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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

Disinfection byproducts of iopamidol, iohexol, diatrizoate and their distinct acute toxicity on Scenedesmus sp., Daphnia magna and Danio rerio

2023-05-18

The COVID-19 pandemic resulted in increasing the usage of iodinated contrast media (ICM), and thus an increase in the prevalence of ICM-contaminated wastewater. While ICM is generally safe, this has the potential to be problematic because as medical wastewater is treated and disinfected, various ICM-derived disinfection byproducts (DBPs) may be generated and released into the environment. However, little information was available about whether ICM-derived DBPs are toxic to aquatic organisms. In this study, the degradation of three typical ICM (iopamidol, iohexol, diatrizoate) at initial concentration of 10 μM and 100 μM in chlorination and peracetic acid without or with NH4+ was investigated, and the potential acute toxicity of treated disinfected water containing potential ICM-derived DBPs on Daphnia magna, Scenedesmus sp. and Danio rerio was tested. The degradation results suggested that only iopamidol was significantly degraded (level of degradation >98%) by chlorination, and the degradation rate of iohexol and diatrizoate were significantly increased in chlorination with NH4+. All three ICM were not degraded in peracetic acid. The toxicity analysis results indicate that only the disinfected water of iopamidol and iohexol by chlorination with NH4+ were toxic to at least one aquatic organism. These results highlighted that the potential ecological risk of ICM-contained medical wastewater by chlorination with NH4+ should not be neglected, and peracetic acid may be an environment-friendly alternative for the disinfection of wastewater containing ICM.

Authors: Nan Zhou, Huihui Liu, Xianhai Yang, Peter Watson, Feifei Yang
Full Source: Chemosphere 2023 May 18;333:138885. doi: 10.1016/j.chemosphere.2023.138885.

The COVID-19 pandemic resulted in increasing the usage of iodinated contrast media (ICM), and thus an increase in the prevalence of ICM-contaminated wastewater.

The toxicity of nanoparticles and their interaction with cells: an in vitro metabolomic perspective

2023-01-30

Nowadays, nanomaterials (NMs) are widely present in daily life due to their significant benefits, as demonstrated by their application in many fields such as biomedicine, engineering, food, cosmetics, sensing, and energy. However, the increasing production of NMs multiplies the chances of their release into the surrounding environment, making human exposure to NMs inevitable. Currently, nanotoxicology is a crucial field, which focuses on studying the toxicity of NMs. The toxicity or effects of nanoparticles (NPs) on the environment and humans can be preliminary assessed in vitro using cell models. However, the conventional cytotoxicity assays, such as the MTT assay, have some drawbacks including the possibility of interference with the studied NPs. Therefore, it is necessary to employ more advanced techniques that provide high throughput analysis and avoid interferences. In this case, metabolomics is one of the most powerful bioanalytical strategies to assess the toxicity of different materials. By measuring the metabolic change upon the introduction of a stimulus, this technique can reveal the molecular information of the toxicity induced by NPs. This provides the opportunity to design novel and efficient nanodrugs and minimizes the risks of NPs used in industry and other fields. Initially, this review summarizes the ways that NPs and cells interact and the NP parameters that play a role in this interaction, and then the assessment of these interactions using conventional assays and the challenges encountered are discussed. Subsequently, in the main part, we introduce the recent studies employing metabolomics for the assessment of these interactions in vitro.

Authors: Mohammad Awashra, Piotr Młynarz
Full Source: Nanoscale advances 2023 Jan 30;5(10):2674-2723. doi: 10.1039/d2na00534d.

