

Bulletin Board

Contents

AUG. 11, 2023

(click on page numbers for links)

CHEMICAL EFFECTS

Occurrence, Fate, Human Exposure, and Toxicity of Commercial Photoinitiators.....	2
Evaluation of the cytotoxicity and genotoxicity of glufosinate-ammonium at technical and commercial grades in HepG2 cells	4

ENVIRONMENTAL RESEARCH

The Effect of Environmental Disasters on Endocrine Status, Hematology Parameters, Body Composition, and Physical Performance in Young Soccer Players: A Case Study of the Aral Sea Region4	
A Review of the Aquatic Environmental Transformations of Engineered Nanomaterials	6
Microplastic Pollution Prevention: The Need for Robust Policy Interventions to Close the Loopholes in Current Waste Management Practices.....	6

PHARMACEUTICAL/TOXICOLOGY

Current Review of Increasing Animal Health Threat of Per- and Polyfluoroalkyl Substances (PFAS): Harms, Limitations, and Alternatives to Manage Their Toxicity	7
Isolation of Pseudomonas oleovorans Carrying Multidrug Resistance Proteins MdtA and MdtB from Wastewater	8
Physiologically Based Pharmacokinetic Modelling to Predict Imatinib Exposures in Cancer Patients with Renal Dysfunction: A Case Study	9

OCCUPATIONAL

Hand Hygiene compliance and associated factors among healthcare workers in selected tertiary care hospitals in Bangladesh.....	10
Exposure to Biological Fluids in Dental Practice-Narrative Review on Appropriate Risk Assessment to Guide Post-Exposure Management	11

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Bulletin Board

Technical

AUG. 11, 2023

CHEMICAL EFFECTS

Occurrence, Fate, Human Exposure, and Toxicity of Commercial Photoinitiators

2023-07-29

Photoinitiators (PIs) are a family of anthropogenic chemicals used in polymerization systems that generate active substances to initiate polymerization reactions under certain radiations. Although polymerization is considered a green method, its wide application in various commercial products, such as UV-curable inks, paints, and varnishes, has led to ubiquitous environmental issues caused by PIs. In this study, we present an overview of the current knowledge on the environmental occurrence, human exposure, and toxicity of PIs and provide suggestions for future research based on numerous available studies. The residual concentrations of PIs in commercial products, such as food packaging materials, are at microgram per gram levels. The migration of PIs from food packaging materials to foodstuffs has been confirmed by more than 100 reports of food contamination caused by PIs. Furthermore, more than 20 PIs have been detected in water, sediment, sewage sludge, and indoor dust collected from Asia, the United States, and Europe. Human internal exposure was also confirmed by the detection of PIs in serum. In addition, PIs were present in human breast milk, indicating that breastfeeding is an exposure pathway for infants. Among the most available studies, benzophenone is the dominant congener detected in the environment and humans. Toxicity studies of PIs reveal multiple toxic end points, such as carcinogenicity and endocrine-disrupting effects. Future investigations should focus on synergistic/antagonistic toxicity effects caused by PIs coexposure and metabolism/transformation pathways of newly identified PIs. Furthermore, future research should aim to develop "greener" PIs with high efficiency, low migration, and low toxicity.

Authors: Xiaomeng Ji, Jiefeng Liang, Jiale Liu, Jie Shen, Yiling Li, Yingjun Wang, Chuanyong Jing, Scott A Mabury, Runzeng Liu

Full Source: Environmental science & technology 2023 Jul 29. doi: 10.1021/acs.est.3c02857.

Photoinitiators (PIs) are a family of anthropogenic chemicals used in polymerization systems that generate active substances to initiate polymerization reactions under certain radiations.

