CHEMWATCH

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CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

CHEMICAL EFFECTS

Caring for coca, living with chemicals: Towards ecological harm reduction

2023-08-30

In this paper, we show how the materialisation of chemical harms linked to the cultivation of coca and its processing into coca paste reside in a wider politics of structural violence which is also situated ecologically. Drawing on the qualitative interview accounts of coca farmers in Putumayo, Colombia, we attend to practices of care in the field and in the laboratory. We look first at chemicals used in coca's cultivation (herbicides, fertilizers, pesticides), and second at chemicals (such as sulphuric acid, sodium carbonate, magnesium permanganate) used in the processing of coca leaf into paste (before the paste is sold on for refinement into cocaine). Our analysis highlights the tensions which inevitably arise in the balance and multiplicities of care - for crops, livelihood, and environment. We trace how farmers' narratives of the neutralisation of chemical risks habituate chemical harms as mundane, even uneventful, in an economic imperative to 'carry on as normal' in the coca economy. We emphasise health and harm as matters of care which not only affect humans but living environments. Accounts of 'risk environment' can give insufficient attention to Nature, and this leads us to consider 'ecological harm reduction'.

Authors: Tim Rhodes, Linda Sofía Ordoñez, Camilo Acero, Magdalena Harris, Adam Holland, Francisco Gutiérrez Sanín

Full Source: The International journal on drug policy 2023 Aug 30;120:104179. doi: 10.1016/j.drugpo.2023.104179.

In this paper, we show how the materialisation of chemical harms linked to the cultivation of coca and its processing into coca paste reside in a wider politics of structural violence which is also situated ecologically.

Understanding the sources of mercury release from coal: A combined experimental and molecular simulation study

2023-08-28

Understanding the occurrence modes of mercury in coal is important as its release poses long-term adverse effects on the environment and human health during coal production and utilization. However, the matter still remains a subject of controversy due to differing results from direct and indirect analyses, which suggest various possible modes of occurrence for mercury in coal. Additionally, the experimental measurement of Hg concentration presents challenges, further contributing to the complexity of the issue. A comprehensive investigation of experiments and molecular simulations is conducted herein. Electron probe microanalysis and elemental mapping analysis show that elemental Hg is concentrated in framboidal pyrites while absent in organic matter. To understand the occurrence modes of mercury in inorganic and organic materials at the atomic level, molecular simulations are performed for Hg2+ adsorption and retention in MMT, pyrite, and kerogen slit nanopores. It is found that the inorganic MMT and pyrite surfaces have a greater adsorption capacity than the organic kerogen surface (pyrite > MMT > kerogen). The outer-sphere adsorption is mainly observed with at least one monolayer of water molecules exiting between the ion and mineral surfaces. MMT has the highest retention for Hg2+ transport as the self-diffusion coefficient is the smallest among the three slit pores (MMT < pyrite < kerogen). The high adsorption and retention originate from the strong Hg2+-mineral interaction. These results suggest that mercury in coal is most likely associated with inorganic minerals instead of organic matter.

Authors: Jian Wu, Wenquan Xie, Jingqiang Tan, Lingfu Liu

Full Source: Journal of hazardous materials 2023 Aug 28;460:132429. doi: 10.1016/j.jhazmat.2023.132429.

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Authors: Jian Wu, Wenquan Xie, Jingqiang Tan, Lingfu Liu
Full Source: Journal of hazardous materials 2023 Aug 28;460:132429. doi: 10.1016/j.jhazmat.2023.132429.

