the lower tiers considers only a limited temporal and spatial variability. However, for soil organisms, such as earthworms, those scales play a significant role as species move through the soil in response to environmental factors. To overcome this gap, we propose a conceptual integration of pesticide exposure, ecology, and toxicological effects on earthworms using a modular modeling approach. An essential part of this modular approach is the environment module, which utilizes exposure models to provide spatially and temporally explicit information on environmental variables (e.g., temperature, moisture, organic matter content) and chemical concentrations. The behavior module uses this information and simulates the feeding and movement of different earthworm species using a trait-based approach. The resulting exposure can be processed by a toxico kinetic-toxicodynamic (TKTD) module. TKTD models are particularly suitable to make effect predictions for time-variable exposure situations as they include the processes of uptake, elimination, internal distribution, and biotransformation of chemicals and link the internal concentration to an effect at the organism level. The population module incorporates existing population models of different earthworm species. The modular approach is illustrated using a case study with an insecticide. Our results emphasize that using a modular model approachwill facilitate the integration of exposure and effects and thus enhance the risk assessment of soil organisms.

Anther-smut fungi from more contaminated sites in Chernobyl show lower infection ability and lower viability following experimental irradiation

Authors: Arnaise S, Shykoff JA, Moller AP, Mousseau TA, Giraud T

Source: ECOLOGY AND EVOLUTION Early Access: MAY, 2020, DOI: 10.1002/ece3.6376

Abstract: The long-term contamination that followed the nuclear disaster at Chernobyl provides a case study for the effects of chronic ionizing radiation on living organisms and on their ability to tolerate or evolve resistance to such radiation. Previously, we studied the fertility and viability of early developmental stages of a castrating plant pathogen, the anther-smut fungus Microbotryum lychnidis-dioicae, isolated from field sites varying over 700-fold in degree of radioactive contamination. Neither the budding rate of haploid spores following meiosis nor the karyotype structure varied with increasing radiation levels at sampling sites. Here, we assessed the ability of the same M. lychnidis-dioicae strains to perform their whole life cycle, up to the production of symptoms in the plants, that is, the development of anthers full of fungal spores; we also assessed their viability under experimental radiation. Fungal strains from more contaminated sites had no lower spore numbers in anthers or viability, but infected host plants less well, indicating lower overall fitness due to radioactivity exposure. These findings improve our understanding of the previous field data, in which the anther-smut disease prevalence on Silene latifolia plants caused by *M. lychnidis*-dioicae was lower at more contaminated sites. Although the fungus showed relatively high

resistance to experimental radiation, we found no evidence that increased resistance to radiation has evolved in populations from contaminated sites. Fungal strains from more contaminated sites even tolerated or repaired damage from a brief acute exposure to gamma radiation less well than those from non- or less contaminated sites. Our results more generally concur with previous studies in showing that the fitness of living organisms is affected by radiation after nuclear disasters, but that they do not rapidly evolve higher tolerance.

Ex situ environmental risk assessment of polluted soils using threshold guide values for the land snail *Cantareus aspersus*

Authors: Louzon M, Pauget B, Gimbert F, Morin-Crini N, de Vaufleury A

Source: SCIENCE OF THE TOTAL ENVIRONMENT 721:137789, 2020, DOI: 10.1016/j.scitotenv.2020.137789

Abstract: Environmental risk assessment of contaminated soils should ideally be carried out with complementary approaches (chemical and biological) conducted in situ and ex situ. While biological methods based on the assessment of effect and bioaccumulation in bioindicators exist for soil fauna organisms, such as land snails, the methodology is currently limited in the field to 14 metallic elements (MEs). To provide new relevant tools to the stakeholders of polluted fields, the aim of this work is to determine ex situ threshold guide values (ex situ TGVs), for 15 MEs, 16 polycyclic aromatic hydrocarbons (PAHs) and 7 polychlorinated biphenyls (PCBs). These ex situ TGVs are the usual concentration of contaminants found in the viscera of the bioindicator *Cantareus aspersus* after 28 days of exposure to uncontaminated soils. The second objective was to assess and validate the relevance of these ex situ TGVs for the interpretation of contamination levels in various European contaminated soils based on global index calculations: i) The sum of the excess of transfers (SETs) and ii) the weighted SETs based on the general toxicity points of each contaminant used to evaluate the risk of transferred MEs, PAHs and PCBs (ERITMEs, ERITPAHs and ERITPCBs, respectively). In addition, the influence of soil physico-chemical properties on accumulation was modelled to better understand their roles in bioavailability. The presented ex situ TGV and the associated indicators (the global sum of the excess of transfers and global ecotoxicological risk) provide a basis by which stakeholders can prioritize the management of polluted soils depending on the risk they may represent. The determination of ex situ TGVs for organic and inorganic compounds provides new tools to characterize excess contaminant transfers, and it will also allow the use of snails for ERAs, notably for common pollutants, such as PAHs and PCBs for which guide values are not available.

Miscanthus x giganteus culture on soils highly contaminated by metals: Modelling leaf decomposition impact on metal mobility and bioavailability in the soil-plant system

Authors: Al SoukiKS, Line C, Louvel B, Waterlot C, Douay F, Pourrut B

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 199:110654, 2020, DOI: 10.1016/j.ecoenv.2020.110654

Abstract: *Miscanthus x giganteus* is suggested as a good candidate for phytostabilization of metal-polluted soils. Its late harvest in winter generates large amounts of leaf litter on the soil surface. However, little is known about the mobility and the bioavailability of metals following leaf decomposition and the consequences on the succeeding culture. Ex situ artificial aging for 1, 3, and 6 months was conducted with miscanthus leaf fragments incorporated into three agricultural soils displaying a gradient concentration in Cd (0.6, 3.1 and 7.9 mg kg(-1)), Pb (32.0, 194.6 and 468.6 mg kg(-1)), and Zn (48.4, 276.3 and 490.2 mg kg(-1)) to simulate the leaf litter input over 20 years of miscanthus culture. We investigated the impacts on physicochemical and biological soil parameters, CaCl2-extractable metal, and their subsequent ryegrass shoot concentrations, and hence on ryegrass health. The results showed that the amended soils possessed higher pH along with greater available phosphorous and soil

organic carbon values. The respiratory activity and microbial biomass carbon in the amended soils increased mainly after 1 month of aging, and decreased afterwards. Despite the higher Pb- and Zn-CaCl2 extractability in the amended soils, the phytoavailability slightly increased only in the most contaminated soils. Moreover, leaf incorporation did not affect the ryegrass biomass, photosynthetic pigment contents, nor the antioxidative enzyme activities. Conclusively, leaf incorporation induced slight variations in soil physicochemical and biological parameters, as well as metal extractability, but not to an extent that might cause a considerable threat to the subsequent culture. Nevertheless, these results are preliminary data that require confirmation by long-term insitu experimentations as they reflect the modelization of long-term impact of leaf decomposition on soil-plant system.

Undernutrition combined with dietary mineral oil hastens depuration of stored dioxin and polychlorinated biphenyls in ewes. 1. Kinetics in blood, adipose tissue and faeces

Authors: Rey-Cadilhac L, Cariou R, Ferlay A, Jondreville C, Delavaud C, Faulconnier Y, Alcouffe S, Faure P, Marchand P, Le Bizec B, Jurjanz S, Lerch S

Source: PLOS ONE 15(3): e0230629, 2020, DOI: 10.1371/journal.pone.0230629

Abstract: Food safety crises involving persistent organic pollutants [POPs, e.g. dioxins, polychlorinated biphenyls (PCBs), organochlorine pesticides] lead to systematic slaughter of livestock to prevent their entry into the food chain. Therefore, there is a need to develop strategies to depurate livestock moderately contaminated with POPs in order to reduce such economic and social damages. This study aimed to test a POPs depuration strategy based on undernutrition (37% of energy requirements) combined with mineral oil (10% in total dry matter intake) in nine non-lactating ewes contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and PCBs 126 and 153. In order to better understand the underlying mechanisms of the depuration process, POPs kinetics and body lipids dynamics were followed concomitantly over 57-day of depuration in POPs storage (adipose tissue, AT), central distribution (blood) and excretion (faeces) compartments. Faecal POPs concentrations in underfed and mineral oil supplemented ewes increased by 2.0 to 2.6-fold, but not proportionally to lipids concentration which increased by 6-fold, compared to the control ewes. Nonetheless, after 57 days of depuration in undernutrition and mineral oil supplementation, AT POPs concentrations were 1.5 to 1.6-fold higher while serum concentrations remained unchanged compared to the control ewes. This was concomitant with a decrease by 2.7-fold of the AT estimated lipids weight along the depuration period. This reduction of the volume of the storage compartment combined with the increase of POPs faecal excretion in underfed and mineral oil supplemented ewes led to a reduction by 1.5-fold of the PCB 126 AT burden, while no changes were observed for TCDD and PCB 153 burdens (vs. no change for PCB 126 and increases for TCDD and PCB 153 AT burdens in control ewes). The original approach of this study combining the fine description at once of POPs kinetic and of body lipids dynamic improved our understanding of POPs fate in the ruminant.

Undernutrition combined with dietary mineral oil hastens depuration of stored dioxin and polychlorinated biphenyls in ewes. 2. Tissue distribution, mass balance and body burden

Authors: Lerch S, Rey-Cadilhac L, Cariou R, Faulconnier Y, Jondreville C, Roux D, Dervilly-Pinel G, Le Bizec B, Jurjanz S, Ferlay A

Source: PLOS ONE 15(3):e0230628, 2020, DOI: 10.1371/journal.pone.0230628

Abstract: Food safety crises involving persistent organic pollutants (POPs) lead to systematic slaughter of livestock to prevent contaminants from entering the food chain. Therefore, there is a need to develop strategies to depurate livestock moderately contaminated with POPs to reduce economic and social damage. This study aimed to test undernutrition (37% of energy

requirements) combined with mineral oil (10% in total dry matter intake) in nine non-lactating ewes contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and polychlorinated biphenyls (PCBs) 126 and 153 as a strategy to enhance the depuration of POPs through faecal excretion. To better understand the underlying mechanisms of the depuration process, lipophilic POPs and lipid fluxes were co-monitored in various body and excretion compartments. Body compartments (adipose tissues, muscle, liver and blood) and the total empty body were analyzed for lipids and POPs concentrations and burdens at slaughter, as well as excretion compartments (faeces and wool) collected during the depuration period. Decreases in empty body total and lipid weights were 6-fold higher in underfed and supplemented ewes compared to control ewes. In addition, over the depuration period undernutrition and supplementation treatment increased faecal TCDD, PCBs 126 and 153 excretions by 1.4- to 2.1-fold but tended to decrease wool PCB 153 excretion by 1.4-fold. This induced 2- to 3-fold higher decreases in the empty body POPs burdens for underfed and supplemented ewes. Nonetheless, when expressed relative to the calculated initial empty body burdens, burdens at slaughter decreased only slightly from 97%, 103% and 98% for control ewes to 92%, 97% and 94% for underfed and supplemented ones, for TCDD, PCBs 126 and 153, respectively. Fine descriptions at once of POPs kinetic (companion paper 1) and mass balance (companion paper 2), and of body lipid dynamics were very useful in improving our understanding of the fate of POPs in the ruminants.

Impact assessment of legacy wastes from ancient mining activities on current earthworm community

Authors: Mariet AL, Gauthier-Manuel H, Lagiewski T, Begeot C, Walter-Simonnet AV, Gimbert F

Source: JOURNAL OF HAZARDOUS MATERIALS 393:122369, 2020, DOI: 10.1016/j.jhazmat.2020.122369

Abstract: Mineral resource exploitation by human societies throughout history led to the deposit of mining and smelting wastes and the subsequent contamination of surrounding soils by trace metals. After several centuries, the impact of these legacy hazardous wastes may remain a cause of environmental concern, especially for indigenous soil invertebrate populations such as earthworms. Therefore, we conducted a passive biomonitoring campaign in a former metallurgical district (Vosges Mountains, eastern France). According to community descriptors, we evidenced a significant decrease of anecic and endogeic earthworm density in the former mining stations. To link these results to soil contamination and bioaccumulation levels in earthworm tissues, we propose an original modelling approach using nonlinear mixed-effects regression models. Beyond a dose-response relationship between metal internal concentrations and their levels in soils, we highlighted contrasted behaviors according to ecological groups (epianecics and endogeics most impacted). We interpreted these results in relation to some eco-physiological features without completely exclude the influence of textural characteristics of soil, especially for deep-burrowing species such as anecic strict. Nonetheless, the presence of earthworm populations currently living in highly contaminated sites and handling elevated internal concentrations raises the question of the acquisition of genetic adaptive traits and the trophic transfers of metals.

Proteogenomics-Guided Evaluation of RNA-Seq Assembly and Protein Database Construction for Emergent Model Organisms

Authors: Cogne Y, Gouveia D, Chaumot A, Degli-Esposti D, Geffard O, Pible O, Almunia C, Armengaud J

Source: PROTEOMICS:1900261, 2020, DOI: 10.1002/pmic.201900261

Abstract: Proteogenomics is gaining momentum as, today, genomics, transcriptomics, and proteomics can be readily performed on any new species. This approach allows key alterations to molecular pathways to be identified when comparing conditions. For animals and plants, RNA-seq-informed proteomics is the most popular means of interpreting tandem mass spectrometry spectra acquired for species for which the genome has not yet been sequenced.

It relies on high-performance de novo RNA-seq assembly and optimized translation strategies. Here, several pre-treatments for Illumina RNA-seq reads before assembly are explored to translate the resulting contigs into useful polypeptide sequences. Experimental transcriptomics and proteomics datasets acquired for individual Gammarus fossarum freshwater crustaceans are used, the most relevant procedure is defined by the ratio of MS/MS spectra assigned to peptide sequences. Removing reads with a mean quality score of less than 17-which represents a single probable nucleotide error on 150-bp reads-prior to assembly, increases the proteomics outcome. The best translation using Transdecoder is achieved with a minimal open reading frame length of 50 amino acids and systematic selection of ORFs longer than 900 nucleotides. Using these parameters, transcriptome assembly and translation informed by proteomics pave the way to further improvements in proteogenomics.

Removal of organic micropollutants in anaerobic membrane bioreactors in wastewater treatment: critical review

Authors: Lim M, Patureau D, Heran M, Lesage G, Kim J

Source: ENVIRONMENTAL SCIENCE-WATER RESEARCH & TECHNOLOGY 6(5):1230-1243, 2020, DOI: 10.1039/c9ew01058k

Abstract: The anaerobic membrane bioreactor (AnMBR) is a promising technology for achieving an energy-saving or even energy-positive wastewater treatment process as it produces high effluent quality and renewable energy in the form of methane. Nevertheless, concerns on inflowing organic micropollutants (OMPs) caused by various human and industrial activities into the AnMBR system are proliferating. The extent to which the removal of OMPs in the AnMBR is understood should vary greatly depending upon the removal pathways mainly involved such as sorption into biomass, transformation, or membrane filtration. This review paper describes the fate and removal mechanisms of OMPs in an AnMBR system. Although the overall performance of AnMBR treating various wastewaters has been observed under such reduced conditions, understanding and modeling the removal mechanisms of OMPs in this type of reactor still requires much research. Elucidating the removal mechanisms of OMPs will lead to improvements in the design and operation of an AnMBR system while optimizing the performance and saving energy.

Biotic and Abiotic Factors Influencing Arsenic Biogeochemistry and Toxicity in Fluvial Ecosystems: A Review

Authors: Barral-Fraga L, Barral MT, MacNeill KL, Martina-Prieto D, Morin S, Rodriguez-Castro MC, Tuulaikhuu BA, Guasch H

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH 17:7, 2020, DOI: 10.3390/ijerph17072331

Abstract: This review is focused on the biogeochemistry of arsenic in freshwaters and, especially, on the key role that benthic microalgae and prokaryotic communities from biofilms play together in through speciation, distribution, and cycling. These microorganisms incorporate the dominant iAs (inorganic arsenic) form and may transform it to other arsenic forms through metabolic or detoxifying processes. These transformations have a big impact on the environmental behavior of arsenic because different chemical forms exhibit differences in mobility and toxicity. Moreover, exposure to toxicants may alter the physiology and structure of biofilms, leading to changes in ecosystem function and trophic relations. In this review we also explain how microorganisms (i.e., biofilms) can influence the effects of arsenic exposure on other key constituents of aquatic ecosystems such as fish. At the end, we present two real cases of fluvial systems with different origins of arsenic exposure (natural vs. anthropogenic) that have improved our comprehension of arsenic biogeochemistry and toxicity in freshwaters, the Pampean streams (Argentina) and the Anllons River (Galicia, Spain). We finish with a briefly discussion of what we consider as future research needs on this topic. This work especially contributes to the general understanding of biofilms influencing arsenic biogeochemistry and highlights the strong impact of nutrient

availability on arsenic toxicity for freshwater (micro) organisms.