Bulletin Board

Technical

AUG. 11, 2023

Evaluation of the cytotoxicity and genotoxicity of glufosinate-ammonium at technical and commercial grades in HepG2 cells

2023-07-30

Exposure to genotoxic agents is associated with the development of cancer and related diseases. For this reason, assessing the genotoxicity of chemical compounds is necessary. In this line, information about the genotoxic effect of glufosinate-ammonium (GLA) has been reported only for the technical grade. However, humans are frequently exposed to commercial formulations of pesticides. Commercial formulations are characterized by using inner agents that increase toxicity compared to pesticides in technical grade. This study aimed to determine the cytotoxic and genotoxic effects of GLA on HepG2 cells. MTT and comet assays were performed to evaluate cell viability and DNA damage, respectively. HepG2 cells were exposed for 24 h to different concentrations of GLA (at 0.01 µg/mL; 0.04 µg/mL; 0.1 µg/mL; 0.24 µg/mL; 0.52 µg/mL; 1.25 µg/mL; 2.62 µg/mL and 13.12 µg/mL) in commercial- (Finale Ultra®) or technical-grade (GLAT). The results indicated that only Finale Ultra® induced a reduction in cell viability at 13.12 µg/mL. Furthermore, exposure to Finale Ultra® or GLAT was associated with increased DNA damage at concentrations from 0.52-13.12- µg/mL. This study shows the genotoxic effect of GLA on HepG2 cells.

Authors: Ezeidy Denisse Gallardo-Valle, Dayanne Carbajal-Noguera, Ma Elena Moreno-Godínez, Eugenia Flores-Alfaro, Isela Parra-Rojas, Gerardo Huerta-Beristain, Teresa Domínguez-Reyes, Marco Antonio Ramírez-Vargas
Full Source: Journal of environmental science and health. Part. B, Pesticides, food contaminants, and agricultural wastes 2023 Jul 30;1-6. doi: 10.1080/03601234.2023.2241322.

Exposure to genotoxic agents is associated with the development of cancer and related diseases.

ENVIRONMENTAL RESEARCH

The Effect of Environmental Disasters on Endocrine Status, Hematology Parameters, Body Composition, and Physical Performance in Young Soccer Players: A Case Study of the Aral Sea Region

2023-07-03

The Aral Sea region (Uzbekistan) is infamous because of the ecological disaster characterized by the disappearance of the Aral Sea due to excessive uncontrolled water intake for agriculture needs. A new desert

Bulletin Board

Technical

AUG. 11, 2023

occurrence, soil and climate aridization led to pesticide and toxic metals environment pollution. The impact of environmental conditions in some areas of Uzbekistan on the health of soccer players is not as noticeable as, for example, the effectiveness of training, so it is not widely discussed in scientific papers. The aim of the present study was to study the features of endocrine status, hematology parameters (e.g., red blood cells (RBC) and hemoglobin (Hb)), and their influence on body composition and physical fitness performance in local young soccer players of the Aral Sea region as the territory of ecological disaster. The study involved 60 male soccer players aged from 18 to 22 years. Participants were divided into two groups: the experimental group (EG), which consisted of 30 soccer players living on the territory of the Aral ecological disaster region, and the control group (CG), which included 30 soccer players, natives of the ecologically favorable region of Uzbekistan. All volunteers had anthropometric measurements, concentrations of insulin-like growth factor-1 (IGF-1), total testosterone (TT), estradiol (E2), cortisol (C), RBC, and Hb count. Moreover, Yo-Yo Intermittent Recovery Test Level 1 (YYIRT1) and professional skills tests such as dribbling shuttle test (DSt) and goal accuracy test (GAt) were assessed. When comparing the CG group to the EG group, it was observed that the EG group exhibited statistically significantly reduced levels of TT and E2 ($p < 0.05$). No significant statistical difference was observed between the two groups in terms of IGF-1 and C ($p > 0.05$). Regarding hematological parameters, Hb, Ht, and mean corpuscular volume (MCV) were found to be significantly lower in the EG compared with the CG ($p < 0.05$). Moreover, the distance covered in the YYIRT1 test was found to be significantly lower in soccer players within the EG compared with the CG ($p < 0.05$). Additionally, it was determined that there was no significant difference between the groups in terms of DSt and GAt values ($p > 0.05$). Lastly, significant differences were observed between the EG and CG in terms of anthropometric characteristics (diameters, skinfold, and somatotype profile) ($p < 0.05$). The present study showed that the changes in evaluated characteristics might result from the complex influence of endocrine-disrupting chemicals, the content of which is high in the environment of the Aral Sea region. The results obtained may help monitor the health of athletes living in an environmentally unfriendly environment.