ENVIRONMENTAL RESEARCH

Evidence for the anaerobic oxidation of methane coupled to nitrous oxide reduction in landfill cover soils: Promotor and inhibitor

2023-08-31
Anaerobic oxidation of methane coupled to nitrous oxide reduction (N2O-AOM) is an important microbial pathway for mitigating greenhouse gases. However, it remains largely unknown whether this process could occur in landfills, which are important anthropogenic sources of greenhouse gases emissions. Here, 13CH4 was supplied in microcosm incubations to track potential rates for the N2O-AOM process in landfill cover soils (LCS). The highest rates for the N2O-AOM process were observed in the bottom layers of LCS and it could be remarkably promoted by the addition of electron shuttles. In addition, 2-bromoethanesulfonic sodium inhibited the N2O-AOM process and reduced the expression of the mcrA gene, showing that ANME archaea/methanogens might be the methane oxidizer for the N2O-AOM process. Our results implied that the N2O-AOM process was an overlooked process for synchronous control of methane and nitrous oxide and may contribute to the future management of greenhouse gases emissions from landfills.
Authors: Sai Xu, Xinyi Zhang, Yuxiang Zhu
Full Source: The Science of the total environment 2023 Aug 31;166752. doi: 10.1016/j.scitotenv.2023.166752.

Anaerobic oxidation of methane coupled to nitrous oxide reduction (N2O-AOM) is an important microbial pathway for mitigating greenhouse gases.

Current progress on fluoride occurrence in the soil environment: Sources, transformation, regulations and remediation

2023-08-31
Fluorine is a halogen element widely distributed in nature, but due to excessive emissions from industrial manufacturing and agricultural production, etc., the soil is over-enriched with fluoride and the normal growth of plants is under stress, and it also poses a great threat to

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human health. In this review, we summarized the sources of fluoride in soil, and then analyzed the potential mechanisms of fluoride uptake in soil-plant systems. In addition, the main influences of soil ecosystems on plant fluoride uptake were discussed, soil management options to mitigate fluoride accumulation in plants were also summarized. The bioremediation techniques were found to be a developmental direction to improve fluoride pollution. Finally, we proposed other research directions, including fluoride uptake mechanisms in soil-plant systems at the molecular expression levels, development of visualization techniques for fluoride transport in plants, interactions mechanisms between soil microhabitats and plant metabolism affecting fluoride uptake, as well as combining abiotic additives, nanotechnology and biotechnology to remediate fluoride contamination problems.
Authors: Minghan Wang, Haoyang Wang, Ge Lei, Biao Yang, Teng Hu, Yingying Ye, Wei Li, Yaoyu Zhou, Xiao Yang, Huaqin Xu
Full Source: Chemosphere 2023 Aug 31;139901. doi: 10.1016/j.chemosphere.2023.139901.

A study on managing plastic waste to tackle the worldwide plastic contamination and environmental remediation

2023-08-31
Over the past 50 years, the emergence of plastic waste as one of the most urgent environmental problems in the world has given rise to several proposals to address the rising levels of contaminants associated with plastic debris. Worldwide plastic production has increased significantly over the last 70 years, reaching a record high of 359 million tonnes in 2020. China is currently the world's largest plastic producer, with a share of 17.5%. Of the total marine waste, microplastics account for 75%, while land-based pollution accounts for responsible for 80-90%, and ocean-based pollution 10-20% only in overall pollution problems. Even at small dosages (10 μg/mL), microplastics have been found to cause toxic effects on human and animal health. This review examines the sources of microplastic contamination, the prevalent reaches of microplastics, their impacts, and the remediation methods for microplastic contamination. This review explains the relationship between the community composition and the presence of microplastic particulate matter in aquatic ecosystems. The interaction between microplastics and emerging pollutants, including heavy metals, has been linked to enhanced toxicity. The review article provided a comprehensive overview of microplastic, including its fate, environmental toxicity, and possible remediation strategies. The results of our study are of great value as they illustrate a current perspective

Over the past 50 years, the emergence of plastic waste as one of the most urgent environmental problems in the world has given rise to several proposals to address the rising levels of contaminants associated with plastic debris.

and provide an in-depth analysis of the current status of microplastics in development, their test requirements, and remediation technologies suitable for various environments.
Authors: A K Priya, M Muruganandam, Muhammad Imran, Rana Gill, Minnam Reddy Vasudeva Reddy, Mohd Shkir, M A Sayed, T H AlAbdulaal, H Algarni, Mohd Arif, Niraj Kumar Jha, Satbir S Sehgal
Full Source: Chemosphere 2023 Aug 31;139979. doi: 10.1016/j.chemosphere.2023.139979.