Field evaluation of one Cu-resistant somaclonal variant and two clones of tobacco for copper phytoextraction at a wood preservation site

Authors: Kolbas A, Herzig R, Marchand L, Maalouf JP, Kolbas N, Mench M

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early access, 2020, DOI: 10.1007/s11356-020-09151-y

Abstract: A Cu-resistant somaclonal tobacco variant (NBCu 10-8-F1, C1), its BaG mother clone (C3), and the FoP tobacco clone (C2) were cultivated at a wood preservation site on Cu-contaminated soils (239-1290 mg Cu kg(-1) soil range) and an uncontaminated control site (CTRL, 21 mg Cu kg(-1)) to assess their shoot DW yields and potential use for bioavailable Cu stripping. The Cu concentration in the soil pore water varied between 0.15 and 0.84 mg L-1. Influences of Cu exposure and soil treatments, i.e., untreated soil (Unt), soils amended with compost and either dolomitic limestone (OMDL) or zerovalent iron grit (OMZ), on plant growth and shoot ionome were determined. All transplants survived and grew even at high total soil Cu. Shoots were harvested after 3 months (cut 1). Subsequently, bottom suckers developed and were harvested after 2 months (cut 2). Total shoot DW yield (cuts 1 + 2) varied between 0.8 and 9.9 t DW ha(-1) year(-1) depending on tobacco cultivars, soil treatments, and soil Cu exposure. It peaked for all cultivars in the OMDL plots at moderate Cu exposure (239-518 mg kg(-1) soil), notably for the C2 plants. Cut 2 contributed for 11-43% to total shoot DW yield. Increase in shoot DW yield diluted shoot Cu concentration. At low Cu exposure, total shoot Cu removal peaked for the variant. At moderate Cu exposure, shoot Cu concentrations were similar in all cultivars, but total shoot Cu removal was highest for the C2 plants. At high Cu exposure (753-1140 mg kg(-1)), shoot Cu concentrations peaked for the C2 plants in the Unt plots, the C1 and C2 plants in the OMZ plot, and the C3 ones in the OMDL plots. Shoot Cu removal (in g Cu ha(-1) year(-1)) ranged from 15.4 (C2 on the CTRL soil) to 261.3 (C2 on moderately contaminated OMDL soils). The C2 plants phytoextracted more Cu than the C1 and C3 ones in the Unt plots and in the OMDL plots at moderate Cu exposure. In the OMDL plots with high Cu exposure, shoot Cu removal was highest for the C1 plants. Soil amendments improved shoot Cu removal through increase in either shoot DW yield (OMDL-3-fold) or shoot Cu concentration (OMZ-1.3-fold). Increased shoot Cu concentration induced an ionome imbalance with increased shoot Al, Fe, B, and Mg concentrations and decreased P and K ones. Copper concentrations in plant parts varied in decreasing order: roots > leaves > inflorescence (cymes including seeds) > stem, whereas Cu removal ranked as roots > stem = leaves > inflorescence.

Cross talk: Two way allelopathic interactions between toxic Microcystis and Daphnia

Authors: Savic GB, Bormans M, Edwards C, Lawton L, Briand E, Wiegand

Source: HARMFUL ALGAE 94:101803, 2020, DOI: 10.1016/j.hal.2020.101803

Abstract: Due to eutrophication, freshwater ecosystems frequently experience cyanobacterial blooms, many of which produce bioactive metabolites that can affect vertebrates and invertebrates life traits. Zooplankton are able to develop tolerance as a physiological response to cyanobacteria and their bioactive compounds, however, this comes with energetic cost that in turn influence Daphnia life traits and may impair populations. Vice versa, it has been suggested that Daphnia are able to reduce cyanobacterial dominance until a certain cyanobacterial density; it remains unclear whether Daphnia metabolites alone influence the physiological state and bioactive metabolites production of cyanobacteria. Hence, this study investigates mutual physiological reactions of toxic Microcystis aeruginosa PCC7806 and Daphnia magna. We hypothesize that a) the presence of D. magna will negatively affect growth, increase stress response and metabolites production in M. aeruginosa PCC7806 and b) the presence of M. aeruginosa PCC7806 will negatively affect physiological responses and life traits in D. magna. In order to test these hypotheses experiments were conducted in a specially

designed co-culture chamber that allows exchange of the metabolites without direct contact. A clear mutual impact was evidenced. Cyanobacterial metabolites reduced survival of D. magna and decreased oxidative stress enzyme activity. Simultaneously, presence of D. magna did not affect photosynthetic activity. However, ROS increase and tendencies in cell density decrease were observed on the same day, suggesting possible energy allocation towards anti-oxidative stress enzymes, or other protection mechanisms against Daphnia infochemicals, as the strain managed to recover. Elevated concentration of intracellular and overall extracellular microcystin MC-LR, as well as intracellular concentrations of aerucyclamide A and D in the presence of Daphnia, indicating a potential protective or anti-grazing function. However, more research is needed to confirm these findings.

Usability of the bivalves Dreissena polymorpha and *Anodonta anatina* for a biosurvey of the neurotoxin BMAA in freshwater ecosystems

Authors: Lepoutre A, Hervieux J, Faassen EJ, Zweers AJ, Lurling M, Geffard A, Lance E

Source: ENVIRONMENTAL POLLUTION 259:113885, 2020, DOI: 10.1016/j.envpol.2019.113885

Abstract: The environmental neurotoxin beta-methylamino-L-alanine (BMAA) may represent a risk for human health in case of chronic exposure or after short-term exposure during embryo development. BMAA accumulates in freshwater and marine organisms consumed by humans. It is produced by marine and freshwater phytoplankton species, but the range of producers remains unknown. Therefore, analysing the phytoplankton composition is not sufficient to inform about the risk of freshwater contamination by BMAA. Filter-feeders mussels have accumulation capacities and therefore appear to be relevant to monitor various pollutants in aquatic ecosystems. We investigated the suitability of the freshwater mussels Dreissena polymorpha and *Anodonta anatina* for monitoring BMAA in water. Both species were exposed to 1, 10, and 50 µg of dissolved BMAA/L daily for 21 days, followed by 42 days of depuration in clean water. On days 0, 1, 7, 14, and 21 of exposure and 1, 7, 14, 21 and 42 of depuration, whole *D. polymorpha* and digestive glands of A. anatina were sampled, and the total BMAA concentration was measured. D. polymorpha accumulated BMAA earlier (from day 1 at all concentrations) and at higher tissue concentrations than *A. anatina*, which accumulated BMAA from day 14 when exposed to 10 µg BMAA/L and from day 7 when exposed to 50 µg BMAA/L. As BMAA accumulation by *D. polymorpha* was time and concentration-dependent, with a significant elimination during the depuration period, this species may be able to reflect the levels and dynamics of water contamination by dissolved BMAA. The species A. anatina could be used for monitoring water concentrations above 10 µg BMAA/L.

Dissolved organic matter does not promote glyphosate degradation in auto-heterotrophic aquatic microbial communities

Authors: Artigas J, Batisson I, Carles L

Source: ENVIRONMENTAL POLLUTION 259:113951, 2020, DOI: 10.1016/j.envpol.2020.113951

Abstract: Environmental dissolved organic matter (DOM) has been proved to increase microbial population sizes and stimulate the degradation of some pesticide molecules. Among these molecules, the present study investigated the biodegradation of the herbicide glyphosate depending on photoautotrophs DOM supply in a microbial consortium isolated from river biofilms. Degradation experiments in the laboratory were performed in dark and light conditions, as well as after antibiotic supply, in order to characterize the eventual interactions between photoautotrophs and heterotrophs activity during glyphosate degradation. Fifty percent of the initial concentration of glyphosate (0.6 mM) was transformed into aminomethyl phosphonic acid (AMPA) after 9 days in presence or absence of light. Accordingly, the photoautotrophic DOM supply was not stimulating glyphosate degradation by microbial heterotrophs. This lack of response was probably explained by the low net primary production values and weak dissolved organic carbon

production recorded in light treatments. The supply of the antibiotic drastically stopped glyphosate transformation demonstrating the central role of bacteria in the biodegradation of the herbicide. Glyphosate also modified the structure of prokaryotes assemblages in the consortium by increasing the relative abundances of Alphaproteobacteria and slightly decreasing those of Gammaproteobacteria. The chemoorganotrophic bacteria Phenylobacterium sp. (Alphaproteobacteria) was related to the transformation of glyphosate in our microbial consortium. The present study highlights the complexity of microbial interactions between photoautotrophs and heterotrophs in microbial assemblages that can contribute to the degradation of pesticides present in aquatic environments.

Thiamethoxam induces transgenerational hormesis effects and alteration of genes expression in *Aphis gossypii*

Authors: Ullah F, Gul H, Tariq K, Desneux N, Gao XW, Song DL

Source: PESTICIDE BIOCHEMISTRY AND PHYSIOLOGY 165:104557, 2020, DOI: 10.1016/j.pestbp.2020.104557

Abstract: Insecticide induced-hormesis, a bi-phasic phenomenon characterized by low dose stimulation and high dose inhibition following exposure to insecticide, is crucial to insect pest resurgence. In this study, the effects of low or sublethal concentrations of thiamethoxam on biological traits and genes expression were investigated for *Aphis gossypii* Glover following 72 h exposures. Leaf-Dip bioassay results showed that thiamethoxam was very toxic against adult A. gossypii with an LC50 of 1.175 mg L-1. The low lethal (LC15) and sublethal (LC5) concentrations of thiamethoxam significantly reduced longevity and fecundity of the directly exposed aphids. However, stimulatory effects on pre-adult stage, longevity, and fertility were observed in the progeny generation (F-1) of A. gossypii, when parental aphids (F-0) were exposed to LC15 of thiamethoxam. Subsequently, biological traits such as intrinsic rate of increase (r), finite rate of increase (lambda), and net reproductive rate (R-0) increased significantly to F-1 individuals due to LC15 treatment. No significant responses were observed for LC5 of thiamethoxam. The LC15 of thiamethoxam significantly increased the expression level of vitellogenin and ecdysone receptors genes in progeny generation, while no effects were observed for treatment with LC5. Additionally, the expression levels of P450 genes including CYP6CY14, CYP6CZ1, CYP6DC1, CYP6CY9, and CYP6DD1 were up-regulated in the exposed aphids. Taken together, our results show the hormetic effects of thiamethoxam on F-1 individuals, which might be due to the intermittent changes in expression of genes involved in fertility, growth and insecticide detoxification in *A. gossypii*.

A sepiolite-based formulation for slow release of the herbicide mesotrione

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Source: APPLIED CLAY SCIENCE 189:105503, 2020, DOI: 10.1016/j.clay.2020.105524

Abstract: A slow release formulation (SRF) of the herbicide mesotrione (MS) [2-(4-mesyl-2-nitrobenzoyl)cyclohexane-1,3-dione] was designed for extended weed control relative to that of conventional formulations. The SRF was designed by incorporating the herbicide in micelles formed by the fatty amine ethoxylated surfactant Ethomeen T/15 (ET15) followed by their further sorption on the clay mineral sepiolite. The content of active substance (a.s.) was very high, 16.8% w.w. The surfactant per se was adsorbed by developing surface aggregates on sepiolite's surface. FTIR spectroscopy and zeta potential measurements demonstrated that electrostatic interactions were responsible of the sorption of MS by using micelles loaded with the herbicide, modifying the conformation of ET15 on sepiolite. Toxicity assays by using Microtox (R) tests yielded a value of IC50 for the SRF (52.6 +/- 3.6 mg L-1) that was one order of magnitude higher than that reported for the commercial formulation Callisto (R) (1.1 +/- 0.1 mg L-1). In vitro water release experiments stated that the release of MS was a controlled-diffusion process. Application of SRF and Callisto (R) as post-emergence in field trials of maize showed that after 10 days of treatment (DAT), the amount in the soil of the herbicide from the SRF was about

two-fold higher than that of Callisto (R), with a larger accumulation (42% of the total) in the upper soil layer (0-10 cm depth). No significant differences in soil accumulation at longer times and in the crop yield were observed. Consequently, the use of the designed sepiolite-based formulation significantly reduced MS leaching over the conventional formulation while maintaining the desired bioactivity for weed control.

Effects of sewage sludge supplementation on heavy metal accumulation and the expression of ABC transporters in *Sinapis alba* L. during assisted phytoremediation of contaminated sites

Authors: Jaskulak M, Grobelak A, Vandenbulcke F

Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 197:110606, 2020, DOI: 10.1016/j.ecoenv.2020.110606

Abstract: ATP binding cassette (ABC) transporters, types C, G, and B were monitored via qPCR in order to investigate the influence of heavy metal (HM) contamination of post-industrial and post-agricultural soils and the effects of its supplementation with sewage sludge, on *Sinapis alba* plants. Five house-keeping genes were selected and validated to ensure the best reference points. The relative expression of ABC types C and G genes was profoundly affected by experimental conditions and included their upregulation after plants exposure to heavy metals and downregulation after supplementation with sewage sludge. However, ABC type C was more responsive then type G. The experimental conditions altered the expression of ABC type C gene faster than ABC type G and thus, the expression of ABC type C can therefore potentially be used as a bioindicator during assisted phytoremediation of degraded sites. In clean soil, supplementation with sewage sludge with a slight content of heavy metals still caused an upregulation in the expression of ABC types C and G, which showed that proper toxicity assessments are necessary to ensure safe application of sewage sludge into soils. Results showed that the analysed genes take a significant part in plants metal detoxification and that their expression is regulated at transcriptional level after exposure to soil contaminated with heavy metals by both, industrial activities and by sewage sludge supplementation. Thus, their expression can potentially be used as an early-warning biomarker when soil supplementation with sewage sludge is incorporated into the soil-management process.

Modeling chlordecone toxicokinetics data in growing pigs using a nonlinear mixed-effects approach

Authors: Fourcot A, Feidt C, Bousquet-Melou A, Ferran AA, Gourdine JL, Bructer M, Joaquim-Justo C, Rychen G, Fournier A

Source: CHEMOSPHERE 250:126151, 2020, DOI: 10.1016/j.chemosphere.2020.126151

Abstract: The use of chlordecone (CLD), a chlorinated polycyclic pesticide used in the French West Indies banana fields between 1972 and 1993, resulted in a long-term pollution of agricultural areas. It has been observed that this persistent organic pollutant (POP) can transfer from contaminated soils to food chain. Indeed, CLD is considered almost fully absorbed after involuntary ingestion of contaminated soil by outdoor reared animals. The aim of this study was to model toxicokinetics (TKs) of CLD in growing pigs using both non-compartmental and nonlinear mixed-effects approaches (NLME). In this study, CLD dissolved in cremophor was intravenously administrated to 7 Creole growing pigs and 7 Large White growing pigs (1 mg kg(-1) body weight). Blood samples were collected from time t = 0 to time t = 84 days. CLD concentrations in serum were measured by GCMS/MS. Data obtained were modeled using Monolix (2019R). Results demonstrated that a bicompartmental model best described CLD kinetics in serum. The influence of covariates (breed, initial weight and average daily gain) was simultaneously evaluated and showed that average daily gain is the main covariate explaining inter-individual TKs parameters variability. Body clearance was of 76.7 mL kg(-1) d(-1) and steady-state volume of distribution was

of 6 L kg(-1). This modeling approach constitutes the first application of NLME to study CLD TKs in farm animals and will be further used for rearing management practices in contaminated areas.

Spinosad application in an apple orchard affects both the abundance of the spider Araneus diadematus and its web construction behaviour

Authors: Mazzia C, Capowiez Y, Marliac G, Josselin D, Pasquet A

Source: ECOTOXICOLOGY 29(4):389-397, 2020, DOI: 10.1007/s10646-020-02179-3

Abstract: The principles of organic production are based on the respect of ecological processes including the promotion of natural enemies to control pests. However, as a last resort, some natural pesticides can be applied such as the pesticide spinosad. This neurotoxic insecticide is now widely used even in non-organic production systems. As generalist predators, spiders, and especially orb web spiders, which prey on flying pests, are thought to be useful for biocontrol. To study the effects of spinosad on orb web spiders, we applied spinosad (Success4 (R)) at the normal application rate (96 g ha(-1)) in an orchard covered by nets where Araneus diadematus was very abundant. Its abundance (number of webs), location when present on the web and web characteristics were determined one day before (D - 1) and 1, 3, 6, 10 and 14 days after the application (D + 1, D + 3, D + 6, D + 10 and D + 14). After spinosad application, at D + 1 and D + 14, the number of A. diadematus webs decreased by 28% and 47%, respectively, compared to D - 1 where we observed on average 0.2 webs m(-2). This decrease is likely due to a combination of direct pesticide effects, reduced prey availability and mechanical effects of the air blast sprayer. The short-term toxicity of spinosad was assessed using behavioural markers: (i) the percentage of abnormally located spiders (i.e. neither in the centre of the web nor hidden under the apple leaves) for 30 and 50% of the webs at D + 1 and D + 3 respectively, (ii) the percentage of incomplete webs (made only of the non-sticky spiral) in 35 and 75% of the cases at D + 1 and D + 3 respectively and (iii) one web characteristic, the mean parallelism between spirals, that was significantly reduced at D + 1 compared to D - 1. The study of the other web characteristics indicated that spiders did not modify the capture area but rather significantly decreased their investment in silk at D + 6 and D + 10 by reducing the number of radii and spiral turns. Overall, the application of spinosad (Success4 (R)), representing a triple disturbance (mechanical, toxicological and alimentary), has a negative impact on the orb web spider A. diadematus and should thus be used with caution if growers want to promote the contribution of these spiders to natural biocontrol in their fields.

Target and non-target impact of systemic insecticides on a polyphagous aphid pest and its parasitoid

Authors: Ricupero M, Desneux N, Zappala L, Biondi A

Source: CHEMOSPHERE 247:125728, 2020, DOI: 10.1016/j.chemosphere.2019.125728

Abstract: Systemic insecticides are used to control agricultural pests globally and their non-target impact at non-lethal doses on beneficial arthropods has been recognized. We assessed the baseline toxicity of imidacloprid, thiamethoxam and sulfoxaflor-based insecticides on the polyphagous aphid pest, Aphis gossypii (Hemiptera: Aphididae), and their non-target effects on its main parasitoid, Aphidius colemani (Hymenoptera: Braconidae), evaluated by residual contact exposure to the median lethal (LC50), the low lethal (LC20) and the sublethal (LC1) concentrations of the three tested insecticides, earlier estimated for the target pest. The results showed that the LC(50)s for the aphid were 6.4 x 10(-3), 5 x 10(-3), 2.9 x 10(-2) times lower compared to the label concentrations of imidacloprid, thiamethoxam and sulfoxaflor, respectively. LC50 of thiamethoxam caused the highest mortality rate on the parasitoid followed by sulfoxaflor, while imidacloprid had the lowest impact. No significant sublethal effects on reprodution were observed for A. colemani survived to the insecticide exposure. Our findings highlight the importance of case-specific evaluation to optimize pesticide applications in Integrated Pest Management packages taking into account the ecological services provided by biological control agents.