Authors: Valerii O Erkudov, Kenjabek U Rozumbetov, Francisco Tomás González-Fernández, Andrey P Pugovkin, Ilal I Nazhimov, Azat T Matchanov, Halil İbrahim Ceylan
Full Source: Life (Basel, Switzerland) 2023 Jul 3;13(7):1503. doi: 10.3390/life13071503.

Bulletin Board

Technical

AUG. 11, 2023

A Review of the Aquatic Environmental Transformations of Engineered Nanomaterials

2023-07-18

Once released into the environment, engineered nanomaterials (ENMs) undergo complex interactions and transformations that determine their fate, exposure concentration, form, and likely impact on biota. Transformations are physical, chemical, or biological changes that occur to the ENM or the ENM coating. Over time, these transformations have an impact on their behaviour and properties. The interactions and transformations of ENMs in the environment depend on their pristine physical and chemical characteristics and the environmental or biological compartment into which they are released. The uniqueness of each ENM property or lifecycle results in a great deal of complexity. Even small changes may have a significant impact on their potential transformations. This review outlines the key influences and outcomes of ENM evolution pathways in aquatic environments and provides an assessment of potential environmental transformations, focusing on key chemical, physical, and biological processes. By obtaining a comprehensive understanding of the potential environmental transformations that nanomaterials can undergo, more realistic models of their probable environmental behaviour and potential impact can be developed. This will, in turn, be crucial in supporting regulatory bodies in their efforts to develop environmental policy in the field of nanotechnology.

Authors: Daniel Mark Harrison, Sophie M Briffa, Antonino Mazzonello, Eugenia Valsami-Jones

Full Source: Nanomaterials (Basel, Switzerland) 2023 Jul 18;13(14):2098. doi: 10.3390/nano13142098.

Microplastic Pollution Prevention: The Need for Robust Policy Interventions to Close the Loopholes in Current Waste Management Practices

2023-07-23

Plastic materials that are less than 5 mm in size are defined as Microplastics (MPs). MPs that are intentionally produced are called primary MPs; however, the most abundant type in the environment consists of the remainder created by the fragmentation of large plastic debris through physical, chemical, and oxidative processes, which are called secondary MPs. Due to their abundance in the environment, poor degradability, toxicological properties, and negative impact on aquatic and terrestrial organisms, including humans, MP pollution has become

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Bulletin Board

Technical

AUG. 11, 2023

a global environmental issue. Combatting MP pollution requires both remediation and preventive measures. Although remediation is a must, considering where the technology stands today, it may take long time to make it happen. Prevention, on the other hand, can be and should be done now. However, the effectiveness of preventive measures depends heavily on how well MP escape routes are researched and understood. In this research, we argue that such escape routes (rather, loopholes) exist not only due to mismanaged plastic waste, but also due to cracks in the current waste management systems. One known MP loophole is facilitated by wastewater treatment plants (WWTP). The inability of existing WWTP to retain finer MPs, which are finally released to water bodies together with the treated wastewater, along with the return of captured larger MPs back to landfills and their release into the environment through land applications, are a few examples. Organic waste composting and upcycling of waste incineration ash provide other MP escape pathways. In addition, it is important to understand that the plastics that are in current circulation (active use as well as idling) are responsible for producing MPs through regular wear and tear. Closing these loopholes may be best attempted through policy interventions.

Authors: Hiroshan Hettiarachchi, Jay N Meegoda

Full Source: International journal of environmental research and public health 2023 Jul 23;20(14):6434. doi: 10.3390/ijerph20146434.

PHARMACEUTICAL/TOXICOLOGY

Current Review of Increasing Animal Health Threat of Per- and Polyfluoroalkyl Substances (PFAS): Harms, Limitations, and Alternatives to Manage Their Toxicity

2023-07-20

Perfluorinated and polyfluorinated alkyl substances (PFAS), more than 4700 in number, are a group of widely used man-made chemicals that accumulate in living things and the environment over time. They are known as “forever chemicals” because they are extremely persistent in our environment and body. Because PFAS have been widely used for many decades, their presence is evident globally, and their persistence and potential toxicity create concern for animals, humans and environmental health. They can have multiple adverse health effects, such as liver damage, thyroid disease, obesity, fertility problems, and cancer. The most significant source of living exposure to PFAS is dietary intake (food and water), but given massive industrial and domestic use, these substances

