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CHEMICAL EFFECTS

Irrigation with Water Contaminated by Sugarcane Pesticides and Vinasse Can Inhibit Seed Germination and Crops Initial Growth

2022-02-09

Sugarcane crops are dependent on chemicals for maintaining plantations. Therefore, environmental consequences concern adjacent areas that can be affected by contaminants in common use, including pesticides and vinasse (i.e., a by-product from the ethanol industry). This study aimed to evaluate phytotoxicity through two plant bioassays with water from mesocosms contaminated with the herbicide 2,4-D (447.0 µg L-1), the insecticide fipronil (63.5 µg L-1), and sugarcane vinasse (1.3%). First, the germination test (4 d) with Eruca sativa L. assessed water samples collected three times after the contamination (2 h, 14 d, and 30 d), considering germination, shoot, and root growth. The results from this bioassay indicated higher phytotoxicity for 2,4-D as it fully inhibited the shoot and root growth even in low concentrations (0.2 µg L-1). However, no significant effect was reported for fipronil and vinasse. Also, the 2,4-D effects drastically decreased due to an expressive concentration reduction (99.4% after 30 d in mixture with vinasse). Second, the irrigation test with Phaseolus vulgaris L. and Zea mays L. considered shoot and root growth and biomass under 21 days after plants emergence. The herbicide 2,4-D inhibited the initial growth of tested species, especially the roots (up to 45% inhibition). Furthermore, sugarcane vinasse caused harmful effects on plant growth (up to 31% inhibition). Therefore, our data showed that these contaminants could inhibit plant germination and initial growth under our tested conditions. These evaluations can endorse risk assessments and water management in sugarcane crops surrounding areas.

Authors: Allan Pretti Ogura, Raquel Aparecida Moreira, Laís Conceição Menezes da Silva, Giovana Spinelli Negro, Juliane Silberschmidt Freitas, Thandy Junio da Silva Pinto, Laís Fernanda de Palma Lopes, Maria Paula Cardoso Yoshii, Bianca Veloso Goulart, Cassiana Carolina Montagner, Evaldo Luiz Gaeta Espíndola

Full Source: Archives of environmental contamination and toxicology 2022 Feb 9. doi: 10.1007/s00244-022-00914-x.

Sugarcane crops are dependent on chemicals for maintaining plantations.

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The botanical biofiltration of volatile organic compounds and particulate matter derived from cigarette smoke

2022-02-09

Despite the growing use of control measures, environmental tobacco smoke (ETS) remains a significant pollutant source in indoor air in many areas of the world. Current control methods for reducing ETS exposure are inadequate to protect public health in environments where cigarettes are smoked. An alternative solution is botanical biofiltration which has previously been shown to lower concentrations of volatile organic compounds (VOCs) and particulate matter (PM) from a range of polluted air streams. This study is the first to assess the potential of a botanical biofilter with the species Spathiphyllum wallisii (Peace Lily) for the removal of cigarette-derived VOCs and all size fractions of PM. Single pass removal efficiencies of 43.26% for total VOCs and 34.37% for total suspended particles were achieved. The botanical biofilter reduced the concentrations of a range of harmful ETS chemicals including nicotine, limonene, and toluene. Evaluation of the re-emission of ETS constituents filtered by the botanical biofilter revealed no particle resuspension or off gassing. The results demonstrate the potential of botanical biofilters to reduce public ETS exposure, although further research is needed to improve upon and ensure the efficiency of these systems for practical applications.

Authors: Angela L Morgan, Fraser R Torpy, Peter J Irga, Robert Fleck, Raissa L Gill, Thomas Pettit

Full Source: Chemosphere 2022 Feb 9;133942. doi: 10.1016/j.chemosphere.2022.133942.

Despite the growing use of control measures, environmental tobacco smoke (ETS) remains a significant pollutant source in indoor air in many areas of the world.