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Cadmium distribution in mature durum wheat grains using dissection, laser ablation-ICP-MS and synchrotron techniques

Authors: Yan BF, Isaure MP, Mounicou S, Castillo-Michel H, De Nolf W, Nguyen C, Cornu, JY

Source: ENVIRONMENTAL POLLUTION 260:113987, 2020, DOI: 10.1016/j.envpol.2020.113987

Abstract: Understanding how essential and toxic elements are distributed in cereal grains is a key to improving the nutritional quality of cereal-based products. The main objective of this work was to characterize the distribution of Cd and of nutrients (notably Cu, Fe, Mn, P, S and Zn) in the durum wheat grain. Laser ablation inductively coupled mass spectrometry and synchrotron micro X-ray fluorescence were used for micro-scale mapping of Cd and nutrients. A dissection approach was used to quantitatively assess the distribution of Cd and nutrients among grain tissues. Micro X-ray absorption near-edge spectroscopy was used to identify the Cd chemical environment in the crease. Cadmium distribution was characterized by strong accumulation in the crease and by non-negligible dissemination in the endosperm. Inside the crease, Cd accumulated most in the pigment strand where it was mainly associated with sulfur ligands. High-resolution maps highlighted very specific accumulation areas of some nutrients in the germ, for instance Mo in the root cortex primordia and Cu in the scutellum. Cadmium loading into the grain appears to be highly restricted. In the grain, Cd co-localized with several nutrients, notably Mn and Zn, which challenges the idea of selectively removing Cd-enriched fractions by dedicated milling process.

Effects of Pollution on Fish Behavior, Personality, and Cognition: Some Research Perspectives

Authors: Jacquin L, Petitjean Q, Cote J, Laffaille P, Jean S

Source: FRONTIERS IN ECOLOGY AND EVOLUTION 8:86, 2020, DOI: 10.3389/fevo.2020.00086

Abstract: Pollutants, and more generally, environmental stressors, are a neglected source of behavioral and cognitive variations in wild populations. Based on recent literature in fish, we highlight four interesting research perspectives to better understand the effects of pollutants on the links between fish behavior, cognition and fitness. First, (1) we review the neurotoxic effects of pollutants on fish behavior, personality, and cognition. These behavioral and cognitive effects could in turn affect the level of exposure to pollutants, potentially generating feedback loops that may amplify the effects of pollutants on fish fitness. Second, we propose that (2) the effects of pollutants should be studied in a multistress context, i.e., in realistic environmental conditions in combination with other stressors, because some stressors could amplify the behavioral effects of pollutants on fitness. Third (3), existing studies show that physiology, personality, cognition, and fitness components are often linked in syndromes. Pollutants could lead to syndrome disruption, which could affect the evolutionary trajectories of exposed populations. Future studies should thus focus on the complex links between traits to better understand the consequences of stressors on evolutionary trajectories. Fourth, (4) exposure to chronic pollution could lead to local adaptation or maladaptation, which could result into high intraspecific variability of sensitivity among wild populations. In addition, evolutionary responses to pollution could constrain, or be constrained by evolutionary responses to other stressors. We thus encourage future studies to use integrative approaches to bridge the gap between ecotoxicology, cognitive ecology and evolutionary ecology in a multistress framework to tackle these exciting questions and improve our ability to predict the effects of anthropogenic stressors on wildlife.

To what extent can the biogeochemical cycling of mercury modulate the measurement of dissolved mercury in surface freshwaters by passive sampling?

https://doi.org/10.15454/BGEP-SC64

Authors: Bretier M, Dabrin A, Billon G, Mathon B, Miege C, Coquery M

Source: CHEMOSPHERE 248:126006, 2020, DOI: 10.1016/j.chemosphere.2020.126006

Abstract: Mercury (Hg) is a pollutant of global concern owing to its great toxicity even at very low concentrations. Its toxicity depends on its chemical forms evidencing the importance to study its speciation. Dissolved Hg (Hg-(d)) and methylmercury (MeHg(d)) monitoring in surface freshwaters represents a great challenge because of their very low concentrations and substantial temporal variability at different timescales. The Hg-(d) temporal variability depends on the environmental conditions such as the hydrology, water temperature, redox potential (Eh), and solar photo cycle. Passive samplers represent an alternative to improve the assessment of Hg-(d) and MeHg(d) concentrations in surface freshwaters by integrating their temporal variability. An original sampling strategy was designed to assess the relevance of 3-mercaptopropyl DGT (Diffusive Gradient in Thin films) to integrate in situ the temporal variations of labile Hg (Hg(DGT)) and MeHg (MeHg(DGT)) concentrations. This strategy was implemented on two rivers to study the dynamics of Hg-(d), Hg(DGT), MeHg(d) and MeHg(DGT) at diurnal and annual timescales. We evidenced that Hg(DGT) and MeHg(DGT) concentrations were generally consistent with discrete sampling measurements of Hg-(d) and MeHg(d) in dynamic surface freshwaters. However, Hg(DGT) concentrations were overestimated (2-16 times higher) in case of low flow or low water depth, low suspended particulate matter (SPM) concentrations and elevated daily photoperiod. The most probable hypothesis is that such conditions promoted Hg-0 production, and resulted in Hg-0 uptake by DGT. Thus, attention should be paid when interpreting Hg(DGT) concentrations in surface freshwaters in environmental conditions that could promote Hg-0 production.

Modelling assisted phytoremediation of soils contaminated with heavy metals - Main opportunities, limitations, decision making and future prospects

Authors: Jaskulak M, Grobelak A, Vandenbulcke F

Source: CHEMOSPHERE 249:126196, 2020, DOI: 10.1016/j.chemosphere.2020.126196

Abstract: The heavy metals (HMs) soils contamination is a growing concern since HMs are not biodegradable and can accumulate in all living organisms causing a threat to plants and animals, including humans. Phytoremediation is a cost-efficient technology that uses plants to remove, transform or detoxify contaminants. In recent years, phytoremediation is entering the stage of large-scale modelling via various mathematical models. Such models can be useful tools to further our understanding and predicting of the processes that influence the efficiency of phytoremediation and to precisely plan such actions on a large-scale. When dealing with extremely complicated and challenging variables like the interactions between the climate, soil and plants, modelling before starting an operation can significantly reduce the time and cost of such process by granting us an accurate prediction of possible outcomes. Research on the applicability of different modelling approaches is ongoing and presented work compares and discusses available models in order to point out their specific strengths and weaknesses in given scenarios. The main aim of this paper is to critically evaluate the main advantages and limitations of available models for large-scale phytoremediation including, among others, the Decision Support System (DSS), Response Surface Methodology (RSM), BALANS, PLANTIX and various regression models. Study compares their applicability and highlight existing gaps in current knowledge with a special reference to improving the efficiency of large-scale phytoremediation of sites contaminated with heavy-metals. The presented work can serve as a useful tool when choosing the most suitable model for the phytoremediation of contaminated sites.

Impacts of metallic trace elements on an earthworm community in an urban wasteland: Emphasis on the bioaccumulation and genetic characteristics in *Lumbricus castaneus*

Authors: Audusseau H, Vandenbulcke F, Dume C, Deschins V, Pauwels M, Gigon A, Bagard M, Dupont L

Source: SCIENCE OF THE TOTAL ENVIRONMENT 718:137259, 2020, DOI: 10.1016/j.scitotenv.2020.137259

Abstract: Metallic trace elements (MTEs) soil pollution has become a worldwide concern, particularly regarding its impact on earthworms. Earthworms, which constitute the dominant taxon of soil macrofauna in temperate regions and are crucial ecosystem engineers, are in direct contact with MTEs. The impacts of MTE exposure on earthworms, however, vary by species, with some able to cope with high levels of contamination. We combined different approaches to study the effects of MTEs at different levels of biological organisation of an earthworm community, in a contaminated urban wasteland. Our work is based on field collection of soil and earthworm samples, with a total of 891 adult earthworms from 8 species collected, over 87 quadrats across the study plot. We found that MTE concentrations are highly structured at the plot scale and that some elements, such as Pb, Zn, and Cu. are highly correlated. Comparing species assemblage to MTE concentrations, we found that the juvenile and adult abundances, and community composition, were significantly affected by pollution. Along the pollution gradient, as species richness decreased. *Lumbricus castaneus* became more dominant. We thus investigated the physiological response of this species to a set of specific elements (Pb, Zn, Cu, and Cd) and studied the impacts of MTE concentrations at the plot scale on its population genetic. These analyses revealed that *L castaneus* is able to bioaccumulate high quantities of Cd and Zn, but not of Cu and Pb. The population genetic analysis, based on the genotyping of 175 individuals using 8 microsatellite markers, provided no evidence of the role of the heterogeneity in MTE concentrations as a barrier to gene flow. The multidisciplinary approach we used enabled us to reveal the comparatively high tolerance of *L castaneus* to MTE concentrations, suggesting that this is a promising model to study the molecular bases of MTE tolerance.

Potential Use of Earthworms to Enhance Decaying of Biodegradable Plastics

Authors: Sanchez-Hernandez JC, Capowiez Y, Ro KS

Source: ACS SUSTAINABLE CHEMISTRY & ENGINEERING 8(11):4292-4316, 2020, DOI: 10.1021/acssuschemeng.9b05450

Abstract: Biosolid application, wastewater irrigation, and plastic mulching technologies are major sources of plastic pollution in agroecosystems. Microplastics may interact with soil physicochemical properties and organisms and negatively affect plant growth. To alleviate environmental plastic pollution, synthetic and biobased biodegradable polymers are replacing nonbiodegradable polymers, but their biodegradation rate in the field is frequently lower than that estimated from standardized biodegradation testing. Plastic polymer biodegradation is a multistep process that involves plastic deterioration, microbial colonization, production of polymer-degrading exoenzymes, and mineralization. However, these physicochemical and biological processes are not always efficient because of unfavorable environmental conditions (e.g., temperature, soil moisture). We propose to use earthworms to increase the biodegradable polymer biodegradation rate by creating optimal habitats for microbial proliferation. Earthworm-induced processes that lead to soil alteration (bioturbation) and solid organic wastes decomposition (vermicomposting) are described to understand how earthworms may favor biodegradable plastic mineralization. Therefore, we suggest two practical sustainable bioengineering strategies: (1) enhancing bioturbation by inoculating agricultural soils with soil-dwelling earthworms, which is viable for horticulture where using biodegradable mulching films increases plastic debris in the soil and (2) vermicomposting with blended biodegradable plastic debris and solid organic wastes, which is complementary to industrial or home composting of single-use biodegradable plastics.

Genotoxicity in the rivers from the Brantas catchment (East Java, Indonesia): occurrence in sediments and effects in *Oreochromis niloticus* (Linn AE us 1758)

Authors: Risjani Y, Loppion G, Couteau JM, Yunianta Y, Widowati I, Hermawati A, Minier, C

Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Early access, 2020, DOI: 10.1007/s11356-020-08575-w

Abstract: This paper reports the first data from an integrated study investigating genotoxicity in the Brantas River, Java, Indonesia. Results showed that organic sediment extracts from the sites in the Brantas Delta retained genotoxic compounds identified using the SOS Chromotest and that the Aloo River and, to a lesser extent, the Surabaya River were the most contaminated studied sites. This genotoxicity was attributable to compounds that did not require any bioactivation under the test conditions. Occurrence of genotoxic effects was further investigated in erythrocytes from Nile tilapia, *Oreochromis niloticus*. High numbers of micronuclei were counted, especially in fish sampled in the rivers of the Brantas Delta. Moreover, cytoplasmic alterations which could be indicative of the presence of lipofuscin were found in the cytoplasm of the fish blood cells, especially in fish from the Aloo, Surabaya and Kalimas rivers. Altogether, our data showed that genotoxicity is occurring in fish living in rivers of the delta of the Brantas River and suggest that sediments from these sites may constitute a major source of pollution and hazard for species living or feeding in the area.

Determination of polycyclic aromatic hydrocarbon (PAH) contents in micro-volumes of the whole blood and liver of Red Kite by a simplified GC-MS/MS method

Authors: Morin-Crini N, Scheifler R, Amiot C, Riols R, Coeurdassier M

Source: INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY 2020 Early access, DOI: 10.1080/03067319.2020.1726899

Abstract: The aim of this work was to determine PAH concentrations in two matrices, fluid samples and biological tissue, from Red Kite. For this purpose, a simplified and sensitive method for the analysis of 16 PAHs at trace levels in small samples of whole blood and liver was developed and validated using dispersive extraction in n-hexane combined with gas chromatography-triple quadrupole mass spectrometry (GC-MS/MS). For blood and liver, the average limits of detection were 0.71 ng mL(-1) and 3.16 ng g(-1), the mean relative standard deviations (RSD (%)) were 16% and 15%, and the mean relative recoveries were 100% and 92% for all PAH compounds, respectively. This method was applied to PAH determination in the liver and blood of Red kites from wild populations. At least one PAH was detected in the blood and in the liver of 83% and 62% of the individual birds, respectively. Acenaphthene, anthracene and phenanthrene were the most frequently detected in the blood, while the blood concentrations of naphthalene, phenanthrene and pyrene were the highest. In the liver, fluoranthene was detected in 54% of the individual birds, followed by naphthalene, fluoranthene, phenanthrene and benzo[k]fluoranthene, with the highest concentrations being those of naphthalene and phenanthrene. This demonstrated that our method is suitable for assessing trace levels of PAHs in red kite blood and tissue and monitoring exposure in their natural environment. Moreover, our data show that raptors may be exposed to a mixture of PAHs, among which some belong to the IARC carcinogen classes for humans 1 and 2B, throughout their life cycle.

Health risk assessment to dioxins, furans and PCBs in young children: The first French evaluation

Authors: Hulin M, Sirot V, Vasseur P, Mahe A, Leblanc JC, Jean J, Marchand P, Venisseau A, Le Bizec B, Riviere G

Source: FOOD AND CHEMICAL TOXICOLOGY 139:111292, 2020, DOI: 10.1016/j.fct.2020.111292

Abstract: A total diet study (TDS) was conducted between 2010 and 2016 to characterize the health risk related to chemical residues in food of French not breastfed children under three years of age (infant TDS). Among the targeted substances, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) have been characterized as they accumulate through the

food chain, especially in lipid-rich food items, and because they have been associated with a number of adverse effects in humans.

Food samples (n = 180) were collected to be representative of the dioxins and PCB exposure through the whole diet of non-breastfed children from 1 to 36 months old and prepared as consumed (including cooking) prior to analysis.

Dietary exposure was then assessed for 705 representative children under 3 years of age based on their food consumptions recorded through a 3-consecutive-days record. Levels of PCDD/Fs and PCBs in infant food were lower than those observed in common food, leading to significant differences in exposure according to age groups. Mean exposures to PCDD/Fs ranged from 0.22 to 0.44 pg TEQ(WHO05).kg bw(-1).d(-1) (0.40-0.65 at the 90th percentile), depending on the age group and the hypothesis considered to manage left-censored data. Mean exposure to non-dioxin-like PCBs ranged from 0.87 ng kg bw(-1).d(-1) (1.55 at the 90th percentile) in the 1-4 months old children to 3.53 ng kg bw(-1).d(-1) (5.44 at the 90th percentile) in the 13-36 months old children. For dioxins and NDL-PCBs, the tolerable daily intake (TDI) was exceeded for some age groups, in particular for older ones.

Therefore, appropriate management measures must continue for reducing exposure; it concerns mainly common milk in youngest children, ultra-fresh dairy products and fish. For PCBs, recommendations on fish consumption should be reminded. Moreover, toxicity studies focusing on mixtures of dioxin-like compounds should be encouraged in order to take into account effect of mixtures.

Improving Silver Birch (*Betula pendula*) Growth and Mn Accumulation in Residual Red Gypsum Using Organic Amendments

Authors: Zapata-Carbonell J, Ciadamidaro L, Parelle J, Chalot M, Tatin-Froux F

Source: FRONTIERS IN ENVIRONMENTAL SCIENCE 8:24, 2020, DOI: 10.3389/fenvs.2020.00024

Abstract: The increasing production of wastes that are landfilled might contribute to sources of potentially toxic elements; this is the case of residual red gypsum tailings, a by-product of titanium dioxide extraction. Revegetation of such a site is essential, and Mn phytoextraction may render the operations economically profitable. This study aimed to apply phytomanagement techniques for increasing the plant development, tailings revegetation and an optimal Mn phytoextraction using silver birch, the most abundant plant species on this site. To enhance the nutrient availability from the tailings, amendments that reduce the pH, i.e., pine bark chips, Miscanthus straw, white peat, and ericaceous compost, were mixed with residual red gypsum and birches were allowed to grow for 3 months. The pine bark chips and ericaceous compost led to a maximum decrease in pH, allowing the accumulation of up to 1400 mg Mn kg(-1) dry matter in the leaves silver birch leaves. However, some nutrient competition was found in the pine bark treatment, which halved biomass production as compared to control. Further amendment addition may be needed to take advantage of the pine bark capabilities as a soil conditioner and Mn solubilizing treatment in residual red gypsum.

Inorganic Mercury and Methyl-Mercury Uptake and Effects in the Aquatic Plant *Elodea nuttallii*: A Review of Multi-Omic Data in the Field and in Controlled Conditions

Authors: Cosio C

Source: APPLIED SCIENCES-BASEL 10(5):1817, 2020, DOI: 10.3390/app10051817

Abstract: (1) Background: Mercury is a threat for the aquatic environment. Nonetheless, the entrance of Hg into food webs is not fully understood. Macrophytes are both central for Hg entry in food webs and are seen as good candidates for biomonitoring and bioremediation; (2) Methods: We review the knowledge gained on the uptake and effects of inorganic Hg (IHg) and methyl-Hg (MMHg) in the macrophyte *Elodea nuttallii* found in temperate freshwaters; (3) Results: *E. nuttallii* bioaccumulates IHg and MMHg, but IHg shows a higher affinity to cell walls. At the individual level, IHg reduced chlorophyll, while MMHg

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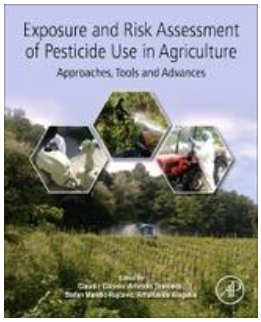
increased anthocyanin. Transcriptomics and metabolomics in shoots revealed that MMHg regulated a higher number of genes than IHg. Proteomics and metabolomics in cytosol revealed that IHg had more effect than MMHg; (4) Conclusions: MMHg and IHg show different cellular toxicity pathways. MMHg's main impact appears on the non-soluble compartment, while IHg's main impact happens on the soluble compartment. This is congruent with the higher affinity of IHg with dissolved OM (DOM) or cell walls. E. nuttallii is promising for biomonitoring, as its uptake and molecular responses reflect exposure to IHg and MMHg. More generally, multi-omics approaches identify cellular toxicity pathways and the early impact of sublethal pollution.

