

Bulletin Board

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Technical

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CHEMICAL EFFECTS

The acute toxicity of bitumen-influenced groundwaters from the oil sands region to aquatic organisms

2022-08-01

The extraction of surface mined bitumen from oil sands deposits in northern Alberta, Canada produces large quantities of liquid tailings waste, termed oil sands process-affected water (OSPW), which are stored in large tailings ponds. OSPW-derived chemicals from several tailings ponds migrating past containment structures and through groundwater systems pose a concern for surface water contamination. The present study investigated the toxicity of groundwater from near-field sites adjacent to a tailings pond with OSPW influence and far-field sites with only natural oil sands bitumen influence. The acute toxicity of unfractionated groundwater and isolated organic fractions was assessed using a suite of aquatic organisms (*Pimephales promelas*, *Oryzias latipes*, *Daphnia magna*, *Hyalella azteca*, *Lampsilis* spp., *Ceriodaphnia dubia*, *Hexagenia* spp., and *Vibrio fischeri*). Assessment of unfractionated groundwater demonstrated toxicity towards all invertebrates in at least one far-field sample, with both near-field and far-field samples with bitumen influence toxic towards *P. promelas*, while no toxicity was observed for *O. latipes*. When assessing the unfractionated groundwater and isolated organic fractions from near-field and far-field groundwater sites, *P. promelas* and *H. azteca* were the most sensitive to organic components, while *D. magna* and *L. cardium* were most sensitive to the inorganic components. Groundwater containing appreciable amounts of dissolved organics exhibited similar toxicities to sensitive species regardless of an OSPW or natural bitumen source. The lack of a clear distinction in relative acute toxicities between near-field and far-field samples indicates that the water-soluble chemicals associated with bitumen are acutely toxic to several aquatic organisms. This result, combined with the similarities in chemical profiles between bitumen-influenced groundwater originating from OSPW and/or natural sources, suggests that the industrial bitumen extraction processes corresponding to the tailings pond in this study are not contributing unique toxic substances to groundwater, relative to natural bitumen compounds present in groundwater flow systems.

Authors: Anthony E Bauer, L Mark Hewitt, James W Roy, Joanne L Parrott, Adrienne J Bartlett, Patricia L Gillis, Warren P Norwood, Martina D Rudy, Sheena D Campbell, Maegan R Rodrigues, Lisa R Brown, Ruth Vanderveen, Lorna E Deeth, Emily A M Holman, Joseph Salerno, Julie R Marentette, Christine Lavallo, Cheryl Sullivan, Kallie Shires, Melissa Galicia, Julian

The extraction of surface mined bitumen from oil sands deposits in northern Alberta, Canada produces large quantities of liquid tailings waste, termed oil sands process-affected water (OSPW), which are stored in large tailings ponds.

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Rubino, Mitra Brown, Alicia O'Neill, Greg Bickerton, D George Dixon, Richard A Frank

Full Source: The Science of the total environment 2022 Aug 1;157676. doi: 10.1016/j.scitotenv.2022.157676.

Association between lead exposure and DNA damage (genotoxicity): systematic review and meta-analysis

2022-08-05

Studies suggest that chronic lead (Pb) exposure may induce deoxyribonucleic acid (DNA) damage. However, there is no synthesised evidence in this regard. We systematically reviewed existing literature and synthesised evidence on the association between chronic Pb exposure and markers of genotoxicity. Observational studies reporting biomarkers of DNA damage among occupationally Pb-exposed and unexposed controls were systematically searched from PubMed, Scopus and Embase databases from inception to January 2022. The markers included were micronucleus frequency (MN), chromosomal aberrations, comet assay, and 8-hydroxy-deoxyguanosine. During the execution of this review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Mean differences in the biological markers of DNA damage between Pb-exposed and control groups were pooled using the random-effects model. The heterogeneity was assessed using the Cochran-Q test and I² statistic. The review included forty-five studies comparing markers of DNA damage between Pb-exposed and unexposed. The primary studies utilised buccal and/or peripheral leukocytes for evaluating the DNA damage. The pooled quantitative results revealed significantly higher DNA damage characterised by increased levels of MN and SCE frequency, chromosomal aberrations, and oxidative DNA damage (comet assay and 8-OHdG) among Pb-exposed than the unexposed. However, studies included in the review exhibited high levels of heterogeneity among the studies. Chronic Pb exposure is associated with DNA damage. However, high-quality, multicentred studies are required to strengthen present observations and further understand the Pb's role in inducing DNA damage. CRD42022286810.