Occurrence, distribution, and risk assessment of parabens in the surface water of Terengganu River, Malaysia

2023-05-17

The concentration, distribution, and risk assessment of parabens were determined in the surface water of the Terengganu River, Malaysia. Target chemicals were extracted via solid-phase extraction, followed by high-performance liquid chromatography analysis. Method optimization produced a high percentage recovery for methylparaben (MeP, 84.69 %), ethylparaben (EtP, 76.60 %), and propylparaben (PrP, 76.33 %). Results showed that higher concentrations were observed for MeP (3.60 μg/L) as compared with EtP (1.21 μg/L) and PrP (1.00 μg/L). Parabens are ubiquitously present in all sampling stations, with >99 % of detection. Salinity and conductivity were the major factors influencing the level of parabens in the surface water. Overall, we found no potential risk of parabens in the Terengganu River ecosystem due to low calculated risk

The concentration, distribution, and risk assessment of parabens were determined in the surface water of the Terengganu River, Malaysia.

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assessment values (risk quotient < 1). In conclusion, parabens are present in the river, but their levels are too low to pose risks to aquatic organisms.
Authors: Rohaya Abd Wahab, Tuan Fauzan Tuan Omar, Mohd Yusoff Nurulnadia, Najaa Nur Atiqah Rozulan
Full Source: Marine pollution bulletin 2023 May 17;192:115036. doi: 10.1016/j.marpolbul.2023.115036.

ENVIRONMENTAL RESEARCH

Neuro-Environmental Interactions: a time sensitive matter

2023-05-05
The assessment of resting state (rs) neurophysiological dynamics relies on the control of sensory, perceptual, and behavioral environments to minimize variability and rule-out confounding sources of activation during testing conditions. Here, we investigated how temporally-distal environmental inputs, specifically metal exposures experienced up to several months prior to scanning, affect functional dynamics measured using rs functional magnetic resonance imaging (rs-fMRI). We implemented an interpretable XGBoost-Shapley Additive Explanation (SHAP) model that integrated information from multiple exposure biomarkers to predict rs dynamics in typically developing adolescents. In 124 participants (53% females, ages: 13-25 years) enrolled in the Public Health Impact of Metals Exposure (PHIME) study, we measured concentrations of six metals (manganese, lead, chromium, cupper, nickel and zinc) in biological matrices (saliva, hair, fingernails, toenails, blood and urine) and acquired rs-fMRI scans. Using graph theory metrics, we computed global efficiency (GE) in 111 brain areas (Harvard Oxford Atlas). We used a predictive model based on ensemble gradient boosting to predict GE from metal biomarkers, adjusting for age and biological sex. Model performance was evaluated by comparing predicted versus measured GE. SHAP scores were used to evaluate feature importance. Measured versus predicted rs dynamics from our model utilizing chemical exposures as inputs were significantly correlated ($p < 0.001$, $r = 0.36$). Lead, chromium, and copper contributed most to the prediction of GE metrics. Our results indicate that a significant component of rs dynamics, comprising approximately 13% of observed variability in GE, is driven by recent metal exposures. These findings emphasize the need to estimate and control for the influence of past and current chemical exposures in the assessment and analysis of rs functional connectivity.
Authors: Azzurra Invernizzi, Stefano Renzetti, Elza Rechtman, Claudia Ambrosi, Lorella Mascaro, Daniele Corbo, Roberto Gasparotti, Cheuk Y Tang, Donald R Smith, Roberto G Lucchini, Robert O Wright, Donatella Placidi, Megan K Horton, Paul Curtin
Full Source: bioRxiv : the preprint server for biology 2023 May 5;2023.05.04.539456. doi: 10.1101/2023.05.04.539456.

The assessment of resting state (rs) neuro-physiological dynamics relies on the control of sensory, perceptual, and behavioral environments to minimize variability and rule-out confounding sources of activation during testing conditions.