Bulletin Board

Technical

AUG. 11, 2023

are now punctually present not only domestically but also in the outdoor environment. For example, livestock and wildlife can be exposed to PFAS through contaminated water, soil, substrate, air, or food. In this review, we have analyzed and exposed the characteristics of PFAS and their various uses and reported data on their presence in the environment, from industrialized to less populated areas. In several areas of the planet, even in areas far from large population centers, the presence of PFAS was confirmed, both in marine and terrestrial animals (organisms). Among the most common PFAS identified are undoubtedly perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA), two of the most widely used and, to date, among the most studied in terms of toxicokinetics and toxicodynamics. The objective of this review is to provide insights into the toxic potential of PFAS, their exposure, and related mechanisms.

Authors: Alessio Filippo Peritore, Enrico Gugliandolo, Salvatore Cuzzocrea, Rosalia Crupi, Domenico Britti

Full Source: International journal of molecular sciences 2023 Jul 20;24(14):11707. doi: 10.3390/ijms241411707.

Isolation of *Pseudomonas oleovorans* Carrying Multidrug Resistance Proteins MdtA and MdtB from Wastewater

2023-07-14

The pollution of industrial wastewater has become a global issue in terms of economic development and ecological protection. *Pseudomonas oleovorans* has been studied as a bacterium involved in the treatment of petroleum pollutants. Our study aimed to investigate the physicochemical properties and drug resistance of *Pseudomonas oleovorans* isolated from industrial wastewater with a high concentration of sulfate compounds. Firstly, *Pseudomonas oleovorans* was isolated and then identified using matrix-assisted flight mass spectrometry and 16S rDNA sequencing. Then, biochemical and antibiotic resistance analyses were performed on the *Pseudomonas oleovorans*, and a microbial high-throughput growth detector was used to assess the growth of the strain. Finally, PCR and proteomics analyses were conducted to determine drug-resistance-related genes/proteins. Based on the results of the spectrum diagram and sequencing, the isolated bacteria were identified as *Pseudomonas oleovorans* and were positive to reactions of ADH, MTE, CIT, MLT, ONPG, and ACE. *Pseudomonas oleovorans* was sensitive to most of the tested antibiotics, and its resistance to SXT and CHL and MIN and TIM was intermediate. The growth experiment showed that *Pseudomonas oleovorans* had a good growth rate in nutrient broth. Additionally, gyrB was the resistance gene, and mdtA2, mdtA3, mdtB2, mdaB, and emrK1

The pollution of industrial wastewater has become a global issue in terms of economic development and ecological protection.

Bulletin Board

Technical

AUG. 11, 2023

were the proteins that were closely associated with the drug resistance of *Pseudomonas oleovorans*. Our results show the biochemical properties of *Pseudomonas oleovorans* from industrial wastewater with a high concentration of sulfate compounds and provide a new perspective for *Pseudomonas oleovorans* to participate in biological removal of chemical pollutants in industrial wastewater.

Authors: Haifeng Wang, Chenyang Sun, Xing Chen, Kai Yan, Hongxuan He
Full Source: *Molecules* (Basel, Switzerland) 2023 Jul 14;28(14):5403. doi: 10.3390/molecules28145403.

Physiologically Based Pharmacokinetic Modelling to Predict Imatinib Exposures in Cancer Patients with Renal Dysfunction: A Case Study

2023-07-11

Imatinib is mainly metabolised by CYP3A4 and CYP2C8 and is extensively bound to α -acid glycoprotein (AAG). A physiologically based pharmacokinetic (PBPK) model for imatinib describing the CYP3A4-mediated autoinhibition during multiple dosing in gastrointestinal stromal tumor patients with normal renal function was previously reported. After performing additional verification, the PBPK model was applied to predict the exposure of imatinib after multiple dosing in cancer patients with varying degrees of renal impairment. In agreement with the clinical data, there was a positive correlation between AAG levels and imatinib exposure. A notable finding was that for recovery of the observed data in cancer patients with moderate RI (CrCL 20 to 39 mL/min), reductions of hepatic CYP3A4 and CYP2C8 abundances, which reflect the effects of RI, had to be included in the simulations. This was not the case for mild RI (CrCL 40 to 50 mL/min). The results support the finding of the clinical study, which demonstrated that both AAG levels and the degree of renal impairment are key components that contribute to the interpatient variability associated with imatinib exposure. As indicated in the 2020 FDA draft RI guidance, PBPK modelling could be used to support an expanded inclusion of patients with RI in clinical studies.