PHARMACEUTICAL/TOXICOLOGY

Affinity selection mass spectrometry speeding drug discovery

2023-09-01
Affinity selection mass spectrometry (AS-MS) has gained momentum in drug discovery. This review summarizes how this technology has slowly risen as a new paradigm in hit identification and its potential synergy with DNA encoded library technology. It presents an overview of the recent results on challenging targets and perspectives on new areas of research, such as RNA targeting with small molecules. The versatility of the approach is illustrated and strategic drivers discussed in terms of the experience of a small-medium CRO and a big pharma organization.
Teaser: This review highlights the interest aroused by AS-MS as a screening technology, assessing the shared experience of a small-medium contract research organization (CRO) and a big pharma organization.
Authors: Renaud Prudent, Hugues Lemoine, Jarrod Walsh, Didier Roche
Full Source: Drug discovery today 2023 Sep 1;103760. doi: 10.1016/j.drudis.2023.103760.

Affinity selection mass spectrometry (AS-MS) has gained momentum in drug discovery.

Seasonal purification efficiency, greenhouse gas emissions and microbial community characteristics of a field-scale surface-flow constructed wetland treating agricultural runoff

2023-08-30
Controlling nonpoint source pollution (NPSP) is very important for protecting the water environment, and surface-flow constructed wetlands (SFCWs) have been widely established to mitigate NPSP loads. In this study, the pollutant removal efficiencies, greenhouse gas (GHG) emissions, and chemical and microbial community properties of the sediment in a large-scale SFCW established beside a plateau lake (Qilu Lake) in southwestern China to treat agricultural runoff were evaluated over a year. The SFCW performed best in terms of nitrogen removal in autumn (average efficiency of 63.5% at influent concentrations of 9.3-35.4 mg L-1) and demonstrated comparable efficiency in other seasons (23.7-40.0%). The removal rates of total phosphorus (TP) and chemical oxygen demand (COD) were limited (18.6% and 12.4% at influent concentrations of 1.1 and 45.5 mg L-1 on average, respectively). The SFCW was a hotspot of CH4 emissions, with an average flux of 31.6 mg m-2·h-1; moreover, CH4 emissions contributed the most to the global warming potential (GWP) of the SFCW. Higher CH4 and N2O fluxes were detected in winter and in the front-end section of the SFCW with high pollutant concentrations, and plant presence increased CH4 emissions. Significant positive relationships between nutrient and heavy metal contents in the SFCW sediment were detected. The microbial community compositions were similar in autumn and winter, with Thiobacillus, Lysobacter, Acinetobacter and Pseudomonas dominating, and this distribution pattern was clearly distinct from those in spring and summer, with high proportions of Spirochaeta_2 and Denitratisoma. The microbial co-occurrence network in spring was more complex with stronger positive correlations than those in winter and autumn, while it was more stable in autumn with more keystone taxa. Optimization of the construction, operation and management of SFCWs treating NPSP in lake watersheds is necessary to promote their environmental benefits.
Authors: Xiaowan Chen, Shengjiong Deng, Bohua Ji, Suqing Wu, Junjun Chang
Full Source: Journal of environmental management 2023 Aug 30;345:118871. doi: 10.1016/j.jenvman.2023.118871.