Survey on endocrine-disrupting chemicals in seafood: Occurrence and distribution

2022-02-09

Currently, the presence of endocrine disrupting chemicals (EDCs) in the marine environment pose a potential risk to both wildlife and human health. The occurrence of EDCs in seafood depends of several factors such as source and amounts of EDCs that reach the aquatic environment, physicochemical features of EDCs, and its accumulation in trophic chain. This review highlights the occurrence and distribution of EDCs along the seafood in the last 6 years. The following EDCs were included in this review: brominated flame retardants (PBDEs, PBBs, HBCDDs, TBBPA, and novel flame retardants); pharmaceuticals (paracetamol, ibuprofen, diclofenac, carbamazepine), bisphenols, hormones, personal care products (Musk and UV Filters), and pesticides (organochlorides, organophosphates,

and pyrethroids). Some of them were found above the threshold that may cause negative effects on human, animal, and environmental health. More control in some countries, as well as new legislation and inspection over the purchase, sale, use, and production of these compounds, are urgently needed. This review provides data to support risk assessment and raises critical gaps to stimulate and improve future research.
Authors: Sara C Cunha, Dhoone Menezes-Sousa, Flávia V Mello, Joyce A T Miranda, Fabiola H S Fogaca, Mariana B Alonso, João Paulo M Torres, José O Fernandes
Full Source: Environmental research 2022 Feb 9;112886. doi: 10.1016/j.envres.2022.112886.

ENVIRONMENTAL RESEARCH

PBDEs in the marine environment: Sources, pathways and the role of microplastics

2022-02-09
Brominated flame retardants (BFRs) are an important group of additives in plastics that increase resistance to ignition and slow down the rate of burning. Because of concerns about the environment and human health, however, some of the most widely employed BFRs, including hexabromocyclododecane (HBCD) and commercial mixtures of penta-, octa- and deca- (poly)bromodiphenyl ethers (PBDEs), have been restricted or phased out. In this review, the oceanic sources and pathways of PBDEs, the most widely used BFRs, are evaluated and quantified, with particular focus on emissions due to migration from plastics into the atmosphere versus emissions associated with the input of retarded or contaminated plastics themselves. Calculations based on available measurements of PBDEs in the environment suggest that 3.5 and 135 tonnes of PBDEs are annually deposited in the ocean when scavenged by aerosols and through air-water gas exchange, respectively, with rivers contributing a further 40 tonnes. Calculations based on PBDE migration from plastic products in use or awaiting or undergoing disposal yield similar net inputs to the ocean but indicate a relatively rapid decline over the next two decades in association with the reduction in the production and recycling of these chemicals. Estimates associated with the input of PBDEs when "bound" to marine plastics and microplastics range from about 360 to 950 tonnes per year based on the annual production of plastics and PBDEs over the past decade, and from about 20 to 50 tonnes per annum based on the abundance and distribution of PBDEs in marine plastic litter. Because of the persistence and pervasiveness of plastics in the ocean and diffusion coefficients for PBDEs on the order of 10-20 to 10-27 m2 s-1, microplastics are likely to act as a long-term source of these chemicals though gradual migration. Locally, however, and more important from an ecotoxicological perspective, PBDE migration may be significantly enhanced when physically and chemically weathered microplastics are exposed to the oily digestive fluids conditions of fish and seabirds.
Authors: Andrew Turner
Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Feb 9;118943. doi: 10.1016/j.envpol.2022.118943.

Brominated flame retardants (BFRs) are an important group of additives in plastics that increase resistance to ignition and slow down the rate of burning.