OUVRAGES / RAPPORTS / ACTES DE CONGRES

Exposure and Risk Assessment of Pesticide Use in Agriculture: 1st Ed. Approaches, Tools and Advances



Editors: Claudio, Colosio Aristidis, Tsatsakis Stefan, Mandic-Rajcevic, Athanasios Alegakis ; Academic Press, 1st November 2020, 530 p.

ISBN: 9780128124666

Exposure and Risk Assessment of Pesticide Use in Agriculture: Approaches, Tools and Advances offers an overview of the different methods available in toxicology for pesticide exposure and risk assessment, ranging from the regulatory field, to in-field research studies. The book provides technical background on each method, describing known and grounded tools, new uses of tools and development prospects. This book is ideal for researchers in pesticide toxicology, exposure toxicology, toxicologic risk assessment, occupational hygiene and medicine, and pesticide toxicology as well as occupational health and industrial hygiene practitioners, regulatory experts of corporate and public bodies, and advanced students.

Accès au document

REVUE DE PRESSE / ALTERNATIVES / BIOPESTICIDES

Alternatives au glyphosate : le travail du sol est le levier principal en grandes cultures

Actu-environnement 17/06/20

Le travail du sol est le principal levier pour lutter contre les adventices en grandes cultures. Il permet d'éviter le recours au désherbage chimique, et donc au glyphosate, estime l'Inrae. Mais les autres modes de production restent dans l'impasse.

L'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (Inrae) a publié, le 9 juin, son analyse sur les impacts économiques du déploiement d'alternatives au glyphosate en grandes cultures. Dans le cadre du plan de sortie du glyphosate d'ici 2021, le Premier ministre a demandé à l'Inrae d'évaluer les solutions alternatives au glyphosate par type de culture, et les impacts économiques pour chaque filière. [...]

Accès au document

Alternative aux phytos Amoeba engage la procédure d'homologation en Europe de son biocide naturel

Terre-Net 29/05/20

La société française Amoeba a annoncé vendredi avoir lancé la procédure d'homologation en Europe de sa méthode de traitement des plantes

par voie biologique, qui repose sur l'utilisation d'une amibe.

L'autorisation de commercialisation est demandée pour un usage fongicide. Les champignons sont à l'origine de la plus grande partie des maladies des plantes (pourriture grise, cloque, mildiou, oïdium, rouille, tavelure...).

Amoeba promeut comme alternative aux produits chimiques l'utilisation d'une amibe, Willaertia magna C2c Maky, initialement isolée dans les eaux thermales d'Aix-les-Bains (Savoie).

Contrairement à d'autres amibes capables de détruire des micro-organismes, elle est présentée comme non-pathogène et non-toxique. [...]

Accès au document

REVUE DE PRESSE / ASSOCIATIONS

Baisse supposée des pesticides : le ministère de l'Agriculture fait ce jour un coup de com' sur des chiffres provisoires

Générations futures 30/06/20

Générations Futures note que le gouvernement a communiqué en fin d'après-midi mardi 30 sur une supposée baisse des volumes de 44% des volumes de pesticides vendus en 2019 par rapport à 2018.

Cette communication appelle de la part de Générations Futures les remarques suivantes :

il est surprenant que ce type de données soit rendue publique sans que les parties prenantes du plan Ecophyto (sensé réduire les pesticides mis en œuvre en 2008) ne soient prévenues et destinataires des informations officielles ! […]

Générations futures se réjouit bien sûr de toute diminution de la vente et de l'usage des pesticides mais rappelle que cette supposée baisse intervient après une forte hausse en 2018 (+ de 20 %), les chiffres sont donc à mettre en perspective.

De plus Générations Futures s'étonne de voir avancés des chiffres en volume …alors que l'indicateur de suivi du plan est le NODU, basé sur le nombre de doses, et pas le volume des pesticides. Pourquoi le gouvernement n'utilise t'il pas l'indicateur de référence du plan, qui pourrait donner des chiffres assez différents ?

Il faut toujours prendre des chiffres de vente de pesticides publiés en juillet avec un certain recul car l'expérience nous montre que les remontées d'information peuvent être incomplètes à cette période et les chiffres définitifs connus seulement à l'automne (ça a été le cas plusieurs des années passées).

« Le ministère de l'agriculture fait donc un coup de com' en informant sur des données non consolidées et le tout sans en informer les parties prenantes. Pour toutes ces raisons Générations Futures rappelle le gouvernement à revenir à un fonctionnement normal du suivi du plan Ecophyto ce qui sous-entend un respect des parties prenantes et une vraie transparence dans les données utilisées. » déclare F. Veillerette Directeur de Générations Futures

Accès au document

La commission de l'environnement du Parlement européen exige de la future stratégie européenne sur les produits chimiques une approche axée prioritairement sur la santé

Générations futures 30/06/20

Hier, la commission de l'environnement, de la santé et de la sécurité alimentaire du Parlement européen (ENVI) a adopté, à une écrasante majorité, une résolution définissant sa position sur la stratégie européenne durable sur les produits chimiques [1]. La stratégie finale est en cours d'élaboration et est attendue pour le second semestre 2020. [...]

https://doi.org/10.15454/BGEP-SC64

Les points saillants de la résolution proposée sont les suivants : […]

Un élargissement de l'utilisation de l'évaluation générique des risques ;

Une action accélérée sur les produits chimiques prioritaires, y compris : des dispositions pour une définition horizontale des **perturbateurs endocriniens** connus et suspectés et desactions pour minimiser l'exposition ; un plan d'action pour éliminer progressivement les utilisations non essentielles des **PFAS** ; l'accélérations de l'élimination progressive des pesticides à haut risque d'ici 2030 ;

Une meilleure comptabilité des mélanges et l'utilisation d'approches de regroupement dans les évaluations ; […]

Accès au document

Produits phytos - 44 % de pesticides vendus en 2019

Terre-Net 30/06/20

Les ventes de pesticides ont reculé en France de 44 % en volume en 2019, après l'envolée des ventes intervenue en 2018 (+ 18 %), a annoncé mardi le gouvernement.

Les quantités vendues de glyphosate, désherbant controversé, « diminuent de 35 % (- 3 358 tonnes) entre 2018 et 2019 après avoir augmenté de 11 % (+ 999 tonnes) entre 2017 et 2018 », ont précisé les ministères de la transition écologique et de l'agriculture dans un communiqué conjoint.

Le gouvernement français avait promis fin 2017 que cette molécule serait interdite « dans ses principaux usages » dans un délai de trois ans, sans attendre les cinq ans décidés au niveau européen. [...]

Accès au document

Pac et Green Deal L'eurodéputé B. Biteau veut aller plus loin dans la réduction des pesticides

Terre-Net 30/06/20

Dans le cadre du Green Deal, la Commission européenne a dévoilé mi-mai ses stratégies Biodiversité et de la Ferme à l'assiette, deux stratégies dont les ambitions respectives ne semblent pas compatibles, estime le député européen Benoît Biteau (EELV), qui défend une suppression totale des pesticides et des engrais de synthèse et milite pour une Pac qui accompagne davantage les transitions.

« Les ambitions portées par les stratégies Farm to fork (de la fourche à la fourchette) et Biodiversité ne sont pas toujours en conformité », a expliqué le député européen Benoît Biteau (EELV), lors d'une visioconférence avec les journalistes de l'Afja, le 26 juin. « La réduction de 50 % des pesticides et des engrais de synthèse sont des objectifs parfaitement atteignables sans impacter la productivité agricole, mais qui ne suffisent pas à enrayer la disparition des oiseaux et insectes », estime l'élu, agriculteur en Charente-Maritime depuis 14 ans. Ils ne permettent pas non plus de réaliser les objectifs de la stratégie Biodiversité, pourtant proposée par la même Commission européenne.

Pour Benoît Biteau, réduire la dose ne résout pas les problèmes en matière de biodiversité. « C'est très réducteur de cantonner la problématique des pesticides à un problème de santé publique, il faut que l'on convoque une approche globale », incluant les effets sur le climat et sur l'environnement, ajoute-t-il. « On ne doit pas continuer sur des voies qui menacent les générations futures, et c'est d'autant plus vrai que l'on a des études qui montrent que c'est possible », insiste l'agriculteur. [...]

Accès au document

Le cuivre utilisé en bio est-il biodégradable ? Oui… mais en fait non, selon Générations Futures (!)

Alerte-Environnement 27/06/20

Le 17 juin, la section bordelaise de Générations Futures affirme que les pesticides bio sont biodégradables :

Bizarre, en général, dès qu'on tweete #pesticides la clique du glyphe nous interpelle sur les pesticides #bio. Mais pas ici ? Forcément,

les #pesticides autorisés en #bio sont biodégradables et ne se retrouvent pas dans l'eau du robinet ! CQFD. pic.twitter.com/W63Uam6DSO

— Générations Futures Bordeaux (@GF_Bordeaux) June 17, 2020

Ce qui scandalise certains Twittos attachés aux faits et à la science (donc à la vérité) :

Le cuivre, pesticide « naturel » utilisé en bio s'accumule dans les sols et les stérilise.

— Emmanuelle Ducros (@emma_ducros) June 17, 2020

Le cuivre n'est pas mobile dans le sol il n'ira pas dans la nappe mais intoxiquera durablement le sol en surface. J'ai le souvenir d'une photo sur un forum d'une ancienne parcelle de vigne ou l'on voyait dans le blé l'emplacement des ancienne vignes des années après.

— hazard michel (@hazard__michel) June 17, 2020

Un rapport de l'INRA de janvier 2018 ne dit pas autre chose (page 3) :

Peu de Français le savent mais on trouve des résidus de cuivre dans le vin bio. Vous noterez que le secteur conventionnel ne s'en est pas emparé dans la foulée pour dénoncer le secteur bio car lui compte sur la qualité de ses produits pour convaincre, pas sur la diabolisation du secteur concurrent… En ce sens, le conventionnel est cohabitationniste quand le lobby du bio est remplaciste.

Le 18 juin, la section bordelaise de Générations Futures affirme finalement que le cuivre n'est « bien sûr » pas biodégradable :

[2/5] Non, bien sûr, le cuivre n'est pas biodégradable ! Contrairement aux #PerturbateursEndocriniens, pour le Cuivre, c'est la dose qui fait le poison. A faible dose (eau du robinet), il est un oligoélément indispensable à la vie . A forte dose, il est toxique. pic.twitter.com/HxLAT0LcdX [...]

Accès au document

Action locale UFC-Que Choisir -Épandages agricoles - Pas près de nos habitations !

UFC-Que choisir 25/06/20

Près de 30 associations locales ont écrit à leur préfet pour réclamer que l'on augmente les distances de sécurité entre les épandages et les habitations.

Depuis maintenant plus de six mois, l'UFC-Que Choisir s'oppose fermement aux dernières mesures concernant les distances minimales de sécurité à respecter entre les zones d'épandage agricole et les logements. Ainsi, le décret du 27 décembre 2019 autorise des intervalles de 5 ou 10 mètres en fonction du type de culture (haute ou basse) et de 20 mètres si les pesticides utilisés contiennent des substances préoccupantes ; des dispositions largement insuffisantes pour préserver la santé des populations vivant à proximité des parcelles traitées. Pire, une charte issue d'un dialogue entre agriculteurs, élus locaux et résidents devait permettre d'abaisser, sous certaines conditions, cet éloignement à 3 mètres, soit à peau de chagrin. Mais depuis le 3 février, selon une instruction technique de la Direction générale de l'alimentation (DGAL), rattachée au ministère de l'Agriculture, il n'est plus nécessaire que la concertation soit terminée pour que les réductions s'appliquent, et ce jusqu'au 30 juin. Plus grave, le 30 mars, sous couvert de confinement (qui rend la consultation difficile), les modalités de diminution de cet écart sont assouplies ! Face à ces décisions ne protégeant ni les milieux (en particulier, les ressources en eau) ni les habitants, et négligeant l'avis de ces derniers, l'UFC-Que Choisir, avec un collectif d'ONG, a déposé divers recours devant le Conseil d'État. […] Les réponses se font toujours attendre, alors que la saison des épandages est en passe de s'achever à l'heure où nous écrivons ces lignes…

Accès au document

Des pesticides dans le bio à cause de l'UE ? C'est déjà le cas et l'UE n'y peut rien…

Alerte-Environnement 21/06/20

Nos lecteurs ne l'ignorent pas, « bio » ne signifie pas « absence de pesticides » ou même « absence de pesticides de synthèses ». Malheureusement, et les médias y sont pour quelque chose, les Français ne le savent pas (ça

et d'autres choses, ou le fait que parfois, le bio tue). Pas encore tout du moins.

Depuis quelques jours, à l'image de 20 Minutes, des médias mal renseignés ou militants (comment savoir ?) affirment que « le Conseil européen agricole envisage d'assouplir les normes et même d'autoriser, dans certains cas, la présence de pesticides dans les productions issues de l'agriculture biologique ». Sauf que c'est déjà le cas, et pas par la faute de l'UE :

Marrant de voir comment la propagande a formaté les esprits. Oui il y a des pesticides utilisés en bio, la plupart contiennent des molécules qui peuvent se trouver à l'état naturel mais sont synthétisés en laboratoire chimique… [...]

Accès au document

Tell USDA to Reject Bayer-Monsanto's Multi-Herbicide Tolerant Corn

Beyond Pesticides, June 29, 2020

Bayer's Monsanto is requesting non-regulated status for corn that will increase the use of drift-prone and toxic herbicides. This means that the planting of a new genetically engineered (GE) variety of corn, which requires substantial weed killer use, will not be restricted in any way. The syndrome of 'more-corn, more-pesticides, more-poisoning, more-contamination' must stop—as we effect an urgent systemic transformation to productive and profitable organic production practices. Because USDA is proposing to allow a new herbicide-dependent crop under the Plant Protection Act, the agency must, but does not, consider the adverse impacts associated with the production practices on other plants and the effects on the soil in which they are grown. Business as usual is not an option for a livable future.

Sign the petition. Tell USDA we don't need more use of 2,4-D, Dicamba, and other toxic herbicides associated with the planting of new GE corn. [...]

Accès au document

Bayer-Monsanto Chalks Up Court Victory to Take Cancer Warning Off Roundup™-Glyphosate in California, Makes Case for Fundamental Overhaul of Pesticide Law

Beyond Pesticides, June 26, 2020

A court decision in California, challenging a cancer warning on products containing the weed killer glyphosate, highlights the distinct ways in which scientific findings are applied under regulatory standards, in toxic tort cases evaluated by juries, and by consumers in the marketplace. These differences came into focus as a U.S. court quashed California's decision to require cancer warning labels on glyphosate products on June 22. The ruling, by Judge William Shubb of the U.S. District Court for the Eastern District of California, bars the state from requiring labeling that warns of potential carcinogenicity on such herbicides. [...]

Accès au document

Bayer-Monsanto, Committed to Continued Sales of Roundup™-Glyphosate, Announces $10.9 Billion Settlement with Cancer Victims, Protects Company from Future Trials by Jury

Beyond Pesticides, June 25, 2020

Facing approximately 125,000 lawsuits on cancer caused by the weed killer Roundup™ (glyphosate), Bayer/Monsanto announced yesterday that it will pay up to $10.9 billion to resolve current and potential future litigation. According to Bayer, the settlement will "bring closure" to approximately 75% of current Roundup™ litigation. "The company will make a payment of $8.8 billion to $9.6 billion to resolve the current Roundup™ litigation, including an allowance expected to cover unresolved claims, and $1.25 billion to support a separate class agreement to address potential future litigation," according to Bayer's press release. At the same time the company announced a $400 million settlement with farmers whose crops have been damaged by the weed killer dicamba

and $820 million for PCB water litigation. Bayer is a German multinational pharmaceutical and chemical company that purchased Monsanto for $63 billion in 2018. Bayer's stock price increased by 2.5% at the new of the settlements. [...]

Accès au document

Insecticides the Pesticide Industry Said Were "Safer for Bees" Found to Stress and Kill Honey Bees

Beyond Pesticides, June 23, 2020

Next-generation systemic insecticides, billed by the agrichemical industry as "safer for bees" than neonicotinoids, have been found to stress and kill honey bees. As reported, a study by researchers at Oregon State University in the journal PLOS One, sulfoxaflor and flupyradifurone (in the products Transform and Sivanto, respectively) were found to increase apoptosis (cell death) and increase oxidative stress in exposed honey bees.

The study indicates that, "With the recent Environmental Protection Agency (EPA) approval for use of both flupyradifurone and sulfoxaflor, and with the growing concern regarding pollinator health, it is important to better understand any potential negative impacts (especially sub-lethal) of these pesticides on bees." However, this statement begs the question 'why these two new bee-toxic pesticide were approved by EPA in the first place.' [...]

Accès au document

Pollinator Week: We Protect People at Greatest Risk When We Protect Pollinators and the Environment from Toxic Pesticides

Beyond Pesticides 22/06/20

In the wake of the national groundswell for equity and justice in the face of rampant inequality and police brutality against people of color, we acknowledge, during Pollinator Week, holistic actions are needed to solve systemic societal problems that cause racial disparities. Those fighting for environmental justice understand that the harms inflicted by toxic chemical production and use cause disproportionate adverse effects on people of color—from fenceline communities near chemical production plants, to the hazardous and inhumane working conditions in agricultural fields, to the elevated risk factors for black and brown people from toxic pesticide exposure patterns.

Pollinator Week reminds us that we must nurture the ecosystem, which we depend on for life, with a fierce commitment to its inhabitants and a focus on those at highest risk. Therefore, this week is a time to renew our commitment to environmental justice and seek the adoption of policies and practices in our communities, and across the nation and the world, that recognize the urgency to address the disproportionate harm inflicted by toxic pesticide use. [...]

Accès au document

Débat national sur la future Pac Les thématiques environnementales au cœur des contributions

Terre-Net 26/06/20

Missionnée pour organiser une consultation publique autour du plan stratégique national de la future Pac, la Commission nationale du débat public a rendu le 19 juin un rapport d'étape, riche de 127 propositions issues des préoccupations principales des participants en matière agricole. La question du modèle agricole et de ses implications sur l'environnement est celle qui a généré le plus de contributions. [...]