Developmental exposure to a real-life environmental chemical mixture alters testicular transcription factor expression in neonatal and pre-pubertal rams, with morphological changes persisting into adulthood

2023-05-18
Environmental chemical (EC) exposure may be impacting male reproductive health. The translationally relevant biosolids treated pasture (BTP) sheep model was used to investigate gestational low-level EC mixture exposure on the testes of F1 male offspring. Adult rams from ewes exposed to BTP 1 month before and throughout pregnancy had more seminiferous tubules with degeneration and depletion of elongating spermatids, indicating possible "recovery" from previously reported testicular dysgenesis syndrome-like phenotype in neonatal and pre-pubertal BTP lambs. Expression of transcription factors CREB1 (neonatal) and BCL11A and FOXP2 (pre-pubertal) were significantly higher in the BTP exposed testes, with no changes seen in adults. Increased CREB1, which is crucial for testes development and regulation of steroidogenic enzymes, could be an adaptive response to gestational EC exposure to facilitate the phenotypic recovery. Overall, this demonstrates that testicular effects from gestational exposure to low-level mixtures of ECs can last into adulthood, potentially impacting fertility and fecundity.
Authors: Chris S Elcombe, Ana Monteiro, Mohammad Ghasemzadeh-Hasankolaei, Vasantha Padmanabhan, Richard Lea, Kevin D Sinclair, Neil P Evans, Michelle Bellingham
Full Source: Environmental toxicology and pharmacology 2023 May 18;100:104152. doi: 10.1016/j.etap.2023.104152.

Environmental chemical (EC) exposure may be impacting male reproductive health.

Noise Pollution and Associated Hearing Loss in a Metropolitan City-a Preliminary Report

2023-04
To measure the amount of noise produced in busy parts of a metropolitan and also to assess the audiological status of the civilians exposed to such noise. Cross-sectional study for one year between June 2017 and May 2018 was conducted. Noise was measured in four busy parts of an urban city with a digital sound level meter. People involved in various

occupations in the busy parts for more than one year within the age range of 15-45 years were included. Maximum noise level recorded was 106.4 dBA in Koyembedu. Average noise was around 70-85 dBA in Chennai. Totally 100 people were subjected to audiological assessment (69 Males; 31 Females). Among them 93% had hearing loss. Hearing loss was almost equal both in sexes. Sensory hearing loss was the major type (83%). All areas were almost equally affected with maximum (100%) being affected in Annanagar and Koyembedu. The right ear was more affected than the left. All age groups were affected among which the working age group (36-45) years was most affected. The unskilled occupation group was most affected (100%). There was a positive relation between noise levels and hearing loss. Duration of exposure did not have positive correlation with hearing loss. Noise pollution and its induced hearing loss was more prevalent and increased in all four areas. As hearing loss due to noise pollution is predominant as observed in the study, awareness about noise pollution and its effects among the community is a necessity.

Authors: Roopak Visakan Raja, Gurumani Sriraman, Mohan Kameswaran

Full Source: Indian journal of otolaryngology and head and neck surgery : official publication of the Association of Otolaryngologists of India 2023 Apr;75(Suppl 1):278-284. doi: 10.1007/s12070-022-03432-3.

PFAS in municipal landfill leachate: Occurrence, transformation, and sources

2023-05-18

To understand sources and processes affecting per- and polyfluoroalkyl substances (PFAS), 32 PFAS were measured in landfill leachate from 17 landfills across Washington State in both pre-and post-total oxidizable precursor (TOP) assay samples, using an analytical method that was the precursor to EPA Draft Method 1633. As in other studies, 5:3FTCA was the dominant PFAS in the leachate, suggesting that carpets, textiles, and food packaging were the main sources of PFAS. Total PFAS concentrations (Σ32PFAS) ranged from 61 to 172,976 ng/L and 580-36,122 ng/L in pre-TOP and post-TOP samples, respectively, suggesting that little or no uncharacterized precursors remained in landfill leachate. Furthermore, due to chain-shortening reactions, the TOP assay often resulted in a loss of overall PFAS mass. Positive matrix factorization (PMF) analysis of the combined pre- and post-TOP samples produced five factors that represent sources and processes. Factor 1 consisted primarily of 5:3FTCA (intermediate of 6:2 fluorotelomer degradation and characteristic of landfill leachate), while factor 2 was dominated by PFBS (degradant of C-4 sulfonamide chemistry) and, to a lesser extent, by several PFCAs and

To understand sources and processes affecting per- and polyfluoroalkyl substances (PFAS), 32 PFAS were measured in landfill leachate from 17 landfills across Wash-ington State in both pre-and post-total oxi-dizable precursor (TOP) assay samples, using an analytical method that was the precursor to EPA Draft Method 1633.