Combining ecological, eco-cultural, and environmental justice parameters to create Eco-EJ indicators to monitor cultural and environmental justices for diverse communities around contaminated sites

2022-02-12
Assessing environmental quality often requires selection of indicators that can be employed over large spatial scales and over long-time periods to assess the health and well-being of species, natural communities, and ecosystems, and to detect changes warranting intervention. Typically, the ecologic environment and the human environment are evaluated separately and selection of indicators and monitoring approaches are not integrated even though ecological indicators may also provide information on risk to human consumers from contaminants (e.g., eco-cultural indicators) or because of disease levels. This paper is a call for ecologists and managers to consider diverse cultural and environmental injustice disparities and health issues when selecting indicators for environmental assessment and monitoring. There is an opportunity for managers and community members to work together to preserve ecological and cultural resources and heritages. We propose a paradigm that selects indicators and monitoring approaches that lend themselves to the integration of human-diversity and uniqueness in the same manner that the selection of ecological indicators and monitoring approaches consider biological species diversity and uniqueness. The proposed paradigm builds on ecological risk assessment techniques, developing analogous endpoints for neighboring communities. For example, identification and protection of human communities, particularly culturally diverse and environmental justice communities, identification of contaminant corridors (e.g., through water or green corridors) into communities, and eco-monitoring of vulnerable communities are not routine at contaminated sites. Green corridors refers to a width of wild habitat (forest, grasslands) that connects other similar habitat paths

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(usually a corridor runs through an urban or suburban habitat). We coin the term Eco-EJ indicators for these endpoints, including examination of (1) unique cultural relationships to resources; (2) connectedness of on-site and off-site resources and habitats; (3) health of threatened, rare, and unique cultures and communities; and (4) linkages between ecological, eco-cultural, and public health for monitoring and assessment. We also propose that assessment and monitoring include these Eco-EJ indicators, especially for communities near facilities that have extensive chemical or radiological contamination. Developing these indicators to assess risk to culturally diverse and environmental justice communities would be an equivalent goal to reducing risk for significant ecological resources (e.g., endangered species, species of special concern). These Eco-EJ indicators are complementary to the usual human health-risk assessments, would include surveys of neighboring vulnerable communities, and require time and re-organization of current data and additional data collection at site boundaries and in adjacent communities, as well as rethinking the human component of indicators. This approach lends itself to addressing some diverse cultural and environmental justice issues with current indicator selection and biomonitoring, and helps identify specific hotspots of unique ecosystem risk and environmental justice community risk. We briefly discuss ecological and eco-cultural monitoring already on-going at three Department of Energy sites to illustrate how the addition of these indicators might work and add value to environmental management and to their relationships with surrounding communities. We recommend that managers of contaminated sites convene people from culturally diverse communities, environmental justice communities, local and federal government, Tribes, resource trustees, managers, and other stakeholders to develop appropriate site-specific indicators to address environmental inequities around contaminated facilities.

Authors: Joanna Burger, Michael Gochfeld, David S Kosson, Kevin G Brown, Jennifer Salisbury, Michael Greenberg, Christian Jeitner

Full Source: Environmental monitoring and assessment 2022 Feb 12;194(3):177. doi: 10.1007/s10661-021-09535-8.

Palladium nanoparticles as emerging pollutants from motor vehicles: An in-depth review on distribution, uptake and toxicological effects in occupational and living environment

2022-02-09

Palladium nanoparticles (PdNPs) play an integral role in motor vehicles as the primary vehicle exhaust catalyst (VEC) for tackling environmental pollution. Automobiles equipped with Pd-based catalytic converters

Palladium nanoparticles (PdNPs) play an integral role in motor vehicles as the primary vehicle exhaust catalyst (VEC) for tackling environmental pollution.

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were introduced in the mid-1970s and ever since the demand for Pd has steadily increased due to stringent emission standards imposed in many developed and developing countries. However, at the same time, the increasing usage of Pd in VECs has led to the release of nano-sized Pd particles in the environment, thus, emerging as a new source of environmental pollution. The present reports in the literature have shown gradual increasing levels of Pd particles in different urban environmental compartments and internalization of Pd particles in living organisms such as plants, aquatic species and animals. Occupational workers and the general population living in urban areas and near major highways are the most vulnerable as they may be chronically exposed to PdNPs. Risk assessment studies have shown acute and chronic toxicity exerted by PdNPs in both in-vitro and in-vivo models but the underlying mechanism of PdNPs toxicity is still not fully understood. The review intends to provide readers with an in-depth account on the demand and supply of Pd, global distribution of PdNPs in various environmental matrices, their migration and uptake by living species and lastly, their health risks, so as to serve as a useful reference to facilitate further research and development for safe and sustainable technology.