Authors: Karen Rowland Yeo, Oliver Hatley, Ben G Small, Trevor N Johnson
Full Source: *Pharmaceutics* 2023 Jul 11;15(7):1922. doi: 10.3390/pharmaceutics15071922.

Imatinib is mainly metabolised by CYP3A4 and CYP2C8 and is extensively bound to α -acid glycoprotein (AAG).

Bulletin Board

Technical

AUG. 11, 2023

OCCUPATIONAL

Hand Hygiene compliance and associated factors among healthcare workers in selected tertiary care hospitals in Bangladesh

2023-07-27

Background: Hand hygiene (HH) is a fundamental element of patient safety. Adherence to HH among healthcare workers (HCW) varies greatly depending on a range of factors, including risk perceptions, institutional culture, auditing mechanisms, and availability of HH supplies.

Aims: This study aims to evaluate HH compliance and associated factors among healthcare workers in selected tertiary care hospitals in Bangladesh.

Methods: During September 2020 to May 2021, we conducted non-participatory observations at 10 tertiary-care hospitals using WHO '5-moments for hand hygiene tool' to record HH compliance among physicians, nurses, and cleaning staff. We also performed semi-structured interviews to determine the key barriers to complying with HH.

Results: We observed 14,668 hand hygiene opportunities. The overall HH compliance was 25.3%, the highest among nurses (28.5%), and the lowest among cleaning staff (9.9%). HCWs in public hospitals had significantly higher odds of complying with HH practices than those in private hospitals (AOR: 1.73, 95%CI: 1.55-1.93). The odds of performing HH after touching a patient were 3.36 times higher compared with before touching a patient (95% CI: 2.90-3.90). The reported key barriers to performing HH were insufficient supplies (57.9%), skin reactions (26.3%), workload (26.3%), and lack of facilities (22.7%). Overall, observed HH supplies were available in 81.7% of wards for physicians and 95.1% of wards for nurses, however, no designated HH facilities were found for the cleaning staff.

Conclusions: HH compliance among HCWs fell significantly short of the standard for safe patient care. Inadequate HH supplies demonstrates a lack of prioritizing, promoting, and investing in infection prevention and control.

Authors: Md Golam Dostogir Harun, Md Mahabub Ul Anwar, Shariful Amin Sumon, Tahrima Mohsin Mohona, Md Zakiul Hassan, Aninda Rahman, Syed Abul Hassan Md Abdullah, Md Saiful Islam, Lisa P Oakley, Paul Malpiedi, S Cornelia Kaydos-Daniels, Ashley R Styczynski

Full Source: *The Journal of hospital infection* 2023 Jul 27;S0195-6701(23)00241-4. doi: 10.1016/j.jhin.2023.07.012.

Background: Hand hygiene (HH) is a fundamental element of patient safety.

Bulletin Board

Technical

AUG. 11, 2023

Exposure to Biological Fluids in Dental Practice-Narrative Review on Appropriate Risk Assessment to Guide Post-Exposure Management

2023-07-24

Accidental exposure to blood or other biological fluids is a common occurrence in dentistry, and its post-exposure management is a key component of infection prevention and control programs designed to prevent the transmission of blood-borne pathogens such as hepatitis B and C viruses (HBV, HCV) and human immunodeficiency virus (HIV). This narrative review aims to comprehensively review the risk assessment process for each of these pathogens at all steps of the epidemiological process, i.e., source-exposure route-receptive person, in order to provide a better understanding of the delicate differences that influence the transmission risk and that drive the individualized post-exposure management.

Authors: Mihai Săndulescu, Mihnea Ioan Nicolescu, Cristian Funieru, Gülşen Özkaya Şahin, Oana Săndulescu, ESCMID Study Group for Viral Hepatitis (ESGVH)

Full Source: *Pathogens* (Basel, Switzerland) 2023 Jul 24;12(7):968. doi: 10.3390/pathogens12070968.

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