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5:3FTCA. Factor 3 consisted primarily of both short-chain PFCAs (end-products of 6:2 fluorotelomer degradation) and PFHxS (derived from C-6 sulfonamide chemistry), while the main component of factor 4 was PFOS (dominant in many environmental media but minor in landfill leachate, perhaps reflecting a production shift from longer to shorter chain PFAS). Factor 5, highly loaded with PFCAs, was dominant in post-TOP samples and therefore represented the oxidation of precursors. Overall, PMF analysis suggests that the TOP assay approximates some redox processes which occur in landfills, including chain-shortening reactions which yield biodegradable products.

Authors: Staci L Capozzi, Amy L Leang, Lisa A Rodenburg, Bharat Chandramouli, Damon A Delistraty, Cole H Carter

Full Source: Chemosphere 2023 May 18;334:138924. doi: 10.1016/j.chemosphere.2023.138924.

PHARMACEUTICAL/TOXICOLOGY

Impact of environmental characteristics on children's gut microbiota - A pilot study in assessing the role of indoor microbiome and metabolites

2023-05-18

A diverse and balanced human gut microbiota is crucial for maintaining normal human physiological functions. However, the impact of indoor microbiome and metabolites on gut microbiota is not well understood. Methods: A self-administered questionnaire was used to collect information on more than 40 personal and environmental characteristics and dietary habits from 56 children in Shanghai, China. Shotgun metagenomics and untargeted liquid chromatography-mass spectrometry (LC-MS) were used to characterize the indoor microbiome and metabolomic/chemical exposure in children's living rooms. PacBio full-length 16 S rRNA sequencing was used to characterize children's gut microbiota. Associations between environmental characteristics and gut microbiota diversity/composition were assessed using PERMANOVA and regression.

Results: In total, 6247 and 318 indoor and gut microbial species and 1442 indoor metabolites were characterized. Age of children ($R2 = 0.033$, $p = 0.008$), age start kindergarten ($R2 = 0.029$, $p = 0.03$), living adjacent to heavy traffic ($R2 = 0.031$, $p = 0.01$) and drinking soft drinks ($R2 = 0.028$, $p = 0.04$) significantly impacted overall gut microbial composition, consistent with previous studies. Having pets/plants and frequent vegetable

A diverse and balanced human gut microbiota is crucial for maintain-ing normal human physiological functions.

intake were positively associated with gut microbiota diversity and the Gut Microbiome Health Index (GMHI), while frequent juice and fries intake decreased gut microbiota diversity ($p < 0.05$). The abundance of indoor Clostridia and Bacilli was positively associated with gut microbial diversity and GMHI ($p < 0.01$). Total indoor indole derivatives and 6 indole metabolites (L-tryptophan, indole, 3-methylindole, indole-3-acetate, 5-hydroxy-L-tryptophan and indolelactic acid, $p < 0.05$) were positively associated with the abundance of total protective gut bacteria, suggesting a potential role in promoting gut health. Neural network analysis revealed that these indole derivatives were derived from indoor microorganisms. Conclusions: The study is the first to report associations between indoor microbiome/metabolites and gut microbiota, highlighting the potential role of indoor microbiome in shaping human gut microbiota.

Authors: Mei Zhang, Hao Tang, Yang Chen, Zhuoru Chen, Yanyi Xu, Xi Fu, Yu Sun, Zhuohui Zhao

Full Source: Environmental research 2023 May 18;116114. doi: 10.1016/j.envres.2023.116114.