Authors: Raju Nagaraju, Ravibabu Kalahasthi, Rakesh Balachandar, Bhavani Shankara Bagepally

Full Source: Archives of toxicology 2022 Aug 5. doi: 10.1007/s00204-022-03352-9.

Studies suggest that chronic lead (Pb) exposure may induce deoxyribonucleic acid (DNA) damage.

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ENVIRONMENTAL RESEARCH

Environmentally realistic concentrations of ibuprofen influence life histories but not population dynamics of *Daphnia magna*

2022-08-01

Ibuprofen is a nonsteroidal anti-inflammatory drug that can be found in freshwater ecosystems. Due to its current presence in aquatic ecosystems, this pharmaceutical has aroused concerns about its impact on aquatic biota. As a result, ibuprofen is the one of the most frequently studied pharmaceuticals. However, most of these studies focus on short-term observations of biomarkers and physiological endpoints. This paper presents the outcomes of whole-life-cycle observations and six-month observations of the population dynamics of *Daphnia magna* reared under the influence of 1 µg/L, 2 µg/L and 4 µg/L of ibuprofen. Individuals reared under the influence of ibuprofen grew slowly, matured later and lived longer. Moreover, they displayed a higher reproduction rate and carried smaller broods but delivered larger neonates. Ibuprofen in concentrations of 1 µg/L and 2 µg/L had the most significant effect on the above traits. The observed impact of ibuprofen at the individual level did not transfer to population size and dynamics. All the populations represented a typical boom and bust cycle with restricted reproduction during the periods of highest population size. This is the first study to explore the linkage between the life histories of aquatic invertebrates and the actual response of their populations to the occurrence of ibuprofen in the environment. The study emphasizes the need to apply the protocol of whole life-cycle observation in tandem with population scrutiny, since such a protocol can reveal the virtual responses of aquatic biota to the presence of chemicals in the environment.

Authors: Małgorzata Adamczuk

Full Source: The Science of the total environment 2022 Aug 1;157783. doi: 10.1016/j.scitotenv.2022.157783.

Legacy and emerging pollutants in Latin America: A critical review of occurrence and levels in environmental and food samples

2022-08-03

The increase and indiscriminate use of personal care products, food products, fertilizers, pesticides, and health products, among others, have resulted/are resulting in extensive environmental contamination. Most of

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these products contain traces of widespread chemicals, usually known as emerging pollutants (EPs) or pollutants of emerging concern (PEC). The Latin American (LA) region comprises 20 countries with different social and cultural aspects, with 81 % of the population living in urban areas. The LA region has some countries on the top list of users/consumers of EPs, from pesticides and fertilizers to personal care products. However, there is a gap in information related to the distribution of EPs in the environment of this region, with very few existing review texts exploring this issue. Therefore, this present paper advances this approach. An exhaustive literature review, with the selection of 176 documents, provided unique up-to-date information on the presence/distribution of 17 classes of legacy or emerging pollutants in different food and environmental matrices (soil, sediment, water, and air). The study shows that the wide distribution and recorded levels of these pollutants in the continental environment are potential risks to human health, mainly through food and drinking water ingestion. Polycyclic aromatic hydrocarbons are pollutants of deep public concern since they show carcinogenic properties. Several classes of pollutants, like endocrine disruptors, have caused harmful effects on humans and the environment. Besides that, pharmaceutical products and pesticides are compounds of high consumption worldwide, being environmental contamination a real and ongoing possibility. Finally, gaps and future research needs are deeply pointed out.

Authors: Marília Cristina Oliveira Souza, Bruno Alves Rocha, Joseph A Adeyemi, Martí Nadal, José Luis Domingo, Fernando Barbosa Jr

Full Source: The Science of the total environment 2022 Aug 3;157774. doi: 10.1016/j.scitotenv.2022.157774.