Une question centrale, celle du modèle agricole

Le débat généré sur la plateforme en ligne a permis de toucher plus de 810 000 personnes, et de recueillir 9 500 contributions. Parmi les différentes thématiques proposées, « quels modèles agricoles pour la société française ? » a généré le plus de réactions (36 %), devant la question de la transition écologique (18 %) et de « qu'est-ce que je mange ? » (15 %).

Les contributions sur ce thème traduisent sans surprise les oppositions classiques, avec « la position de celles et ceux qui considèrent que les

systèmes agricoles actuels ne sont pas à changer – en particulier le système dit intensif – autrement que pour les adapter graduellement aux enjeux de la transition écologique et dans la limite de ce qui est compatible avec les objectifs premiers de l'agriculture » et « la position de celles et ceux qui estiment que seul un changement profond du système actuel – et notamment l'arrêt du système intensif – peut permettre une transition agro-écologique intégrant pleinement les enjeux environnementaux, sanitaires ainsi que la préservation des ressources naturelles », relève la CNDP. Des positions au sein desquelles les clivages agriculture biologique / agriculture conventionnelle ou anti/pro pesticides se retrouvent également. [...]

Accès au document

N'importons pas l'agriculture que nous ne voulons pas !

Avenir52 25/06/20

À l'issue de son assemblée générale, le 11 juin, la FRSEA Grand Est a publié un communiqué, prenant position contre les accords de libre-échange envisagés avec le Mexique. Nous le reproduisons ci-dessous.

À l'heure de la négociation du green deal, l'Europe continue d'envisager des accords de libre-échange avec le Mexique. Pour les producteurs français et européens, c'est plus de bio, moins de produits phytosanitaires, moins d'antibiotiques, moins d'engrais, et plus de surfaces de haute diversité… Des ambitions sans moyens financiers. Qu'importe, car le choix européen est d'ouvrir les frontières à l'import de produits qui ne respectent pas nos normes de productions françaises et européennes.

L'Europe installe ainsi une concurrence déloyale avec nos agriculteurs : ils disposent d'exonérations de droits de douane, de politiques fiscales et sociales avantageuses, et permettent l'utilisation de produits interdits en Europe (OGM, hormones de croissance, pesticides tels que l'atrazine...).

Ce qui a pour conséquence de placer dans nos rayons des produits qu'il est interdit de produire en France (et en Europe). [...]

Accès au document

Alimentation : La Commission européenne veut transformer champs et assiettes

Que Choisir 06/06/20

Réduire de moitié l'usage des pesticides et des antibiotiques, tripler les surfaces cultivées en bio… La Commission européenne a récemment révélé ses ambitions pour une agriculture plus respectueuse de l'environnement et une alimentation plus saine. Non sans faire grincer des dents…

Le 20 mai dernier, la Commission européenne a présenté sa très attendue stratégie « De la ferme à la fourchette », son plan d'action en faveur d'une agriculture et d'une alimentation plus durables. Et il faut reconnaître que ses objectifs sont plutôt ambitieux. [...]

Accès au document

Réduction des distances d'épandage des pesticides : Le Conseil d'État retire deux textes litigieux mais ne retient pas l'urgence du retrait des dérogations.

Générations futures 5/06/20

Avec huit autres organisations*, nous avons porté une procédure d'urgence devant le Conseil d'État. L'audience du 12 mai avait déjà permis le retrait de deux communication litigieuses en ligne sur le site du Ministère de l'Agriculture et de l'Alimentation.

Le Conseil d'État a rendu, ce jour, son délibéré, défavorable à notre demande d'annuler la circulaire du 3 février 2020 demandant aux Préfets d'entériner les chartes de bonnes pratiques sans concertation et permettre la réduction des distances de pulvérisation des pesticides à proximité des lieux habités. Celle-ci reste donc valide jusqu'au 30 juin. [...]

Accès au document

Federal Court Halts Use of Drift-Prone Dicamba on

https://doi.org/10.15454/BGEP-SC64

Millions of Acres of GE Soy and Cotton

Beyond Pesticides, June 9, 2020

Use of the weed killer dicamba on genetically engineered (GE) cotton and soybeans is now prohibited after a federal court ruling against the U.S. Environmental Protection Agency (EPA) last week. A coalition of conservation groups filed suit in 2018 after EPA renewed a conditional registration for dicamba's 'over the top' (OTT) use on GE cotton and soy developed to tolerate repeated sprayings of the herbicide. "For the thousands of farmers whose fields were damaged or destroyed by dicamba drift despite our warnings, the National Family Farm Coalition is pleased with today's ruling," said National Family Farm Coalition president Jim Goodman in a press release. [...]

Accès au document

Report Finds Monocropping and Toxic Pesticides Threaten Brazil's Native Bees as Country's President Challenges Environmental Protection

Beyond Pesticides, June 8, 2020

Brazil is home to more than 300 native bee species — many of them stingless — that help pollinate the nation's valuable agricultural crops and provide other important environmental services. Yet, chemical-intensive agriculture's intensive pesticide use and devotion to monocropping are a serious threat to these bees, Mongabay reports. Beyond Pesticides maintains that elimination of such pesticides is key to protecting critical pollinators, ensuring a nontoxic food supply, supporting ecosystems and biodiversity, and ensuring safe working conditions for agricultural workers and safety for rural residents. Organic, regenerative agricultural practices, which often avoid monocropping, achieve all of these important goals. Advocates maintain that a transition to such practices is imperative in ensuring a far less toxic future for humans, other residents of Planet Earth, and Nature itself. [...]

Accès au document

Participez à la consultation sur la nouvelle stratégie de l'UE sur les produits chimiques !

Générations futures 03/06/20

Dans le cadre du pacte vert pour l'Europe (European Green Deal), lancé en décembre 2019 et visant à rendre l'économie de l'Union européenne durable, l'ambition « zéro pollution » pour un environnement exempt de substances toxiques a été clairement affichée. Pour répondre à cet objectif, la Commission s'est engagée à présenter une stratégie durable dans le domaine des produits chimiques (Chemical strategy for sustainability).

Cette stratégie vise à réduire les risques liés à la production et à l'utilisation de produits chimiques dangereux, et ainsi à mieux protéger les citoyens et l'environnement tout en encourageant l'innovation pour le développement de solutions de substitution sûres et durables. Cet objectif pourra être atteint en simplifiant et en renforçant le cadre juridique. La Commission examinera les modes de collaboration possibles entre les agences et organismes scientifiques de l'UE, afin d'instaurer un processus dans lequel les substances ne sont évaluées que par une seule agence. Le cadre réglementaire devra aussi être adapté pour tenir compte des données scientifiques sur le risque que constituent les perturbateurs endocriniens, les substances chimiques dangereuses présentent dans les produits (y compris importés), les effets combinés de différents produits chimiques, et les substances chimiques très persistantes. [...]

Accès au document

L'appel de Gil Rivière-Wekstein à Didier Guillaume sur l'interdiction du glyphosate en 2021 : « Il est temps de faire le bon choix »

https://doi.org/10.15454/BGEP-SC64

Alerte-environnement 30/05/20

« Monsieur Guillaume,

Vous avez encore réaffirmé la volonté d'interdire le glyphosate d'ici 2021 et en même temps, dans cette crise économique que nous traversons, vous savez très bien que nous avons besoin d'une agriculture compétitive. C'est un paradoxe. Il est temps de faire un choix, un vrai choix et de revenir sur des décisions qui, comme vous le savez très bien, sont prises pour des raisons idéologiques et non scientifiques. Donc, si vous voulez retrouver la confiance du monde agricole dont nous avons tous besoin, il est temps de faire le bon choix et de revenir sur cette décision. »

Dans 6 mois, l'usage du #glyphosate sera interdit pour des raisons idéologiques. Monsieur le Ministre, @dguillaume26 , pour retrouver la confiance du monde agricole, il est encore temps de revenir sur cette décision ! Mobilisons nous! https://t.co/GnKIJKW7v0pic.twitter.com/dqWoB0M83T

Accès au document

Les preuves ne cessent de s'accumuler sur la dangerosité du BPA

Générations futures 28/05/20

Nouvelle étude scientifique : Preuve d'un lien de causalité entre l'exposition au bisphénol A à de très faibles doses et des effets sur la santé, dont l'apparition de certains cancers.

Une nouvelle étude scientifique réalisée dans le cadre du projet américain CLARITY BPA et coordonnée par la biologiste américaine Ana Soto (Tufts University, à Boston), met en évidence un lien de causalité entre l'exposition à de très faibles doses de bisphénol A (BPA) et des effets observés sur le développement des glandes mammaires chez les rats. Les effets délétères observés peuvent favoriser l'apparition de cancers. Pour rappel, le BPA est un produit chimique de synthèse utilisé massivement dans la production de produits industriels et de revêtement en plastique de type polycarbonate (contenants et emballages alimentaires) et de résines époxy phénoliques (canettes, boîtes de conserve et couvercles métalliques). Il est aussi utilisé en tant que révélateurs pour l'impression des papiers thermiques (tickets de caisse). [...]

Accès au document

Agriculture bio : le tabou des pesticides… y compris de synthèse !

Alerte Environnement 28/05/20

Le site DecodAgri.frrevient sur l'affirmation (mensongère) selon laquelle « l'agriculture biologique n'utilise pas de pesticides ».

En effet, « la confusion règne autour de l'utilisation des produits phytosanitaires dans l'agriculture biologique. Certains affirment qu'elle n'en utilise jamais, d'autres qu'elle n'a pas droit aux « pesticides de synthèse » mais peut utiliser des produits naturels. Un résumé plus juste, mais trompeur car certaines substances autorisées en bio font débat. Les dérivés du cuivre, par exemple, sont obtenus par synthèse chimique ». Une confusion qui conduit le site de l'Agence de l'environnement et de la maîtrise de l'énergie à écrire des bêtises [...]

Accès au document

Ingrédients dans les cosmétiques : le résorcinol épinglé, l'aluminium blanchi

Que choisir 27/05/20

Deux ingrédients largement utilisés dans les cosmétiques, le résorcinol et l'aluminium, viennent de faire l'objet d'avis d'experts qui confortent les choix que nous avons faits dans le cadre de notre application QuelCosmetic.

Il est à la fois colorant, antioxydant, antiseptique : le résorcinol a plus d'une corde à son arc, raison pour laquelle il est largement utilisé. L'industrie des pneus, celles des colles ou des résines en emploient, mais il est aussi présent dans des produits auxquels nous sommes exposés plus directement : les colorations pour cheveux en contiennent très souvent, les crèmes antitaches et les crevettes quelquefois, le médicament Synthol en renferme également. Or, il est connu depuis des années comme un puissant allergène. Moins bien établi jusqu'ici, son potentiel de perturbation endocrinienne vient d'être confirmé par l'Anses (Agence

https://doi.org/10.15454/BGEP-SC64

nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail). [...]

Accès au document

I'd want more tools than just a hammer

PAnna 28/05/20

[...] Limiting the farmer's toolbox

A farmer is at their best when the toolbox is full of options at their disposal to handle the uncertainties of farming. My own small farm utilizes cover crops, crop rotation, natural habitat strips, cultivation, intercropping, succession planting, water drainage swales, mulches, and integration of livestock for fertility. Row crop farmers in Iowa could certainly use each of these tools to their advantage as well — and some of them do, and have done it well for generations.

My concern is that we are allowing corporate interests the power to limit the choices of skilled farmers everywhere, making it that much harder for us to succeed. Agricultural technology development has been centered around insecticides, herbicides, and fungicides in recent decades, and our institutions and regulatory structures have supported this technology. Even the genetically engineered (GE) seeds being developed are primarily concerned with traits that are tolerant to multiple herbicides. [...]

The pesticide-first paradigm takes options away from farmers who would rather have the choice to use different approaches. Soybean farmers find themselves deciding to plant dicamba-ready GE seed "defensively" to avoid damage from chemical trespass even if they do not intend to use dicamba themselves. A farmer that might like to add a small grain or alfalfa to a rotation may find that they inadvertently re-activate residual chemicals in the soil when they add phosphate fertilizer prior to planting. Farmers who would like to use cover crops as a part of a soil health program may find that herbicide residuals from persistent use over time could inhibit germination of those cover crops. [...]

Accès au document

High time for the EU to protect us from exposure to chemical mixtures

Chemtrust 28/05/20

In real life we are all exposed to hundreds of chemicals from multiple sources including from food, consumer products, household dust and drinking water. The environment – rivers, oceans and countryside – is also polluted by hundreds of different substances, including pesticides, plasticisers, flame retardants and pharmaceuticals. However, current safety assessments of chemicals mainly focus on single substances.

Scientific research has shown that mixtures are a real-world issue, with mixtures of chemicals creating combination effects even if each individual chemical is present at levels below which it is known to cause an effect. In 2019, an important conference organised by the EU research projects EDCMixRisk and EuroMix highlighted once more the urgent need to act on this research by adopting more effective regulatory approaches, and the use of better assessment tools for tackling mixture effects. [...]

Accès au document

The Pesticide Atrazine and 200 Other Toxic Chemicals Found in Fracking Wastewater; Contamination Goes Unregulated

Beyond Pesticides, June 4, 2020

A new, simultaneous chemical identification method has found the presence of the weed killer atrazine and 200+ other hazardous chemicals in hydraulic fracturing (fracking) wastewater or produced water, according to collaborative research published in the Journal of Separation Science by scientists at the University of Toledo (UToledo) and the University of Texas at Arlington. Although produced water is a waste product of fracking, the U.S. Environmental Protection Agency (EPA) allows many states to

reuse produced water in agriculture and other industries or dispose of it into waterways. [...]

Accès au document

Occupational Exposure to Pesticides, and Other Environmental Chemicals Increase Risk of Developing ALS

Beyond Pesticides, May 28, 2020

Exposure to agricultural and industrial pesticides, solvents (thinners), electromagnetic fields, and heavy metals predispose humans to amyotrophic lateral sclerosis (ALS), according to an Italian research study, "Environmental and Occupational Risk Factors of Amyotrophic Lateral Sclerosis: A Population-Based Case-Control Study," published in the International Journal of Environmental Research and Public Health. Although research supports ALS's genetic etiology, epidemiologic research associating ALS risks and to environmental, or work-related risk factors (i.e., pesticide use, pollutant exposure, heavy metal exposure, etc.) has been inconsistent and non-definitive. This research demonstrates the importance of assessing aggregate health risks associated with occupational pesticide exposure, especially when determining potential exposure routes in specific occupational sectors. In the study, researchers note, "In particular, having an occupation in the agricultural sector, especially with a long duration of the working activity as well as occupational exposure to some chemicals…might increase ALS risk." [...]

Accès au document

Billet du président - Pesticides - Premier recul gouvernemental

Que choisir 13/05/20

Mardi 12 mai, lors de l'audience devant le Conseil d'Etat dans le cadre de notre recours commun avec d'autres ONG contre l'instruction technique et les communications gouvernementales octroyant d'inadmissibles réductions supplémentaires aux distances minimales d'épandage près des habitations, le gouvernement, pressé par le Magistrat de s'expliquer sur ces dérogations non prévues dans les textes initiaux, a annoncé retirer du site du Ministère de l'Agriculture deux des textes litigieux…

Accès au document

EPA sneaks approval for harmful herbicide

PAN 08/05/20

You've heard of glyphosate, the active ingredient in Roundup. It's deemed a probable carcinogen, and has brought Bayer (Monsanto) to court time and time again over health harms to exposed individuals. You've also heard of dicamba, the drift-prone herbicide that has damaged millions of acres of crops over the last few years, for which farmers are just finally beginning to see justice.

And unfortunately, you're about to become familiar with yet another harmful pesticide that has been quietly approved by EPA while the country is otherwise distracted by the COVID-19 pandemic. Isoxaflutole is here, and it's bad. [...]

Accès au document

DDT Metabolite (DDE) and Other Banned Pesticides Found in Blood Sample of African American Women in Detroit

Beyond pesticides, May 14, 2020

Four banned organochlorine pesticides (OCP) are present in over 60% of a cohort of reproductive-age, black women in Detroit, according to a study published in Environmental Research by Boston University School of Public Health (BUSPH). OCPs are lipophilic (fat combining/dissolving), environmentally steadfast chemicals linked to harmful health effects. This study stresses the importance of monitoring pesticide accumulation, particularly regarding environmentally persistent chemicals and their

metabolization via indirect exposure routes. Lead author Olivia Orta, Ph.D., a postdoctoral research associate in the Department of Epidemiology at BUSPH, highlights the significance of water monitoring—especially in light of historically disproportionately high hazards for people of color (e.g., Flint, Michigan)—and testing sources prone to OCP contamination. She remarks, "The sources that we identified as potential OCP correlates should be tested for pesticide contamination, […] especially drinking water." [...]

Accès au document

Pilot Study Links Celiac Disease to Endocrine Disrupting Long-Lived Chemicals, like DDT, in the Environment

Beyond Pesticides, May 13, 2020

A pilot study at New York University (NYU) provides evidences of a direct relationship between celiac disease (adverse immune response to eating gluten) and exposure to endocrine-disrupting chemicals, including DDE – a metabolite of the infamous, bird-killing pesticide DDT. Researchers at NYU set out to elucidate the connection between the autoimmune disease and persistent organic pollutants (POPs), also known as "forever chemicals" or "legacy chemicals" due to their persistence in nature and the human body. The new research, published in Environmental Science, highlights higher odds for celiac disease among participants with elevated POPs exposure and differing results among male and female participants. Considering the complexity of these initial results, researcher Leonardo Trasande, Ph.D. says, "It's not as if these chemicals were designed with the human body in mind; These chemicals were designed with materials in mind." [...]

Accès au document

Exposition cumulée aux résidus de pesticides : l'Efsa conclut à l'absence de risque

Cultivar 12/05/20

Le 29 avril 2020, l'Efsa (l'Autorité européenne de sécurité des aliments) a publié les résultats de deux évaluations relatives au risque pour l'homme de l'exposition cumulée aux résidus de pesticides dans l'alimentation.