Authors: Aarzoo, Nidhi, M Samim

Full Source: The Science of the total environment 2022 Feb 9;153787. doi: 10.1016/j.scitotenv.2022.153787.

OCCUPATIONAL

How serious are we about protecting workers health? The case of diesel engine exhaust

2022-02-11

Objectives: Regulators frequently deviate from health-based recommendations when setting occupational exposure limits, but the impact on workers' health is rarely made explicit. We present a quantitative evaluation of the expected impact of recently proposed regulatory limits for occupational diesel engine exhaust (DEE) exposure on the excess burden of lung cancer (LC) in Europe.

Methods: We used a lifetable approach, basing our analyses on the DEE exposure distribution in a large general population study, as well as the 5% prevalence used in earlier DEE burden calculations. We evaluated the effects of intervention on DEE exposures according to a health based limit (1 ug/m3 of elemental carbon (EC)) and both Dutch (10 ug/m3) and European (50 ug/m3) proposed regulatory limit values. Results were

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expressed as individual excess lifetime risks (ELR), total excess number of cases and population attributable fraction of LC.
Results: The ELR for the EU working population was estimated to be 341/10 000 workers based on our empirical exposure distribution and 46/10 000 workers based on the 5% prevalence. Implementing the proposed health based DEE limit would reduce the ELR by approximately 93%, while the proposed regulatory limits of 10 and 50 ug/m3 EC would reduce the ELR by 51% and 21%, respectively.
Discussion: Although the proposed regulatory limits are expected to reduce the number of DEE related LC deaths, the residual ELRs are still significantly higher than the targets used for deriving health-based risk limits. The number of additional cases of LC in Europe due to DEE exposure, therefore, remains significant.
Authors: Roel Vermeulen, Lützen Portengen
Full Source: Occupational and environmental medicine 2022 Feb 11;oemed-2021-107752. doi: 10.1136/oemed-2021-107752.

The formation of SCEs as an effect of occupational exposure to formaldehyde

2022-02-12
Formaldehyde (FA) is a ubiquitous toxic chemical employed worldwide due to its disinfectant and preservative properties. Despite being classified as a human carcinogen, FA is still employed as formalin in pathology wards as standard fixative. We evaluated its relationship with the formation of sister-chromatid exchanges (SCEs) in cultured peripheral blood lymphocytes on 57 pathologists and 48 controls and the risk/protective role played by several genetic polymorphisms. All subjects were assessed for SCEs and genotyped for the most common cancer-associated gene polymorphisms: CYP1A1 exon 7 (A > G), CYP1A1*2A (T > C), CYP2C19*2 (G > A), GSTT1 (presence/absence), GSTM1 (presence/absence), GSTP1 (A > G), XRCC1 (G399A), XRCC1 (C194T), XRCC1 (A280G), XPC exon 15 (A939C), XPC exon 9 (C499T), TNFα - 308 G > A), IL10 - 1082 (G > A), and IL6 - 174 (G > C). Air-FA concentration was assessed through passive personal samplers. Pathologists, exposed to 55.2 µg/m3 of air-FA, showed a significantly higher SCEs frequency than controls, exposed, respectively, to 18.4 µg/m3. Air-FA was directly correlated with SCEs frequency and inversely with the replication index (RI). Regression models showed FA exposure as a significant predictor in developing SCEs, while did not highlight any role of the selected polymorphisms. Our study confirms the role of low air-FA levels as genotoxicity inductor, highlighting the

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importance to define exposure limits that could be safer for exposed workers.
Authors: Federica Ghelli, Enrico Cocchi, Valeria Bellisario, Martina Buglisi, Giulia Squillacioti, Alfredo Santovito, Roberto Bono
Full Source: Archives of toxicology 2022 Feb 12. doi: 10.1007/s00204-022-03238-w.