PHARMACEUTICAL/TOXICOLOGY

The PFAS-Tox Database: A systematic evidence map of health studies on 29 per- and polyfluoroalkyl substances

2022-07-14

Background: PFAS (per- and polyfluoroalkyl substances) are a large class of synthetic chemicals widely used in consumer products and industrial processes. The scientific literature on PFAS has increased dramatically in the last decade. Many stakeholders, including regulators, scientists, non-governmental organizations, and concerned individuals could benefit from an efficient way to access the health and toxicological literature related to PFAS.

Objective: To create a systematic evidence map of the available peer-reviewed health or toxicological research for 29 PFAS.

Background: PFAS (per- and polyfluoroalkyl substances) are a large class of synthetic chemicals widely used in consumer products and industrial processes.

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Methods: A protocol for conducting this systematic evidence map was initially published on Zenodo (Pelch et al. 2019c), then peer reviewed and published in Environment International (Pelch et al. 2019d). PubMed database was searched through January 25, 2021. Studies were screened for inclusion and exclusion according to the Populations, Exposures, Comparators, and Outcomes (PECO) statement. Inclusion criteria were intentionally broad and included any human, animal, and/or in vitro study that investigated exposure to one of the 29 PFAS of interest and a human health or toxicological effect. Selected study details were extracted from included studies as described in the protocol. Study appraisal was not conducted. The included studies and extracted meta-data are freely available in the online, interactive systematic evidence map at <https://pfastoxdatabase.org>.

Results: Over 15,000 studies were retrieved from the PubMed literature searches. After manual screening, 1,067 studies were identified and included as investigating the health or toxicological effect of one or more PFAS of interest. There were 505 human, 385 animal, and 220 in vitro studies. Summary tables of the extracted data and overall observations are included in this report.

Conclusions: The PFAS-Tox Database is a useful tool for searching, filtering, and identifying peer reviewed research on the health and toxicological effects of the included PFAS. In this summary of the evidence map we provide examples of data gaps and clusters revealed by the database, with the goal of helping direct future research efforts, facilitate systematic reviews (e.g. on immune effects, mixtures of PFAS, or effects of short chain PFAS), inform regulatory risk assessments, and improve opportunities for cross-disciplinary coordination. We also discuss how this tool supports scientists, regulatory agencies, and other individuals by increasing awareness and access to current evidence regarding the health effects associated with PFAS exposure.

Authors: Katherine E Pelch, Anna Reade, Carol F Kwiatkowski, Francheska M Merced-Nieves, Haleigh Cavalier, Kim Schultz, Taylor Wolffe, Julia Varshavsky

Full Source: Environment international 2022 Jul 14;167:107408. doi: 10.1016/j.envint.2022.107408.

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Positive association between dietary exposure to polybrominated diphenyl ethers and breast cancer risk in the French E3N cohort: The role of vegetable oil consumption

2022-07-30

Exposure to endocrine-disrupting chemicals, like Polybrominated diphenyl ethers (PBDEs), is suspected of playing a role in the occurrence of breast cancer. Moreover, there is growing evidence that food chemical contaminants, especially lipophilic ones such as PBDEs, could interact with different components of the diet. The objective of the present study was to assess the association between dietary intake of PBDEs and breast cancer risk in the French E3N cohort study, and to investigate the potential modification of this association by vegetable oil consumption. The study included 67879 women. Intakes of eight PBDEs were estimated using food consumption data from a validated semi-quantitative food frequency questionnaire, and food contamination levels measured by the French Agency for Food, Environmental and Occupational Health and Safety (ANSES). Cox proportional hazards models were used to estimate Hazard Ratios (HR) and 95% Confidence Intervals (CI) for the association between total PBDEs dietary intake and breast cancer risk. Interaction measures for vegetable oil consumption were estimated on both additive and multiplicative scales. The women were followed for a maximum of 21.4 years, and 5 686 developed an incident breast cancer. A positive linear trend was highlighted between dietary intake of PBDEs in quintile groups and breast cancer risk, borderline with statistical significance (p-trend = 0.06, HRQ5vsQ1 and 95% CI: 1.09 [0.99;1.20]). Interaction measures for vegetable oil consumption were significant in both additive and multiplicative scales. Higher effect sizes of the association were highlighted in high consumers of vegetable oil, i.e. ≥ 4.6 g/day (HRQ5vsQ1 and 95% CI: 1.23 [1.08; 1.40]), and almost no effect were found in low consumers (HRQ5vsQ1 and 95% CI: 0.97 [0.86; 1.10]). Highlighting such interactions between nutrients and chemicals is crucial to develop efficient dietary recommendations to limit the negative health effects associated with exposure to food chemical contaminants.