La 1re évaluation concerne les effets chroniques sur le système thyroïdien, l'autre porte sur les effets aigus sur le système nerveux. Ces évaluations ont été menées en collaboration avec l'institut national de la santé publique et de l'environnement des Pays-Bas (RIVM). L'Efsa indique avoir reçu aussi les contributions d'institutions nationales, d'universités, d'ONG et d'associations commerciales.

D'après les résultats de ces études, l'Efsa indique que le risque pour le consommateur d'une exposition cumulée par l'alimentation est inférieur au seuil qui requiert une action réglementaire et ce pour tous les groupes de populations couverts. [...]

Accès au document

Anses : des études complémentaires sur le potentiel cancérogène du glyphosate

Terre-Net 12/05/20

Face aux controverses sur le classement cancérogène du glyphosate, l'Anses a décidé de lancer un appel d'offres pour la réalisation d'études complémentaires de toxicologie sur le potentiel caractère cancérogène de la substance. Au terme du processus de sélection, l'Agence a annoncé récemment les équipes scientifiques sélectionnées pour réaliser ces études dont les résultats serviront à la réévaluation du glyphosate par l'Union européenne fin 2022. [...]

Après examen des différentes propositions soumises à l'Agence, les équipes sélectionnées sont :

« le consortium coordonné par l'Institut Pasteur de Lille (Institut Pasteur de Lille, CEA, Université de Lille, Inserm (Institut NuMeCan), Université de Toulouse, Arpae (Agency for prevention, environment and energy, Italie), Laberca), dont le programme couvre l'ensemble du cahier des charges,

le Centre international de recherche sur le cancer (Circ), qui propose une étude originale visant à explorer d'éventuels effets génotoxiques du glyphosate suite à une exposition de longue durée de cultures cellulaires ». [...]

Accès au document

Alerte aux pucerons : les betteraviers démunis à cause des mesures dites « environnementales »

Alerte Environnement 30/04/20

C'était le dogmatisme écolo et un quasi-suicide de toute la profession betteravière ou l'autorisation d'utiliser un insecticide dès le stade 2 feuilles, le Teppeki (flonicamide, normalement autorisé au stade 6 feuilles). En effet, depuis le 20 avril, la quasi-totalité des régions de production de betteraves en France sont touchées par une infestation de pucerons verts que d'aucuns qualifient de « très précoce et fulgurante ». À la clef, un risque « très élevé » de jaunisse, donc de perte de rendement de 30 à 50% alors même que le prix actuel de la tonne de betteraves (autour de 20 euros) permet à peine de rentabiliser une production normale… [...]

Accès au document

Pourquoi il est urgent de soutenir l'Initiative Citoyenne Européenne pour une sortie des pesticides « Sauvez les abeilles et les agriculteurs » ?

Générations futures 29/04/20

Deux documents importants, devant contenir des objectifs de réduction des pesticides, devaient être publiés par la Commission européenne au début de l'année, mais ont été reportés au 29/04 puis probablement au 20/05, en raison des efforts de lobbying massifs du lobby des agriculteurs conventionnels.

Progressivement, les versions divulguées du document mettent en évidence une réduction de l'ambition (par exemple, plus d'objectifs de réduction des pesticides obligatoires), se dirigeant vers un scénario de « statu quo». L'agro-industrie affaiblit l'accord vert européen sur la réduction des pesticides et la protection de la biodiversité [...]

Accès au document

Retour sur l'affaire glyphosate : affaire de gros sous aux USA, combat idéologique en Europe

Alerte Environnement 27/04/20

La France Agricole du 27 mars donne la parole à Gil Rivière-Wekstein, auteur du livre Glyphosate, l'impossible débat, paru en février 2020. Il explique que « cette affaire est la plus grande manipulation de l'opinion publique depuis le début du siècle. Il y a cinq ans, le glyphosate était un non-sujet. Tous les jardiniers du monde en avaient. Parmi tous les produits utilisés, ce n'est pas seulement le plus efficace, c'est aussi le moins toxique ». La manipulation a eu lieu en quatre grandes étapes :

C'est l'avis du Centre International de Recherche contre le Cancer (CIRC) classant la molécule comme « cancérigène probable » qui est « l'élément déclencheur », explique Gil Rivière-Wekstein. « Cet avis est contesté par l'ensemble des agences sanitaires du monde, qui estiment qu'il s'agit d'une surinterprétation des études ». Le journaliste juge « douteux » le rôle joué par le toxicologue américain Christopher Portier, connu pour avoir été employé par une ONG antipesticides américaine – l'Environmental Defense Fund. [...]

Accès au document

Billet du président - Pesticides - L'inadmissible décision gouvernementale !

Que Choisir 23/04/20

Trop, c'est trop ! Après avoir avalisé fin 2019 via des textes réglementaires des distances minimales d'épandage près des habitations ridiculement faibles (10, 5 mètres contre les 50 réclamés par les ONG et certaines autorités), le gouvernement profite aujourd'hui du confinement pour permettre, en catimini, des réductions supplémentaires, au moment même où les épandages débutent !

En effet, un communiqué du Ministère de l'Agriculture indique clairement qu'en raison de la situation empêchant des concertations locales, une instruction permet aux utilisateurs de déroger aux distances minimales (évidemment à la baisse !) jusqu'en juin 2020 (bref pendant toute la période où se concentrent habituellement les épandages de pesticides) si les utilisateurs se sont engagés dans un simple projet de charte de bonnes pratiques … sans besoin qu'il soit concerté ! [...]

Accès au document

Glyphosate : toujours pas de solution pour le remplacer et une échéance qui approche en plein chaos économique

Alerte-environnement

Plus personne ne l'ignore, sous la pression des ONG, le gouvernement a pour objectif de sortir de l'essentiel des usages du glyphosate au 1er janvier 2021, et de tous les usages au 1er janvier 2023. Dans le même temps, plus de trois agriculteurs sur quatre n'identifient pas d'alternatives au glyphosate, selon une enquête des instituts techniques Acta, Arvalis, Fnams, ITB, Terres Inovia réalisée sur un échantillon de 7677 producteurs en grandes cultures et publiée le 17 avril. Plus précisément, 77,5% disent ne pas savoir comment faire sans cet herbicide. [...]

Accès au document

Animal Fodder - A Driver of the Global Highly Hazardous Pesticides (HHPs) Industry

Beyond Pesticides, April 30, 2020

Chemical-intensive farming of crops for animal fodder powers the global market for highly hazardous pesticides (HHPs), according to data analyzed by Unearthed, and the Swiss NGO Public Eye. Animal fodder production not only intensifies global pollution, but it also increases pesticide exposure and degrades human, animal, and environmental health. This data analysis supports advocates advancing pesticide policies to eliminate HHPs by identifying which toxic chemicals lead global pesticide sales. However, it will take more than eliminating the worst chemicals to address the impending biodiversity collapse and the climate crisis, according to experts who point to the need for an urgent shift to organic land and agricultural management practices. United Nations' (UN) special rapporteur on toxic substances and human rights, Baskut Tuncak, says, "There is nothing sustainable about the widespread use of highly hazardous pesticides for agriculture. Whether they poison workers, extinguish biodiversity, persist in the environment, or accumulate in a mother's breast milk, these are unsustainable, cannot be used safely, and should have been phased out of use long ago." [...]

Accès au document

One Quarter of Global Insect Population Lost Since 1990

Beyond Pesticides, April 28, 2020

Roughly a quarter of the global insect population has been wiped out since 1990, according to new research published in the journal Science. Billed as one of the most comprehensive assessments to date, the study finds significant overall insect declines, but notes of some specific bright spots. While variation in the ongoing crisis is to be expected, ultimately the trends in the data show the need for immediate policy and regulatory action to protect the insect world as the foundation of global food webs. [...]

Accès au document

Monarch Butterfly Larvae Adversely Affected by Pesticide Drift from Contiguous Soybean and Maize Crop Fields

Beyond Pesticides 23/04/20

Pesticide spray drift from adjacent farmlands expose butterfly larvae to lethal pesticide concentrations, according to research published in Environmental Toxicology and Chemistry by Iowa State University (ISU). Lack of previous experimental pesticide toxicity data makes it unclear as to what degree insecticides impact monarch butterfly (Danaus plexippus) productivity in milkweed (Asclepias spp.) habitats near pesticide-treated pasture. This study adds weight to the idea that pesticides are playing a role in the ongoing decline of this iconic butterfly, as researchers find insecticide drift from adjacent fields to be strongly associated with larval mortality. Future monarch butterfly conservation efforts should consider risks stemming from pesticide exposure when developing butterfly rehabilitation efforts, according to advocates. As co-author Niranjana Krishnan (ISU graduate student) states, "In order to make the best decisions about how and where to plant milkweed, we first need to find basic toxicity and exposure data." [...]

Accès au document

REVUE DE PRESSE / RECHERCHE ET MEDIAS

Microplastic pollution accumulates heavily in coastal areas such as fjords and estuaries

EurekAlert! 30/06/20

Microplastic pollution in marine environments is concentrated most highly in coastal habitats, especially fjords and estuaries, according to a new review article published in the journal Marine Pollution Bulletin. Deep sea environments generally have much lower microplastic concentrations, although there are hotspots where elevated concentrations of microplastic occur.

Each year humans produce 360 million tonnes of plastic, and according to one study, around 8 million tonnes of it enters the ocean. Until recently the fate of microplastics (particles less than 5 mm in size) in the ocean has been unclear, but recent research has found that microscopic particles often settle in marine sediments, following the pattern of other pollutants. [...]

Accès au document

Convention citoyenne pour le climat : les mesures agricoles pourraient être adoptées par Emmanuel Macron

Terre-Net 30/06/20

Le président de la République, qui a reçu le 29 juin les citoyens de la Convention pour le climat, s'est dit prêt à reprendre 146 mesures sur les 149 proposées, incluant par conséquent les propositions relatives à l'agriculture.

Mise en place l'année dernière, la Convention citoyenne pour le climat a rendu sa copie le 21 juin, une feuille de route de 149 propositions devant permettre à la France d'atteindre ses objectifs en matière de réduction des gaz à effet de serre. Suite à ce travail, le président de la République a reçu le 29 juin les 150 citoyens qui avaient été tirés au sort pour constituer ce groupe de réflexion.

Un veto sur trois mesures seulement

Emmanuel Macron s'est ainsi déclaré prêt à reprendre les propositions de la Convention, « à l'exception de trois d'entre elles », à savoir la limitation à 110 km/h sur autoroute, l'idée d'une taxe sur les dividendes, et l'inscription de la préservation de l'environnement dans le préambule de la Constitution.

Le président ouvre donc la possibilité de reprendre toutes les autres mesures, y compris celles qui concernent l'agriculture : 50 % des terres cultivées en agro-écologie, promotion des circuits courts, repas végétariens dans les cantines, interdiction des pesticides d'ici 2040... [...]

Accès au document

https://doi.org/10.15454/BGEP-SC64

Environmental Persistent Organic Pesticides in the Serum and Breast Milk of Lactating North Carolina Women

EPA 25/06/20

Impact/Purpose:

The US EPA MAMA study is an epidemiologic study biomonitoring breast feeding women (serum and milk) for environmental chemicals. This abstract reflects the data on persistent organic pesticides in maternal milk in serum at two distinct points during lactation.

Citation: Hines, E. AND S. Fenton. Environmental Persistent Organic Pesticides in the Serum and Breast Milk of Lactating North Carolina Women. VIRTUAL-Society of Toxicology Meeting, Anaheim, CA, April 30, 2020.

Accès au document

Common food additive causes adverse health effects in mice

EurekAlert! 25/06/20

A common food additive, recently banned in France but allowed in the U.S. and many other countries, was found to significantly alter gut microbiota in mice, causing inflammation in the colon and changes in protein expression in the liver, according to research led by a University of Massachusetts Amherst food scientist.

"I think our results have a lot of implications in the food industry and on human health and nutrition," says lead author Hang Xiao, professor and Clydesdale Scholar of Food Science. "The study confirmed a strong linkage between foodborne titanium dioxide nanoparticles (TiO2 NPs) and adverse health effects." [...]

Accès au document

Effects from low-level concentrations of harmful chemicals preserved in three generations of fish

EurekAlert! 25/06/20

Fish exposed to very low levels of chemicals commonly found in waterways can pass the impacts on to future generations that were never directly exposed to the chemicals, according to Oregon State University researchers.

"What that gets at is something your grandparents may have come into contact with in their environment can still be affecting the overall structure of your DNA in your life today," said Kaley Major, a postdoctoral scholar at Oregon State and lead author of the paper published today in the journal Frontiers in Marine Science. [...]

Accès au document

Entry point for curbing the evolution of antibiotic resistance discovered

EurekAlert! 24/06/20

The team of Professor Tobias Bollenbach from the Institute for Biological Physics at the University of Cologne has published a study on a new approach to improving the effectiveness of antibiotics in bacterial infections. The study 'Highly parallel lab evolution reveals that epistasis can curb the evolution of antibiotic resistance,' on ways to controlling antibiotic resistance through targeted gene interactions has appeared in 'Nature Communications'.

'We wanted to know how genetic disorders in the bacterium E. coli interact with the later evolutionary adaptation to the drug,' said Bollenbach. Doctoral researcher Marta Lukačišinová developed a robotic platform together with Bollenbach and the technician Booshini Fernando with which hundreds of genetically altered Escherichia coli populations could be created simultaneously, and the course of their evolution investigated. 'Our most important result was that we found an entry point for suppressing the spontaneous development of resistance to the administered drug,' Lukačišinová added. [...]

Accès au document

https://doi.org/10.15454/BGEP-SC64

More evidence of causal link between air pollution and early death

EurekAlert! 26/06/20

Study of more than 68 million older Americans using state-of-the-art analyses suggests that US air pollution standards are not protective enough

Strengthening U.S. air quality standards for fine particulate pollution to be in compliance with current World Health Association (WHO) guidelines could save more than 140,000 lives over the course of a decade, according to a new study from Harvard T.H. Chan School of Public Health.

The study, published June 26, 2020 in Sciences Advances, provides the most comprehensive evidence to date of the causal link between long-term exposure to fine particulate (PM2.5) air pollution and premature death, according to the authors.

"Our new study included the largest-ever dataset of older Americans and used multiple analytical methods, including statistical methods for causal inference, to show that current U.S. standards for PM2.5 concentrations are not protective enough and should be lowered to ensure that vulnerable populations, such as the elderly, are safe," said doctoral student Xiao Wu, a co-author of the study. [...]

Accès au document

Global pollution estimates reveal surprises, opportunity

EurekAlert! 26/06/20

It is not unusual to come across headlines about pollution or global warming and find that they reach different conclusions depending upon the data source.

Researchers at Washington University in St. Louis used a harmonized approach, incorporating data from multiple satellites and ground monitors with computer modeling to compile a comprehensive, consistent map of pollution across the globe. Their data spans 1998-2018, providing a current picture of the state of the world's air quality that reveals some surprises, both for better and for worse.

The research was led by Melanie Hammer, a postdoctoral research fellow in the lab of Randall Martin, professor of energy, environmental and chemical engineering in the McKelvey School of Engineering.

Results of their study that looked at PM2.5 -- tiny particles that are able to make their way deep into a person's respiratory system -- were published June 3 in Environmental Science & Technology. [...]

Accès au document

Air pollution, smoking and built environment are associated with an increase risk of childhood obesity

EurekAlert! 24/06/20

How do environmental exposures during pregnancy and childhood influence the risk of obesity in children? The Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, and the University of Southern California led the first major study to investigate the associations between many pollutants and environmental factors - 77 prenatal and 96 childhood exposures - and the risk of childhood obesity. The findings show that air pollution, smoking and certain characteristics of the built environment--such as high population density-- may play a role in the development of obesity in children.

To date, several studies have addressed the effect of environmental pollutants, lifestyle factors, and urban environment factors on childhood obesity, but they studied each single exposure separately. The exposome concept has changed the way we investigate how environmental risks affect health. Instead of analysing the possible health consequences of, exposome studies consider many different exposures a person faces altogether. This approach takes into account many elements we are exposed to through our diet, lifestyle and the environment where we live. [...]

Accès au document

https://doi.org/10.15454/BGEP-SC64

New data reveals even low levels of air pollution triggers gene expression

EurekAlert! 24/06/20

New data from a landmark study by Monash University researchers raises concerns that even short-term exposure to low level air pollution can affect gene expression, leaving us at risk of diseases such as cancer, cardiovascular and respiratory diseases.

It has long been known that exposure to air pollution, including the widespread smoke events of the last Summer in Australia, can lead to short term health problems such as respiratory distress. It is also known that, longer term, exposure to air pollutants leads to oxidative stress and issues like an increased risk of cardiovascular disease. Now the American Lung Association has warned that there is a risk of increased infections if and when a region's pollution spikes - as happened when the Summer bushfires occurred in Australia.

The study, published in the PLOS Medicine, provides the first evidence that exposure to even very low levels of air pollution can change gene expression that are the hallmark of diseases such as cancer. [...]

Accès au document

Study: Air pollution major risk for cardiovascular disease regardless of country income

EurekAlert! 23/06/20

From low-income countries to high-income countries, long-term exposure to fine particulate outdoor air pollution is a major contributor to cardiovascular disease and death, a new Oregon State University study found.

But even small reductions in air pollution levels can result in a reduction of disease risk.

The study shows that countries don't have to immediately eradicate all air pollution to make a difference for people's health, said researcher Perry Hystad, an environmental epidemiologist in OSU's College of Public Health and Human Sciences. Hystad was the lead author on the international study, which also included fellow OSU public health researcher Andrew Larkin. Michael Brauer of the University of British Columbia was the senior author. [...]

Accès au document

Présence de pesticides dans l'eau : Générations futures interpelle à nouveau le Gouvernement

Actu-environnement 17/06/20

« Étant donné le potentiel d'action à faible dose sur le long terme des perturbateurs endocriniens (...), nous interpellons le Gouvernement afin qu'une politique efficace de suppression rapide des plus nocifs et de réduction de l'usage des pesticides soit enfin appliquée après les échecs des premiers plans Ecophyto », souligne François Veillerette, directeur de l'association Générations Futures.