PHARAMACEUTICAL/TOXICOLOGY

Health Impact Associated with Pesticides Use among Vegetables Farmers in Nepal: A Secondary Analysis

2021-12-14
Background: The trend of pesticide use in market-oriented vegetables is steadily increasing in Nepal. Farmers in developing countries use hazardous pesticides taking few or no safety measures. This study is aimed to assess health effects of pesticide exposure among vegetable farmers in Nepal.
Methods: Analysis of secondary data obtained from Nepal Health Research Council was performed. A cross-sectional study on "Health Effects of pesticide among vegetables farmers and adaptation level of integrated pest management program in Nepal 2013" was conducted by Nepal Health Research Council among 660 farmers in four selected districts of Nepal in 2013/2014. The secondary data obtained were statistically analyzed by student's't' test, one-way analysis of variance and Pearson correlation statistics. For all tests used, 5% level of significance was considered.
Results: Fungicide and insecticides were commonly used pesticides by vegetable farmers in Nepal. Around 51% of the pesticides used were moderately hazardous (II) while, 28% were highly hazardous (Ib). Nearly 12% participants did not use any type of Personal Protective Equipments while spraying pesticides in the field. The prevalence of self-reported poisoning and low Acetylcholinesterase levels among farmers was 51% and 10.3% respectively. Acetylcholinesterase level was found to differ significantly in male as compared to female ($P < .05$).
Conclusions: Almost half of the research participants had self-reported poisoning. Low prevalence of depressed Acetylcholinesterase levels was associated with high use of fungicide compared to organophosphate.
Authors: Saroj Bhattrai, Neelam Dhakal, Anil Poudyal, Meghnath Dhimal
Full Source: Journal of Nepal Health Research Council 2021 Dec 14;19(3):498-503. doi: 10.33314/jnhrc.v19i3.3358.

Background: The trend of pesticide use in market-oriented vegetables is steadily increasing in Nepal.

Characterization of a small molecule inhibitor of disulfide reductases that induces oxidative stress and lethality in lung cancer cells

2022-02-08

Phenotype-based screening can identify small molecules that elicit a desired cellular response, but additional approaches are required to characterize their targets and mechanisms of action. Here, we show that a compound termed LCS3, which selectively impairs the growth of human lung adenocarcinoma (LUAD) cells, induces oxidative stress. To identify the target that mediates this effect, we use thermal proteome profiling (TPP) and uncover the disulfide reductases GSR and TXNRD1 as targets. We confirm through enzymatic assays that LCS3 inhibits disulfide reductase activity through a reversible, uncompetitive mechanism. Further, we demonstrate that LCS3-sensitive LUAD cells are sensitive to the synergistic inhibition of glutathione and thioredoxin pathways. Lastly, a genome-wide CRISPR knockout screen identifies NQO1 loss as a mechanism of LCS3 resistance. This work highlights the ability of TPP to uncover targets of small molecules identified by high-throughput screens and demonstrates the potential therapeutic utility of inhibiting disulfide reductases in LUAD.

Authors: Fraser D Johnson, John Ferrarone, Alvin Liu, Christina Brandstädter, Ravi Munuganti, Dylan A Farnsworth, Daniel Lu, Jennifer Luu, Tianna Sihota, Sophie Jansen, Amy Nagelberg, Rocky Shi, Giovanni C Forcina, Xu Zhang, Grace S W Cheng, Sandra E Spencer Miko, Georgia de Rappard-Yuswack, Poul H Sorensen, Scott J Dixon, Udayan Guha, Katja Becker, Hakim Djaballah, Romel Somwar, Harold Varmus, Gregg B Morin, William W Lockwood

Full Source: Cell reports 2022 Feb 8;38(6):110343. doi: 10.1016/j.celrep.2022.110343.

Phenotype-based screening can identify small molecules that elicit a desired cellular response, but additional approaches are required to characterize their targets and mechanisms of action.