OCCUPATIONAL

Fine particulate matter and its constituent on ovarian reserve: Identifying susceptible windows of exposure

2023-08-31
Background: Little is known about the associations of exposure to fine particulate matter (PM2.5) and its constituents with ovarian reserve, and the potential susceptible window of exposure remains unclear.
Methods: We performed a retrospective cohort study of 5189 women who attended a fertility center in Hubei, China, during 2019-2022, and estimated concentrations of PM2.5 and its major constituents during the development of follicles (4th-6th month [W1], 0-4th month [W2], 0-6th month [W3]) and 1-year before measurement (W4) based on Tracking Air

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Pollution in China database. We used multivariable linear regression and logistic regression models to examine the associations of PM2.5 and its constituent exposures with anti-Müllerian hormone (AMH), the preferred indicator of ovarian reserve.
Results: We observed significantly decreased AMH levels associated with increasing PM2.5 concentrations, with the percent changes (95 % confidence intervals [CIs]) of 1.99 % (0.24 %-3.71 %) during W1 and 3.99 % (0.74 %-7.15 %) during W4 for per 10 μg/m3 increases in PM2.5.When PM2.5 exposure levels were equal to 50th percentile (32.6-42.3 μg/m3) or more, monotonically decreased AMH levels and increased risks of low AMH were seen with increasing PM2.5 concentrations during W1 and W4 ($P < 0.05$). Black carbon (BC), ammonium (NH4+), nitrate (NO3-), and organic matter (OM) during W1, and NH4+, NO3-, as well as sulfate (SO42-) during W4 were significantly associated with decreased AMH. Moreover, PM2.5 and SO42- exposures during W4 were positively associated with low AMH. Additionally, the associations were stronger among women aged <35 years, lived in urban regions, or measured AMH in cold-season (P for interaction <0.05).
Conclusion: PM2.5 and specific chemical components (particularly NH4+, NO3-, and SO42-) exposure during the secondary to antral follicle stage and 1-year before measurement were associated with diminished ovarian reserve (DOR), indicating the adverse impact of PM2.5 and its constituent exposures on female reproductive potential.
Authors: Shuangyan Liu, Jing Zhao, Xin Ye, Mingjian Fu, Kexin Zhang, Han Wang, Yujie Zou, Kuai Yu
Full Source: The Science of the total environment 2023 Aug 31;166744. doi: 10.1016/j.scitotenv.2023.166744.

Metal Exposure during Early Pregnancy and Risk of Gestational Diabetes Mellitus: Mixture Effect and Mediation by Phospholipid Fatty Acids

2023-09-01

Despite existing studies exploring the association between metal exposure and gestational diabetes mellitus (GDM), most of them have focused on a single metal or a small mixture of metals.

Despite existing studies exploring the association between metal exposure and gestational diabetes mellitus (GDM), most of them have focused on a single metal or a small mixture of metals. Our prospective work investigated the joint and independent effects of early gestational exposure to 17 essential and nonessential metals on the GDM risk and potential mediation by plasma phospholipid fatty acids (PLFAs) based on a nested case-control study established with 335 GDM cases and 670 randomly matched healthy controls. The Bayesian kernel machine regression (BKMR) and quantile g-computation analyses demonstrated a joint effect from metal co-exposure on GDM risk. BKMR with hierarchical variable selection indicated that the group of essential metals was more strongly associated with GDM than the group of nonessential metals with group posterior inclusion probabilities (PIPs) of 0.979 and 0.672, respectively. Cu (0.988) and Ga (0.570) had the largest conditional PIPs within each group. We also observed significant mediation effects of selected unsaturated PLFAs on Cu-GDM and Ga-GDM associations. KEGG enrichment analysis further revealed significant enrichment in the biosynthesis of unsaturated PLFAs. C18:1 n-7 exhibited the largest proportion of mediation in both associations (23.8 and 22.9%). Collectively, our work demonstrated the joint effect of early gestational metal exposure on GDM risk and identified Cu and Ga as the key species to the joint effect. The findings lay a solid ground for further validation through multicenter investigations and mechanism exploration via laboratory studies.
Authors: Fengjiang Sun, Xiong-Fei Pan, Yongxia Hu, Jinxin Xie, Wenxuan Cui, Yi-Xiang Ye, Yi Wang, Xue Yang, Ping Wu, Jiaying Yuan, Yan Yang, An Pan, Da Chen
Full Source: Environmental science & technology 2023 Sep 1. doi: 10.1021/acs.est.3c04065.