CHEMWATCH

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CHEMICAL EFFECTS

Microplastics in ecosystems: Critical review of occurrence, distribution, toxicity, fate, transport, and advances in experimental and computational studies in surface and subsurface water

2024-09-21

Microplastics (MPs), particles under 5 mm, pervade water, soil, sediment, and air due to increased plastic production and improper disposal, posing global environmental and health risks. Examining their distribution, quantities, fate, and transport is crucial for effective management. Several studies have explored MPs' sources, distribution, transport, and biological impacts, primarily focusing on the marine environment. However, there is a need for a comprehensive review of all environmental systems together for enhanced pollution control. This review critically examines the occurrence, distribution, fate, and transport of MPs in the following environments: freshwater, marine, and terrestrial ecosystems. The concentration of MPs is highly variable in the environment, ranging from negligible to significant amounts (0.003-519.223 items/liter in water and 0-18,000 items/kg dry weight sediment, respectively). Predominantly, these MPs manifest as fibers and fragments, with primary polymer types including polypropylene, polystyrene, polyethylene, and polyethylene terephthalate. A complex interplay of natural and anthropogenic actions, including wastewater treatment plant discharges, precipitation, stormwater runoff, inadequate plastic waste management, and biosolid applications, influences MPs' presence and distribution. Our critical synthesis of existing literature underscores the significance of factors such as wind, water flow rates, settling velocities, wave characteristics, plastic morphology, density, and size in determining MPs' transport dynamics in surface and subsurface waters. Furthermore, this review identifies research gaps, both in experimental and simulation, and outlines pivotal avenues for future exploration in the realm of MPs.

Authors: Mithu Chanda, Jejal Reddy Bathi, Eakalak Khan, Deeksha Katyal, Michael Danquah

Full Source: Journal of environmental management 2024 Sep 21:370:122492. doi: 10.1016/j.jenvman.2024.122492.

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A review of liquid crystal monomers (LCMs) as emerging contaminants: Environmental occurrences, emissions, exposure routes and toxicity

2024-09-19

The widespread occurrence of liquid crystal monomers (LCMs) in the environment has raised concerns about their persistence, bioaccumulation, and toxicity (PBT). Here we review the lifecycle of environmental LCMs, focusing on their occurrences, emission sources, human exposure routes, and toxicity. Industrial emissions from Liquid Crystal Display (LCD) manufacturing and e-waste recycling are the primary point sources of LCMs. In addition, emissions from LCD products, air conditioning units, wastewater treatment plants, and landfills contribute to environmental occurrence of LCMs as secondary sources. Dietary routes were identified as the primary exposure pathways to humans. E-waste dismantling workers and infants/children are vulnerable populations to LCMs exposure. Exposure to LCMs has been shown to potentially induce oxidative stress, metabolic disorders, and endocrine disruption. Accumulation of LCMs in the brain and liver tissues of exposed animals highlights the need for toxicokinetic studies.

Authors: Yulin Wang, Qianqian Jin, Huiju Lin, Xiaotong Xu, Kenneth M Y Leung, Kurunthachalam Kannan, Yuhe He

Full Source: Journal of hazardous materials 2024 Sep 19:480:135894. doi: 10.1016/j.jhazmat.2024.135894.

The widespread occurrence of liquid crystal monomers (LCMs) in the environment has raised concerns about their persistence, bioaccumulation, and toxicity (PBT).

Investigation of the biological activity and toxicity of bioactive silver nanoparticles synthesized via Vitex agnus-castus seed extract on honey bees

2024-09-21

In this study, silver nanoparticles (AgNPs) coated with bioactive molecules were synthesized via Vitex agnus-castus L. (VAC) seed extract (VAC/AgNPs). The synthesized VAC/AgNPs were characterized by surface plasmon resonance (SPR) ultraviolet-visible region spectroscopy (UV-Vis). The hydrodynamic size and surface charge analysis of the particles were measured with a Zeta sizer. The results of UV-Vis and Zeta analysis revealed that AgNPs were synthesized, the size distribution was nanoscale, and the solution was stable. The effects of the synthesized VAC/AgNPs and aqueous extract of VAC seeds on honeybees were investigated by means of lifespan test and histopathological analysis. It was determined that both VAC seed extract and VAC/AgNPs were non-toxic to honeybees at certain doses, positively affected their life span and contributed to

their longevity in the life span test. Furthermore, no adverse effects were detected in terms of intestinal health in histopathological examinations. Therefore, VAC/AgNPs are considered to be a promising bioactive agent for honeybees.
Authors: Seda Ekici, Ogun Bozkaya, Sedat Sevin, Babur Erdem, Okan Can Arslan, Ozge Özgenç Cinar, Esra Bozkaya, Husamettin Ekici
Full Source: Veterinary research communications 2024 Sep 21. doi: 10.1007/s11259-024-10550-6.