L'association a réitéré cette année son analyse des résultats des contrôles de l'eau potable par les agences régionales de santé (ARS).

Résultats : dans 35,6 % des analyses les recherchant, des pesticides ont été retrouvés. Parmi ceux-ci, les substances cancérigènes, mutagènes et reprotoxiques (CMR) et / ou suspectées d'être des perturbateurs endocriniens, représentent 78,5 % des quantifications de résidus de pesticides (et 56,8 % des molécules). Plus précisément, 56,8 % des quantification de résidus de pesticides comportent des perturbateurs endocriniens, et 38,5 % des CMR. [...]

Accès au document

Effondrement mondial des insectes : deux ONG dénoncent l'agriculture industrielle

Actu-Environnement 15/06/20

C'est un nouveau cri d'alarme sur l'effondrement de la biodiversité que lancent Les Amis de la Terre Europe et la Fondation Heinrich Böll à travers leur Atlas des insectes 2020. Les deux ONG affichent des chiffres inquiétants et les relient directement à l'utilisation des pesticides par l'agriculture industrielle.

Quarante-et-un pour cent des espèces d'insectes sont en déclin, un tiers des espèces étudiées sont menacées d'extinction, les pollinisateurs sont fortement touchés alors que 75 % des cultures dépendent d'eux. Ces chiffres viennent à la suite de nombreuses études qui ont déjà documenté le déclin des insectes, qu'il s'agisse des rapports de l'IPBES sur les pollinisateurs et sur l'évaluation mondiale de la biodiversité, des listes rouges de l'UICN, de l'étude allemande montrant que plus de 75 % de la biomasse des insectes volants avait disparu en 27 ans, ou encore des dernière statistiques françaises. [...]

Accès au document

Metabolomic Profiling to Inform Use of Surrogate Species in Ecological Risk Assessments

EPA 12/06/20

The U.S. EPA routinely uses avian and fish toxicity data to set protective standards for amphibians in ecological risk assessments. However, this approach does not always adequately represent aquatic-dwelling and terrestrial-phase amphibian exposure data. While there are multiple amphibian families within the U.S. EPA's ECOTOX database, a lack of concordance of standardized tests used to collect amphibian data limits the ability to estimate the ecological effects of pesticides in these species and affirm the use of surrogate species data. For instance, it is widely accepted that early life stage tests for fish are typically sensitive enough to protect larval amphibians, but metamorphosis from tadpole to a terrestrial-phase adult relies on endocrine cues that are less prevalent in fish. These differences suggest that more robust approaches are needed in order to adequately elucidate the impacts of pesticide exposure in amphibians across critical life stages. Therefore, in the current study, the perturbations in the metabolomic response of larval zebrafish (Danio rerio), a surrogate species frequently used in ecotoxicological studies, are compared to those of African clawed frogs (Xenopus laevis) and southern toad (Anaxyrus terrestris) tadpoles following exposure to high-use pesticides. These species were exposed to pesticides including, but not limited to, atrazine, bifenthrin, chlorothalonil, metolachlor, tebuconazole, or trifluralin over a targeted range spanning reported values beneath those eliciting acute toxicity. For metabolomic profiling, liver tissues or whole organisms were liquid-liquid extracted, derivatized and analyzed by gas chromatography coupled with mass spectrometry. Following spectral alignment and preprocessing, multivariate analysis was utilized to identify dose-dependent changes in the metabolome for each species and each pesticide. Numerous biochemical pathways, such as fatty acid synthesis, amino acid metabolism and the citric acid cycle are frequently impacted by pesticide exposure. Ultimately, data gathered will help inform the applicability of the use of surrogate species in establishing the risk pesticide exposure poses to amphibians and potentially other non-target species.

Citation: Seim, R., D. Glinski, J. Awkerman, B. Hemmer, P. Harris, Sandy Raimondo, AND Matt Henderson. Metabolomic Profiling to Inform Use of Surrogate Species in Ecological Risk Assessments. 2020 SOT Virtual Meeting, Anaheim, CA, March 15 - 19, 2020.

Accès au document

Coal-tar-sealant major source of PAH contamination in Great Lakes tributaries

EurekAlert! 11/06/20

Runoff from pavement with coal-tar-based sealant is the most likely primary source of polycyclic aromatic hydrocarbons, or PAHs, found in the majority of streambed sediments of Great Lakes tributaries, according to a study published in Environmental Toxicology and Chemistry. PAHs are a group of chemicals found in crude oil and coal and occur as a byproduct of burning. PAHs can have harmful effects to organisms in the environment under certain conditions. So, it is important to understand their sources, distribution and magnitude in the Great Lakes Basin. [...]

https://doi.org/10.15454/BGEP-SC64

Accès au document

Living near oil and gas wells may increase preterm birth risk

EurekAlert 09/06/20

Living in close proximity to oil and gas operations may increase the risk of preterm birth, according to new research on births in California's primary oil-producing region. The work could inform discussions about the state's implementation of setbacks from oil and gas extraction facilities.

Researchers examined 225,000 births from mothers who lived within about six miles of oil and gas wells in the San Joaquin Valley from 1998 to 2011. The results show that women who lived near wells in the first and second trimesters were 8 to 14 percent more likely to experience a spontaneous preterm birth - one that would otherwise be unexplained - at 20 to 31 weeks. Spontaneous preterm birth, in which a pregnancy ends before 37 weeks of gestation, is the leading cause of infant death in the United States. [...]

Accès au document

Genomic surveillance of antibiotic resistance in the Philippines established

EurekAlert! 05/06/20

Antibiotic resistance surveillance in the Philippines has moved into the genomic era, enabling better tracking of dangerous bacteria. Researchers at the Centre for Genomic Pathogen Surveillance (CGPS housed at the Wellcome Sanger Institute and The Big Data Institute (BDI), University of Oxford), and the Philippine Research Institute for Tropical Medicine (RITM), set up local DNA sequencing and analysis of drug resistant bacteria in the Philippines. This genomic capacity has enhanced ongoing national infection control including tracking the spread of resistance to last-line antibiotics and identifying drug resistant infections in a hospital baby unit, helping control the outbreak. [...]

Accès au document

PFAS present throughout the Yadkin-Pee Dee river food chain

EurekAlert! 05/06/20

Researchers from North Carolina State University have found per- and polyfluoroalkyl substances (PFAS) in every step of the Yadkin-Pee Dee River food chain, even though the river does not have a known industrial input of these compounds. The study examined the entire aquatic ecosystem for PFAS compounds and identified strong links between ecosystem groups that lead to biomagnification, the process that leads to greater concentrations of these substances in animals that sit higher on the food chain - including humans. [...]

Accès au document

New killing mechanism discovered in 'game-changing' antibiotic

EurekAlert! 05/06/20

Scientists at the University of Liverpool and University of Utrecht have taken another step forward on their quest to develop a viable drug based on teixobactin - a new class of potent natural antibiotic capable of killing superbugs.

Research published in Nature Communications provides fundamental new insights into how teixobactins kill bacteria, including the discovery of a new killing mechanism that could help inform the design of improved teixobactin-based drugs. [...]

Accès au document

Microplastic background pollution in the Curonian Spit beach

EurekAlert! 10/06/20

An article written by an international team of scientists was published recently in Marine Pollution Bulletin magazine. The team included representatives of the Russian Academy of Sciences Shirshov Institute of Oceanology

Atlantic Department, the Immanuel Kant Baltic Federal University, and the Institute of Baltic Sea Research (Warnemunde, Germany). The article was aimed at studying Curonian spit beaches pollution with macro and microplastic. The pollution from both Russian and Lithuanian parts was studied. [...]

Accès au document

Researchers developing quick and simple method of glyphosate detection

EurekAlert 08/06/20

Professor Tilo Pompe from the Institute of Biochemistry at Leipzig University has now reported on the scientific basis of the project together with his colleagues in the journal Biosensors and Bioelectronics.

"Until now, scientists have used costly laboratory methods to detect glyphosate. The detection principle we have developed uses the natural reaction of glyphosate in plants. By imitating this mechanism, the detection principle is highly specific," he said. The corresponding enzyme is bound to a chip surface. During detection, elastic hydrogel microparticles bind to this surface. If glyphosate is present in the detection solution, then depending on the concentration this inhibits the binding of the microparticles to the chip surface. "By using microparticle binding, the detection method offers an extremely high level of sensitivity with regard to pesticide limits for drinking water," said Pompe. At the same time, the method could be applied in practice as a simple, mobile detection principle using optical readout procedures. [...

https://doi.org/10.1016/j.bios.

Accès au document

Thousands of tons of ocean pollution can be saved by changing washing habits

EurekAlert 05/06/20

A new study has revealed that almost 13,000 tonnes of microfibres, equivalent to two rubbish trucks every day, are being released into European marine environments every year - but this could be reduced by as much as 30% if we made a small change to our laundry habits.

The findings have been published by the scientific journal PLOS ONE today (Friday 5 June), ahead of World Oceans Day on Monday 8 June. [...]

Accès au document

Une ONG publie un atlas des insectes pour dénoncer l'usage des phytos

Terre-Net 9/06/20

Plus de 40 % des espèces d'insectes sont en déclin dans le monde, selon l'ONG Friends of the Earth Europe et l'institut Heinrich Böll. Ces deux organisations ont publié mardi 9 juin 2020 un Atlas des insectes pour dénoncer l'utilisation des produits phytosanitaires en Europe et dans le monde.

Les deux organisations appellent à réduire de 80 % l'utilisation des pesticides de synthèse d'ici 2030 dans l'Union européenne, avec une « transition juste pour les agriculteurs ».

L'Atlas des insectes souligne par exemple qu'une espèce de papillons et d'abeilles sur 10 est menacée d'extinction en Europe. [...]

Accès au document

Data gaps hamper monitoring of heavy metals that threaten arctic communities

EurekAlert! 03/06/20

Some Alaskan soils harbor elevated concentrations of heavy metals that can harm human health, but critical data gaps impede understanding of exposure risks for Arctic communities. Clarice Perryman of the University of New Hampshire, Durham, and colleagues present these findings in the open-access journal PLOS ONE on June 3, 2020.

Many Arctic and sub-Arctic communities face heavy metal contamination of their food and water resulting from activities such as mining and drilling. As global temperatures rise, thawing of permafrost--frozen soils--could also release naturally occurring heavy metals into Arctic

ecosystems, potentially intensifying health risks. However, the amount of toxic metals in Arctic soils and the risks they pose are unclear. [...]

Citation: Perryman CR, Wirsing J, Bennett KA, Brennick O, Perry AL, Williamson N, et al. (2020) Heavy metals in the Arctic: Distribution and enrichment of five metals in Alaskan soils. PLoS ONE 15(6): e0233297. https://doi.org/10.1371/journal.pone.0233297

Accès au document

Impact of Diflubenzuron on *Bombus Impatiens* Microcolony Development

EPA 29/05/20

Impact/Purpose: Reliance on the honey bee as a surrogate organism for risk assessment performed on other bees is being challenged. Consequently, there is a need to develop validated methods for assessing toxicity in non-Apis bees including bumble bees. Using diflubenzuron as a model toxicant, we developed a protocol for initiating and monitoring bumble bee microcolonies. While our effort strengthens the foundation for use of this methodology in risk assessment, more work is required to better understand the utility of this model for risk assessment.

Citation: Lehmann, D., M. Batres, AND W. Williams. Impact of Diflubenzuron on Bombus Impatiens Microcolony Development. ENVIRONMENTAL ENTOMOLOGY. Entomological Society of America, Lantham, MD, 49(1):203-210, (2020). https://doi.org/10.1093/ee/nvz150

Accès au document

Gold mining with mercury poses health threats for miles downstream

EurekAlert! 29/05/20

Small-scale gold mining in the Peruvian Amazon poses a health hazard not only to the miners and communities near where mercury is used to extract gold from ore, but also to downstream communities hundreds of kilometers away where people eat mercury-contaminated river fish as part of their diet.

In these downstream communities where fish is an important part of the diet, children under 12 with the highest levels of mercury in their blood and hair suffer a 4.68-point loss in I.Q., researchers report. They are also more anemic, lacking adequate hemoglobin to carry oxygen in their blood. [...]

Accès au document

Study demonstrates association between exposure to air pollution and vascular damage

EurekAlert! 03/06/20

A study led by the Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, contributes new evidence about the negative impact of air pollution on cardiovascular health. The results of the study, which analysed the relationship between several cardiovascular markers and personal exposure to two air pollutants--fine particulate matter (PM2.5) and black carbon--in over 3,000 people living around the Indian city of Hyderabad, showed that exposure to polluted air increases the risk of vascular damage. [...]

Accès au document

Exploring the neurological impact of air pollution

EurekAlert! 03/06/20

Air pollution has become a fact of modern life, with a majority of the global population facing chronic exposure. Although the impact of inhaling polluted air on the lungs is well known, scientists are just now beginning to understand how it affects the brain. A new article in Chemical & Engineering News, the weekly newsmagazine of the American Chemical Society, details how researchers are connecting air pollution to dementia, autism and other neurological diseases. [...]

Accès au document

https://doi.org/10.15454/BGEP-SC64

Un nouvel outil européen pour recenser les perturbateurs endocriniens

Actu-Environnement 05/06/20

Mis en ligne 2 juin 2020, le site edlists.org répertorie la liste des substances reconnues comme étant des perturbateurs endocriniens dans la règlementation européenne sur les produits chimiques. Ce site est le résultat d'une coopération entre la Belgique, le Danemark, les Pays-Bas, la Suède, et la France.

« *De nombreuses listes de perturbateurs endocriniens existent mais les méthodologies pour les élaborer sont très variables et l'information est morcelée, ce qui constitue un frein à la transparence pour les consommateurs*, précise le ministère de la Transition écologique et solidaire. *Le site Internet doit aussi permettre d'améliorer la coopération* entre les agences nationales et européennes *afin de sortir rapidement du marché les substances les plus néfastes, d'accompagner l'industrie dans la lutte contre les substances préoccupantes et d'améliorer l'information des citoyens sur les perturbateurs endocriniens* ». [...]

Accès au document

Novel bioaccumulative compounds found in marine bivalves

Phys.org 03/06/20

A research team in Ehime University found novel bioaccumulative compounds in mussels inhabiting Hiroshima Bay and suggested their unintentional (natural) formation in the environment. The findings were published on March 12, 2020 in Environmental Science & Technology and selected as a supplementary cover of the journal.

Persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethanes (DDTs), and dioxins possess environmentally persistent and bioaccumulative properties and can cause adverse effects on humans and wildlife. POPs are strictly regulated and targeted for abolition (prohibition of production and usage) and for reduction of unintentional formation according to the Stockholm Convention on POPs. Since the Stockholm Convention came into effect in May 2004, several organohalogen compounds (OHCs) have additionally been registered as new POPs. However, legacy and emerging POPs drawing international attention are confined to well-known anthropogenic OHCs, and hence environmental release and biological exposure of unknown POP-like substances have been overlooked. [...]

Accès au document

Antibiotic-destroying genes widespread in bacteria in soil and on people

Science daily 04/06/20

Researchers have found that genes that confer the power to destroy tetracycline antibiotics are widespread in bacteria. But the researchers have also created a chemical compound that shields tetracyclines from destruction, restoring the antibiotics lethality. The findings indicate an emerging threat to one of the most widely used classes of antibiotics -- but also a promising way to protect against that threat. [...]

Accès au document

Pour le député UE P. Canfin, l'État doit financer les alternatives au glyphosate

Agri-mutuel 02/06/20

Dans une interview parue le 31 mai dans le JDD, le député européen Pascal Canfin (Renaissance) propose, pour rendre l'agriculture plus verte, d'utiliser les 15 milliards d'euros supplémentaires, annoncés par la Commission européenne.

« La Commission européenne va renforcer de 15 milliards d'euros le budget alloué à la transition agro-écologique. C'est l'occasion pour la France d'utiliser sa part – près de 2 milliards – pour diminuer les pesticides pour de vrai », estime le député européen Pascal Canfin dans une interview au JDD, parue le 31 mai.

L'ancien ministre délégué au développement et ancien directeur de WWF souhaite notamment que le gouvernement mette l'accent sur la recherche d'alternatives au glyphosate, dont « on doit sortir fin 2020 ». « Pour la crédibilité d'Emmanuel Macron, il faut que l'État prenne en charge les alternatives au glyphosate, comme le matériel de désherbage mécanique », insiste le député européen. « On doit pouvoir dire à tous les viticulteurs, par exemple, que la solution qui leur permettra de sortir du glyphosate sera financée », ajoute-t-il.

Cette proposition fait partie d'un « plan pour une relance verte », que Pascal Canfin a évoqué avec les ministres de l'économie et de la transition écologique. Pour l'eurodéputé, « il faut que 25 milliards d'euros, dans les deux prochaines années, soient consacrés à la transition écologique », grâce en partie aux fonds issus du plan de relance européen.

Accès au document

La Commission lance une consultation sur l'utilisation durable des pesticides

Actu-environnement 1/06/20

La Commission européenne consulte le public jusqu'au 7 août 2020 sur une feuille de route portant sur l'utilisation durable des pesticides. L'exécutif européen a initié une évaluation de la directive du 21 octobre 2009, instaurant un cadre communautaire pour parvenir à une utilisation des pesticides compatible avec le développement durable, et une analyse d'impact de sa révision éventuelle. [...]

Accès au document

Stratégie « De la ferme à la fourchette » : la Commission européenne fixe le cap pour 2030

Actu-environnement 25/05/20

Moins de pesticides, d'engrais et de médicaments, plus de bio. La Commission européenne a présenté sa stratégie « De la ferme à la fourchette » pour rendre plus durable le système alimentaire européen.

La Commission européenne a adopté, le 20 mai, sa stratégie « De la ferme à la fourchette » qui présente ses pistes pour mettre en place un système alimentaire plus durable à l'horizon 2030. L'objectif est de concilier sécurité alimentaire et réduction de l'empreinte environnementale et climatique de la chaîne alimentaire. Prévue dans le cadre du Pacte vert, ce plan a encore plus d'écho avec la crise et les questions soulevées par le Covid-19. [...]