Microbiological and chemical drinking water contaminants and associated health outcomes in rural Appalachia, USA: A systematic review and meta-analysis

2023-05-17

In rural areas of the United States, an estimated ~1.8 million people lack reliable access to safe drinking water. Considering the relative dearth of information on water contamination and health outcomes in Appalachia, we conducted a systematic review of studies of microbiological and chemical drinking water contamination and associated health outcomes in rural Appalachia. We pre-registered our protocols, limiting eligibility to primary data studies published from 2000 to 2019, and searched four databases (PubMed, EMBASE, Web of Science, and the Cochrane Library). We used qualitative syntheses, meta-analyses, risk of bias analysis, and meta-regression to assess reported findings, with reference to US EPA drinking water standards. Of the 3452 records identified for screening, 85 met our eligibility criteria. 93 % of eligible studies (n = 79) used cross-sectional designs. Most studies were conducted in Northern (32 %, n = 27) and North Central (24 %, n = 20) Appalachia, and only 6 % (n = 5) in Central Appalachia. Across studies, E. coli were detected in 10.6 % of samples (sample-size-weighted mean percentage from 4671 samples, 14 publications). Among chemical contaminants, sample-size-weighted mean concentrations for arsenic were 0.010 mg/L (n = 21,262 samples, 6 publications), and 0.009 mg/L for lead (n = 23,259, 5 publications). 32

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% (n = 27) of studies assessed health outcomes, but only 4.7 % (n = 4) used case-control or cohort designs (all others were cross-sectional). The most commonly reported outcomes were detection of PFAS in blood serum (n = 13), gastrointestinal illness (n = 5), and cardiovascular-related outcomes (n = 4). Of the 27 studies that assessed health outcomes, 62.9 % (n = 17) appeared to be associated with water contamination events that had received national media attention. Overall, based on the number and quality of eligible studies identified, we could not reach clear conclusions about the state of water quality, or its impacts on health, in any of Appalachia's subregions. More epidemiologic research is needed to understand contaminated water sources, exposures, and potentially associated health outcomes in Appalachia.

Authors: Amanda Darling, Hannah Patton, Md Rasheduzzaman, Rachel Guevara, Joshua McCray, Leigh-Anne Krometis, Alasdair Cohen

Full Source: The Science of the total environment 2023 May 17;164036. doi: 10.1016/j.scitotenv.2023.164036.

OCCUPATIONAL

Feeling safe versus being safe: Perceptions of safety versus actual disease exposure across the entire health care team

2023-05-19

As supply chains experienced disruptions early in the COVID-19 pandemic, personal protective equipment (PPE) quickly became scarce. The purpose of this study was to examine the impact of perceptions of inadequate PPE, fear of COVID-19 infection, and self-reported direct COVID-19 exposure on health care workers. Data to assess distress, resilience, social-ecological factors, and work and nonwork-related stressors were collected from June to July 2020 at a large medical center. Stressors were analyzed by role using descriptive statistics and multivariate regression analysis. Our data indicate that job role influenced fear of infection and perceptions of inadequate PPE in the early phase of the COVID-19 pandemic. Perceived organizational support was also related to perceptions of inadequate PPE supply. Interestingly, work location, rather than job role, was predictive of direct COVID-19 exposure. Our data highlight a disconnect between the perception of safety in the health care setting with real risk of exposure to infectious disease. This study suggests that leaders in health care should focus on cultivating supportive organizational cultures, assessing both perceived and actual safety, and provide adequate training in safety practices may improve preparedness and organizational trust during

As supply chains experienced disruptions early in the COVID-19 pandemic, personal protective equipment (PPE) quickly became scarce.

times of both certainty and crisis particularly for clinical workers with less education and training.

Authors: Laurence M Boitet, Katherine A Meese, Alejandra Colón-López, Katherine L Sweeney, David A Rogers

Full Source: Journal of healthcare risk management: the journal of the American Society for Healthcare Risk Management 2023 May 19. doi: 10.1002/jhrm.21542.