ENVIRONMENTAL RESEARCH

Environmental toxicology of microplastic particles on fish: A review

2024-09-19
The increase in plastic debris and its environmental impact has been a major concern for scientists. Physical destruction, chemical reactions, and microbial activity can degrade plastic waste into particles smaller than 5 mm, known as microplastics (MPs). MPs may eventually enter aquatic ecosystems through surface runoff. The accumulation of MPs in aquatic environments poses a potential threat to finfish, shellfish, and the ecological balance. This study investigated the effect of MP exposure on freshwater and marine fish. MPs could cause significant harm to fish, including physical damage, death, inflammation, oxidative stress, disruption of cell signalling and cellular biochemical processes, immune system suppression, genetic damage, and reduction in fish growth and reproduction rates. The activation of the detoxification system of fish exposed to MPs may be associated with the toxicity of MPs and chemical additives to plastic polymers. Furthermore, MPs can enhance the bioavailability of other xenobiotics, allowing these harmful substances to more easily enter and accumulate in fish. Accumulation of MPs and associated chemicals in fish can have adverse effects on the fish and humans who consume them, with these toxic substances magnifying as they move up the food chain. Changes in migration and reproduction patterns and disruptions in predator-prey relationships in fish exposed to MPs can significantly affect ecological dynamics. These interconnected changes can lead to cascading effects throughout aquatic ecosystems. Thus, implementing solutions like reducing plastic production, enhancing recycling efforts, using biodegradable materials, and improving waste

The increase in plastic debris and its environmental impact has been a major concern for scientists.

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management is essential to minimize plastic waste and its environmental impact.
Authors: Mahdi Banaee, Cristiana Roberta Multisanti, Federica Impellitteri, Giuseppe Piccione, Caterina Faggio
Full Source: Comparative biochemistry and physiology. Toxicology & pharmacology : CBP 2024 Sep 19:110042. doi: 10.1016/j.cbpc.2024.110042.

Impact of seasonal changes and environmental conditions on suspended and inhalable microplastics in urban air

2024-09-19
Microplastics (MPs) are ubiquitous environmental pollutants extensively detected in atmospheric environments. Airborne MPs have raised concerns due to their transport and potential health risks of inhalation exposure. However, the factors influencing airborne MPs, particularly their concentrations and shapes suspended in urban air, remain unclear. We investigated MPs in total suspension particles with one-year measurements in Taipei City and identified their features using Nile Red staining combined with fluorescence microscopy and micro-Fourier transform infrared (μFTIR) spectroscopy. This study quantified the mean number concentration of total MPs as approximately 6.0 #/m^3. We observed that MP abundance varied seasonally, with higher levels in the warm season than in the cold. A similar trend was noted for polymer types. Fragment-like MPs were the predominant shape, mainly found in polystyrene (PS), polyethylene (PE), and polypropylene (PP), while fibrous MPs, detected mostly as polyethylene terephthalate (PET) and polyamide (PA), were primarily observed at sizes greater than 300 μm. Both fiber and fragment-like MPs were positively associated with particle mass concentration, temperature, ultraviolet (UV) index, and wind speed, but negatively correlated with relative humidity and rainfall. Fibrous MPs were more affected by environmental factors than fragment-like MPs. Meteorological changes significantly influenced suspended MPs more than human activity within the city.
Authors: Yu-Cheng Chen, Chun-Hsuan Wei, Wei-Ting Hsu, Wahyu Diah Proborini, Ta-Chih Hsiao, Zhen-Shu Liu, Hsiu-Chuan Chou, Jhy-Charm Soo, Guo-Chung Dong, Jen-Kun Chen
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Sep 19:124994. doi: 10.1016/j.envpol.2024.124994.

Microplastics (MPs) are ubiquitous environmental pollutants extensively detected in atmospheric environments.

PHARMACEUTICAL/TOXICOLOGY

Oncology Dose Selection in Subsequent Indications: What Can We Learn From FDA-approved Oncology Drugs?