Accès au document

Zones de non traitement : le recours du collectif des maires antipesticides rejeté en référé

Actu-environnement 18/05/20

Le juge des référés du Conseil d'État a rejeté, le 15 mai, le recours du collectif des maires antipesticides sur le décret et l'arrêté du 27 décembre 2019 relatifs aux distances minimales de sécurité pour l'épandage des pesticides près des habitations (zones de non traitement ou ZNT). Une décision similaire avait déjà été prise le 14 février dernier.

« *Si les risques pour la santé de l'utilisation des pesticides sont connus, aucun élément apporté par le collectif ne permettait de démontrer que les distances minimales de sécurité fixées par le Gouvernement - sur la base d'un avis de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (Anses) - étaient insuffisantes* », indique le Conseil d'État. L'apport au dossier de nouvelles pièces par le collectif des maires n'a pas permis de démontrer l'urgence, ajoute-t-il. Le Conseil d'État se prononcera donc sur le fond du dossier dans les mois à venir.

Accès au document

You cannot avoid microplastics

EurekAlert! 13/05/20

Microplastics are everywhere - including in our drinking water, table salt and in the air that we

https://doi.org/10.15454/BGEP-SC64

breathe. Having studied the scope of microplastics in a number of countries, researchers are worried.

- Given the lifetime inevitable exposure to microplastics, we urgently call for a better understanding of the potential hazards of microplastics to human health, says Dr Elvis Genbo Xu, an Assistant Professor of environmental toxicology at the University of Southern Denmark.

There are many studies on microplastics, especially concerning the oceans, but in this study Elvis Genbo Xu and his colleagues, Professor Huanghong Shi from East China Normal University and Professor Eddy Zeng from Jinan University in China, chose to focus on microplastics in table salt, drinking water and air. [...]

Accès au document

Clay layers and distant pumping trigger arsenic contamination in Bangladesh groundwater

EurekAlert! 07/05/20

Well water contaminated by arsenic in Bangladesh is considered one of the most devastating public health crises in the world. Almost a quarter of the country's population, an estimated 39 million people, drink water naturally contaminated by this deadly element, which can silently attack a person's organs over years or decades, leading to cancers, cardiovascular disease, developmental and cognitive problems in children, and death. An estimated 43,000 people die each year from arsenic-related illness in Bangladesh.

To avoid arsenic contamination, many Bangladeshi households access water via private wells drilled to 300 feet or less, beneath impermeable clay layers. Such clay layers have been thought to protect groundwater in the underlying aquifers from the downward flow of contaminants. However, a study published in Nature Communications this week suggests that such clay layers do not always protect against arsenic, and could even be a source of contamination in some wells. [...]

Accès au document

Filtering out toxic chromium from water

EurekAlert! 06/05/20

Hexavalent chromium continues to contaminate water sources around the world, with one US company fined just this February for having put employees at risk. Hexavalent chromium is considered to be extremely toxic, especially when inhaled or ingested, and its use is regulated in Europe and in many countries around the world. It is thought to be genotoxic, leading to DNA damage and the formation of cancerous tumors.

Now, chemists at EPFL are developing energy efficient processes for removing contaminants, this time hexavalent chromium, from water. The results are published today in the Journal of Materials Chemistry A. [...]

Accès au document

USF researchers find human-driven pollution alters the environment even underground

Eurekalert! 08/05/20

The Monte Conca cave system on the island of Sicily is a vast system of springs and pools, sitting below a nature preserve. It might be presumed to be one of the few places untouched by human-driven pollution.

But new research published by a USF microbiology and geoscience team has found that even below ground, the microbial communities in the pools of water in the Monte Conca cave show signs of being altered by pollution from above.

Publishing in the prestigious journal, PLoS One, the team found that water flowing through the vast cave system produced changes in the microbial communities between the wet and dry seasons, with the microbial communities differing in bacterial composition and ecological functions. The study suggests that as surface water flows through agricultural and urban

areas, it collects bacterial contaminants before entering cave systems. [...]

Accès au document

Pétition : France Grandes Cultures appelle à stopper la suppression des produits phytos

Terre-Net 13/05/20

France Grandes Cultures, syndicat spécialisé de la Coordination rurale, a lancé, le 7 mai dernier, la pétition « Stop à la suppression de produits phytos ! ». Elle sera déposée au ministère de l'agriculture le 15 juin 2020.

Avec le lancement de cette pétition« Stop à la suppression des produits phytos ! », « nous voulons montrer aux pouvoirs publics notre refus de nous laisser dépouiller des outils nous permettant de protéger le fruit de notre travail », présente Damien Brunelle, président de France Grandes Cultures (FGC). La pétition sera adressée au ministère de l'agriculture le 15 juin prochain.

« La suppression de nombreux produits phytopharmaceutiques place l'ensemble des productions végétales dans une situation très grave et sans précédent. La forte infestation d'insectes que nous subissons en ce moment sur les grandes cultures en est l'une des manifestations », ajoute le président du syndicat spécialisé de la Coordination rurale. « Depuis 10 ans, les agriculteurs se sont vus privés de plus de 40 % des produits existants (1 806 autorisations de mise sur le marché en 2019 contre 3 036 en 2008) et l'État, sous la pression des lobbies écologistes, souhaite en finir avec la chimie de synthèse, alors même que les solutions alternatives efficaces n'existent pas encore. » [...]

Accès au document

Ouverture d'un fonds de 30 M€ pour accompagner les agriculteurs

Agri-mutuel 11/05/20

Le ministre de l'agriculture a annoncé le 9 mai l'ouverture d'un fonds doté de 30 millions pour aider les agriculteurs à investir et renforcer la protection des riverains lors de l'utilisation de produits phytosanitaires à proximité des habitations.

Une aide à l'investissement, dotée de 30 millions d'euros, a été mise en place pour aider les agriculteurs à renforcer la protection des riverains lors de l'utilisation des produits phytosanitaires, « en cohérence avec le nouveau dispositif mis en œuvre au 1er janvier 2020 », à savoir les zones de non traitement, a indiqué le ministère de l'agriculture le 9 mai. Ces ZNT peuvent en effet être réduites « en cas d'utilisation de matériel performant, répondant à des normes techniques précisées réglementairement », ajoute le communiqué. [...]

Accès au document

Phytosanitaires et ZNT Recours devant le tribunal administratif contre des préfets

Terre-Net 07/05/20

L'association environnementale Eau et Rivières de Bretagne (ERB) va déposer des recours devant le tribunal administratif pour demander l'annulation de dérogations accordées en Bretagne par les préfets pour réduire les distances de pulvérisation de pesticides à proximité des habitations, a-t-elle annoncé mercredi dans un communiqué.

« Le recours a été déposé concernant le Finistère et il est en cours concernant les trois autres départements », a précisé à l'AFP Dominique Le Goux, en charge du dossier « pesticides » à ERB. [...]

Accès au document

Protection des riverains : 30 millions d'euros pour accompagner la mise en place des ZNT

Actu-environnement 12/05/20

https://doi.org/10.15454/BGEP-SC64

Le ministre de l'Agriculture, Didier Guillaume, a annoncé, le 9 mai, l'ouverture d'un dispositif national pour accompagner les agriculteurs dans la mise en place des zones de non traitement (ZNT).

Une enveloppe de 30 millions d'euros permettra d'aider les agriculteurs qui investissent dans des matériels performants afin de réduire les distances de traitement, et / ou choisissent des itinéraires techniques alternatifs. ...

Accès au document

Reach : vers une restriction de la fabrication et de l'utilisation des PFAS

Actu-environnement 12/05/20

Les autorités de cinq pays européens (Allemagne, Pays-Bas, Norvège, Suède, Danemark) ont convenu de préparer une proposition de restriction portant sur la fabrication et l'utilisation d'une large gamme de substances per- et polyfluoroalkylées (PFAS), indique l'Agence européenne des produits chimiques (Echa) dans un communiqué en date du 11 mai.

Dans cette perspective, ces autorités lancent, jusqu'à la fin juillet 2020, un appel à témoignage sur l'utilisation de ces substances. Il s'adresse en particulier aux entreprises qui en produisent ou en utilisent, à celles qui utilisent des alternatives, ainsi qu'aux scientifiques et aux ONG. « *Les informations reçues dans le cadre de l'appel à contributions seront utilisées par les cinq pays pour affiner la portée de la proposition et analyser l'efficacité et l'impact socio-économique des différentes options de restriction* », explique l'Echa. La proposition de restriction, prise dans le cadre du règlement Reach (annexe XV), sera préparée dans les deux années qui viennent, puis transmise aux comités scientifiques de l'Agence pour avis. La décision de restriction, qui pourrait entrer en vigueur en 2025, sera prise par la Commission européenne et examinée par la Parlement et le Conseil.

Accès au document

Microplastique : les plus hauts niveaux jamais mesurés, découverts au fond de la Méditerranée

Actu-environnement 01/05/20

Publiée cette semaine dans la revue Science, une étude internationale, menée par l'Université de Manchester (Royaume-Uni), le National Oceanography Center (Royaume-Uni), l'Université de Brême (Allemagne), l'IFREMER (France), et l'Université de Durham (Royaume-Uni), apporte un éclairage nouveau sur la pollution plastique des mers et des océans.

Le projet de recherche a révélé les niveaux de microplastique les plus élevés jamais enregistrés sur un fond marin, avec jusqu'à 1,9 million d'unités couvrant seulement un mètre carré. Les prélèvements ont été effectués au fond de la mer Tyrrhénienne, une partie de la Méditerranée comprise entre la Corse, la Sardaigne, la Sicile et l'Italie…

Accès au document

Cocktail de pesticides dans l'alimentation : la réglementation actuelle est suffisante selon l'Efsa

Actu-environnement 30/04/20

Faut-il renforcer la réglementation sur les pesticides dans l'alimentation si l'on prend en compte l'effet cocktail ? C'est à dire si on inclut les effets cumulés des différentes molécules retrouvées sur les aliments ? C'est à cette question que l'Autorité européenne de sécurité des aliments (Efsa) a tenté de répondre en réalisant deux évaluations pilotes. L'une sur les effets chroniques sur le système thyroïdien, l'autre portant sur les effets aigus sur le système nerveux. [...]

Accès au document

https://doi.org/10.15454/BGEP-SC64

Antibiotic exposure can 'prime' single-resistant bacteria to become multidrug-resistant

EurekAlert! 27/04/20

Antibiotics save lives -- but using them also helps antibiotic-resistant strains evolve and spread. Each year, antibiotic-resistant bacteria infect some 2.8 million people in the United States, killing more than 35,000, according to the Centers for Disease Control and Prevention. Infections by multidrug-resistant -- or MDR -- bacteria, which are resistant to two or more antibiotics, are particularly difficult to treat.

Scientists at the University of Washington and the University of Idaho have discovered just how readily MDR bacteria can emerge. In a paper published April 6 in Nature Ecology & Evolution, the researchers report that, for a bacterial pathogen already resistant to an antibiotic, prolonged exposure to that antibiotic not only boosted its ability to retain its resistance gene, but also made the pathogen more readily pick up and maintain resistance to a second antibiotic and become a MDR strain. [...]

Accès au document

Adsorbent material developed with PET bottles for the removal of antibiotics from water

EurekAlert! 24/04/20

High-purity organic ligand was extracted from PET waste bottles and used to develop a high-efficiency adsorbent. The material maintained its adsorption properties even after repeated use, indicating wide applicability for water treatment

South Korea with its high antibiotic use is categorized as a country at high risk of the emergence of *multi drug-resistant bacteria, or so-called "super bacteria." According to the Ministry of Environment, antibiotic substances have been detected at livestock wastewater treatment facilities, sewage treatment plants, and in rivers. [...]

Accès au document

Health impacts of pollution upon indigenous peoples

EurekAlert! 24/04/20

A new study from the University of Helsinki presents the current state of knowledge on the exposure and vulnerability of Indigenous Peoples to environmental pollution, reviewing the innumerable impacts that pollution poses on Indigenous communities from all over the world.

"While the number of studies examining the impacts of environmental pollution upon Indigenous Peoples is growing, most of this research is isolated and fragmented across disciplines and geographic regions", says Dr. Álvaro Fernández-Llamazares, from the Faculty of Biological and Environmental Sciences, who led the study. "In fact, few efforts have cut across disciplinary topics and/or regions, and until today there was no global review mapping out the worldwide impacts of environmental pollution on Indigenous Peoples". [...]

Accès au document

RIT scientists develop first 3D mass estimate of microplastic pollution in Lake Erie

EurekAlert! 24/04/20

Rochester Institute of Technology scientists have developed the first three-dimensional mass estimate to show where microplastic pollution is collecting in Lake Erie. The study examines nine different types of polymers that are believed to account for 75 percent of the world's plastic waste.

Plastic behaves differently in lakes than in oceans; previous studies on both have indicated the levels of plastic pollution found on the surface are lower than expected based on how much is entering the water. While massive floating "islands" of accumulated plastic waste have been found in oceans, previous studies have indicated the levels of plastic pollution found on the surface of Lake Erie are lower than expected based on how much is entering the water. [...]
Accès au document

https://doi.org/10.15454/BGEP-SC64

Exposure to air pollution during pregnancy is associated with growth delays

EurekAlert! 22/04/20

Prenatal exposure to air pollution has been linked to various adverse effects on children's health, including lower birth weight and respiratory and neurodevelopmental problems. However, very little is known about how air pollution affects physical growth in the first years of life. A new study by the Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, has found an association between exposure to air pollution during pregnancy and delays in physical growth in the early years after birth.

The Spanish study, published in Environment International, analysed data from more than 1,700 mother-child pairs from Asturias, Gipuzkoa, Sabadell and Valencia enrolled in the birth cohort of the INMA Environment and Childhood Project. [...]

Accès au document

How atrazine regulations have influenced the environment

EurekAlert! 22/04/20

To combat weeds, farmers use a variety of tools and methods. By understanding the strengths and downfalls of each tool, a farmer can make the best decisions for his or her operation to keep pesky weeds out of the field.

One tool farmers can turn to for weed control is applying herbicides. New research is helping us understand a specific herbicide even better: atrazine.

Atrazine is one of the most common herbicides used in the United States. It can be used to manage weeds in crops like corn, sorghum, sugarcane and turf. The chemical kills weeds by preventing photosynthesis in the plant. [...]

Accès au document

CDC Finds Sharp Rise in Home Poisonings Tied to Disinfectant and Sanitizer Use during Covid-19 Pandemic; Safer Products Available

Beyond Pesticides, April 24, 2020

The Centers for Disease Control and Prevent (CDC) has released a study showing a sharp increase—62% in some cases—in calls to poison hotlines about exposures to toxic household cleaners and disinfectants. This poisoning comes with the advent of the novel Coronavirus pandemic, as public health and government officials, and many media outlets have sensibly recommended that people regularly disinfect "high touch" surfaces and objects in their homes and other surroundings, but have not issued warnings on toxic effects nor the availability of lower toxicity or least-toxic products. Compliance with cleaning (sanitizers) and disinfection recommendations is an important public and personal health undertaking, but in this Covid-19 rigor lies a poison problem: the toxicity, as Beyond Pesticides has explained, of some cleaning and disinfecting products that are permitted by the Environmental Protection Agency (EPA) for sale and use. There are safer ways to disinfect those light switches, TV remotes, doorknobs, faucets, etc. [...]

Accès au document

Report de 3 mois du délai de commercialisation du chlorprophame (CIPC)

Arvalis-Info 22/04/20

Dans une note du 16 avril, l'ANSES apporte des précisions sur l'impact de l'ordonnance n°2020-306 du 25 mars 2020 liée aux mesures d'urgence face à la crise du Covid-19. Cette note modifie notamment les délais de grâce initialement accordés aux produits phytosanitaires en cours de retrait.

Concernant le chlorprophame, la note de l'ANSES précise que toutes les spécialités commerciales en contenant pourront être distribuées et

commercialisées jusqu'au 8 juillet 2020 au lieu du 8 avril. [...]

Accès au document

ZNT : des députés dénoncent une réduction des distances d'épandage

Terre-Net 22/04/20

Vingt-cinq députés, dont une majorité de marcheurs et MoDem, ont dénoncé mardi une division par deux des « distances de précaution pour pulvériser les pesticides » à proximité des habitations dans 25 départements, dans une lettre ouverte au ministre de l'agriculture.

« L'arrêté pris en date du 27 décembre 2019 portait pourtant les distances de sécurité minimales pour la pulvérisation des pesticides à proximité des lieux habités, à 5 m pour les cultures basses, type maraîchage, et à 10 m pour les cultures hautes », rappellent les députés, parmi lesquelles l'élue LREM du Finistère Sandrine Le Feur qui accueillera mercredi le président Macron dans sa circonscription.

« Or, depuis ce mois d'avril, 25 départements (dont tous les départements bretons), ont permis de revoir ces distances à 3 m pour les cultures basses et 5 m pour les cultures hautes », déplorent-ils, évoquant la « validation par certains préfets de chartes permettant » cette mesure. [...]

Accès au document

Réduction des pesticides : les pistes du coordinateur interministériel pour vraiment changer les pratiques

Actu-environnement 22/04/20

Constatant lui aussi l'échec des plans Écophyto, Pierre-Étienne Bisch dresse des pistes d'action pour engager une réelle mutation des pratiques agricoles. Formation, rémunération et lutte contre la concurrence déloyale en font partie.

Après avoir rencontré pendant plusieurs mois les parties prenantes de chaque région française, le coordinateur interministériel du plan de réduction de l'usage des produits phytosanitaires fait un premier constat sans appel, dans une note d'étape publiée le 20 avril : « *Il ressort de notre mission que toute tentative de réduction de l'utilisation de produits phytopharmaceutiques aura des effets limités si l'agriculteur ne recherche qu'à optimiser le coût des traitements, par le biais de la seule réduction des quantités utilisées* ». [...]

Accès au document

Pesticides : les ONG s'attaquent aux chartes dérogeant aux distances minimales d'épandage

Actu-environnement 23/04/20

Neuf associations saisissent la justice pour annuler les dérogations accordées aux agriculteurs pour l'épandage de pesticides dans certains départements. Du fait des consultations publiques annulées, le ministère de l'Agriculture a validé des projets de chartes locales sans l'avis du public. Ces chartes étaient l'une des conditions pour réduire les distances d'épandage mises en place début 2020 près des habitations. [...]

Accès au document