2024-09-19

Purpose: The modern oncology drug development landscape has shifted away from traditional cytotoxic chemotherapies. Following their initial approvals, many oncology drugs have been approved in subsequent indications either as monotherapy or in combination to benefit a broader patient population. To date, dose selection strategies for subsequent indications have not been systematically reviewed. This review examines how approved dosing regimens were selected in subsequent indications for FDA-approved oncology drugs.

Methods: The Drugs@FDA database was used to identify FDA-approved new molecular entities (NMEs) between 2010 and 2023. NMEs with more than 1 approved indication were included in the analysis. In total, the dosing regimens for 67 novel oncology drugs that obtained FDA approvals for multiple indications were evaluated.

Findings: Overall, in subsequent indications, 72% of NMEs used the same or clinically equivalent alternative dosing regimens to those approved in the initial indications. Amongst the 28% of NMEs that used different dosing regimens, safety/tolerability was the leading cause of a dosing regimen changes in both monotherapy and combination therapy settings. Other factors leading to changes in dosing regimens include differences in tumor biology, disease burden, pharmacokinetics, and overall benefit-risk profiles obtained from dose-finding studies.

Implications: Our analysis highlighted the importance of selecting a safe, tolerable, and yet efficacious dosing regimen for the initial indication as a suboptimal initially approved regimen could lead to dosing regimen changes in later indications. Preclinical and clinical data could be leveraged to understand the pharmacology, pharmacokinetic, and pharmacodynamic differences between indications and thus support dose selection in subsequent indications.

Authors: Huy X Ngo, Elise Oh, Chunze Li, Jiajie Yu

Full Source: Clinical therapeutics 2024 Sep 19:S0149-2918(24)00259-5. doi: 10.1016/j.clinthera.2024.08.020.

Purpose: The modern oncology drug development landscape has shifted away from traditional cytotoxic chemotherapies.

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A Phase I Open-Label Study of Cediranib Plus Etoposide and Cisplatin as First-Line Therapy for Patients With Extensive-Stage Small-Cell Lung Cancer or Metastatic Neuroendocrine Non-Small-Cell Lung Cancer

2024-09-01

Introduction: Small cell lung cancer (SCLC) is known to express high levels of the proangiogenic factor vascular endothelial growth factor (VEGF). We assessed the safety and tolerability of cediranib, an oral inhibitor of VEGF receptor tyrosine kinases, in combination with etoposide and cisplatin as first-line therapy for extensive-stage (ES) SCLC or metastatic lung neuroendocrine cancer (NEC).

Methods: Patients received up to six 21-day cycles of etoposide (100 mg/m2, days 1-3) and cisplatin (80 mg/m2, day 1) with once-daily cediranib until disease progression or unacceptable toxicity. Cediranib dosing started at 30 mg with de-escalation cohorts planned based on cycle 1 dose-limiting toxicities (DLTs). An expansion cohort of 12 patients was enrolled at the recommended phase II dose.

Results: Twenty-two patients (18 with ES SCLC, 4 with NEC) received treatment. Only 4 patients were enrolled at the 30 mg cediranib dose before other studies established 20 mg/day as the recommended dose with chemotherapy. Among the 18 patients enrolled at the 20-mg dose, common adverse events included nausea/vomiting, neutropenia, and diarrhea; 8 patients (44%) had grade 1 or 2 hypertension, and 2 (11%) had grade 3 hemoptysis. For all 18 patients, the objective response rate and median progression-free survival duration were 67% and 7.9 months. Plasma levels of VEGF were significantly higher, and those of soluble VEGFR2 were significantly lower, on day 22 than at baseline but were not correlated with tumor shrinkage.

Conclusions: Cediranib (20 mg) plus etoposide and cisplatin is well tolerated and has promising clinical activity.

Authors: Kyle F Concannon, Bonnie S Glisson, Robert C Doebele, Chao Huang, Marcelo Marotti, D Ross Camidge, John V Heymach

Full Source: Clinical lung cancer 2024 Sep 1:S1525-7304(24)00193-1. doi: 10.1016/j.cllc.2024.08.015.

Introduction: Small cell lung cancer (SCLC) is known to express high levels of the proangiogenic factor vascular endothelial growth factor (VEGF).

OCCUPATIONAL

Radiation exposure during simulated equine head and limb fan beam standing computed tomography appears safe for personnel using lead shielding

2024-09-20

Objective: To evaluate the radiation dose to personnel locations during simulated head and limb scans with a novel equine standing CT (sCT) system.

Methods: Measurements were made with the use of a helical fan beam sCT system (Equina; Asto CT Inc). Scatter radiation was measured in different positions in the sCT room to mimic the location of the control operator, horse handler, and lead rope handler during simulated equine head and limb imaging. Operator/handler dose was quantified at each location using entrance air kerma measured with a spherical ionization chamber and electrometer.

Results: Radiation dose to the control operator, horse handler, and lead rope handler locations wearing a lead apron during simulated head imaging was 13.3, 3.5, and 6.8 µGy, respectively. Radiation dose to the control operator location wearing a lead apron was 1.3 µGy, and dose to the lead rope handler location wearing a lead apron was 0.2 and 5.4 µGy during simulated pelvic limb and thoracic limb imaging, respectively.

Conclusions: With the more widespread clinical use of equine sCT units in clinical practice, there is concern for increased risk of radiation exposure to personnel who stay in the sCT room during scanning. The control operator location had the highest dose during simulated head imaging, and the lead rope handler location in thoracic limb sCT had the highest dose during simulated limb imaging. Limiting the number of personnel in the sCT room, rotating personnel between handler positions, increasing operator distance from the scanner, and using lead shields and eyeglasses are recommended.

Clinical relevance: Our findings suggest that scanning large numbers of horses per year with the Asto CT Equina would not lead to occupational radiation exposure above the recommended safe threshold for handlers using lead shields and eyeglasses.

Authors: Kaylynn E Veitch, Timothy P Szczykutowicz, Sabrina H Brounts, David L Ergun, Peter Muir, Samantha J Loeber

Full Source: Journal of the American Veterinary Medical Association 2024 Sep 20:1-8. doi: 10.2460/javma.24.06.0424.

Objective: To evaluate the radiation dose to personnel locations during simulated head and limb scans with a novel equine standing CT (sCT) system.

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Exploration of microRNAs from blood extracellular vesicles as biomarkers of exposure to polycyclic aromatic hydrocarbons

2024-09-20

Exposure to polycyclic aromatic hydrocarbons (PAHs), ubiquitously environmental contaminant, leads to the development of major toxic effects on human health, such as carcinogenic and immunosuppressive alterations reported for the most studied PAH, i.e., benzo(a)pyrene (B(a)P). In order to assess the risk associated with this exposure, it is necessary to have predictive biomarkers. Thus, extracellular vesicles (EVs) and their microRNA (miRNA) contents, have recently been proposed as potentially interesting biomarkers in Toxicology. Our study here explores the use of vesicles secreted and found in blood fluids, and their miRNAs, as biomarkers of exposure to B(a)P alone and within a realistic occupational mixture. We isolated EVs from primary human cultured blood mononuclear cells (PBMCs) and rat plasma after PAH exposure and reported an increased EV production by B(a)P, used either alone or in the mixture, in vitro and in vivo. We then investigated the association of this EV release with the blood concentration of the 7,8,9,10-hydroxy (tetrol)-B(a)P reactive metabolite, in rats. By performing RNA-sequencing (RNA-seq) of miRNAs in PBMC-derived EVs, we analyzed miRNA profiles and demonstrated the regulation of the expression of miR-342-3p upon B(a)P exposure. We then validated B(a)P-induced changes of miR-342-3p expression in vivo in rat plasma-derived EVs. Overall, our study highlights the feasibility of using EVs and their miRNA contents, as biomarkers of PAH exposure and discusses their potential in environmental Toxicology.

Authors: Jérémy Amossé, Rima Souki, Maguy El Hajjar, Marie Marques, Valentine Genêt, Alexis Février, Morgane Le Gall, Benjamin SaintPierre, Franck Letourneur, Eric Le Ferrec, Dominique Lagadic-Gossmann, Christine Demeilliers, Lydie Sparfel

Full Source: Ecotoxicology and environmental safety 2024 Sep 20:285:117065. doi: 10.1016/j.ecoenv.2024.117065.

Exposure to polycyclic aromatic hydrocarbons (PAHs), ubiquitously environmental contaminant, leads to the development of major toxic effects on human health, such as carcinogenic and immunosuppressive alterations reported for the most studied PAH, i.e., benzo(a)pyrene (B(a)P).