Authors: Pauline Frenoy, Chloé Marques, Thibault Fiolet, German Cano-Sancho, Gianluca Severi, Francesca Romana Mancini

Full Source: Environment international 2022 Jul 30;167:107444. doi: 10.1016/j.envint.2022.107444.

Exposure to endocrine-disrupting chemicals, like Polybrominated diphenyl ethers (PBDEs), is suspected of playing a role in the occurrence of breast cancer.

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OCCUPATIONAL

Risk assessment and dose-effect of co-exposure to benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS) on pulmonary function: A cross-sectional study

2022-08-03

Inhalation is the most frequent route and the lung is the primary damaged organ for human exposure to benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS). However, there is limited information on the risk and dose-effect of the BTEXS mixture on pulmonary function, particularly the overall effect. We conducted a cross-sectional study in a petrochemical plant in southern China. Spirometry and cumulative exposure dose (CED) of BTEXS were used to measure lung function and exposure levels for 635 workers in 2020, respectively. Forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) were tested and interpreted as percentages to predicted values [FVC or FEV1% predicted], and FEV1 to FVC ratio [FEV1/FVC (%)]. We found the reduction in FVC% predicted and the risk of lung ventilation dysfunction (LVD) and its two subtypes (mixed and restrictive ventilation dysfunction, MVD, and MVD) were significantly associated with BTEXS individuals. In addition, pulmonary function damage associated with BTEXS was modified by the smoking status and age. Generalized weighted quantile sum (gWQS) regressions were used to estimate the overall dose-effect on lung function damage induced by the BTEXS mixture. Our results show wqs, an index of weighted quartiles for BTEXS, was potentially associated with the reduction in FVC and FEV1% predicted with the coefficients [95% confidence intervals (CI)] between -1.136 (-2.202, -0.070) and -1.230 (-2.265, -0.195). Odds ratios (ORs) and 95% CIs for the wqs index of LVD, MVD, and RVD were 1.362 (1.129, 1.594), 1.323 (1.084, 1.562), and 1.394 (1.096, 1.692), respectively. Furthermore, xylene, benzene, and toluene in the BTEXS mixture potentially contribute to the development of lung function impairment. Our novel findings demonstrated the dose-response relationships between pulmonary function impairment and the BTEXS mixture and disclosed the potential key pollutants in the BTEXS mixture.

Authors: Qilong Liao, Yan Zhang, Rui Ma, Zhaorui Zhang, Penglei Ji, Minghui Xiao, Rui Du, Xin Liu, Ying Cui, Xiumei Xing, Lili Liu, Shanfeng Dang, Qifei Deng, Yongmei Xiao

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Aug 3;119894. doi: 10.1016/j.envpol.2022.119894.

Inhalation is the most frequent route and the lung is the primary damaged organ for human exposure to benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS).

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Enrichment and removal of five brominated flame retardants in the presence of co-exposure in a soil-earthworm system

2022-08-01

Brominated flame retardants (BFRs) are widely used because of their excellent flame retardant performance and are frequently detected in the soil environment. Their adverse impacts on soil organisms cannot be ignored. The enrichment and removal dynamics of the five BFRs (pentabromotoluene (PBT), hexabromobenzene (HBB), 1,2-bis(2,4,6-tribromophenoxy) ethane (BTBPE), decabromodiphenyl ethane (DBDPE), and decabromodiphenyl ether (BDE209)) in earthworms and different tissues (epidermis, intestinal tract, and cast) in the presence of co-exposure were explored for the first time. The results showed that the enrichment of the five BFRs in earthworms increased with increasing exposure concentration and time. The distribution of these chemicals in different tissues of earthworms was different. The contents of HBB and PBT in the intestine and epidermis were the highest and were more than 60% during most of the time. Additionally, the contents of BTBPE, BDE209, and DBDPE were significantly increased while the contents of HBB and PBT were significantly decreased in the cast. The correlation analysis indicated that HBB and PBT had a significant relationship in all the tissues, but BDE209 and DBDPE only had a relationship in the cast, which might be attributed to the structure of the pollutants. Additionally, the experiments illustrated that earthworms had strong removal for HBB and PBT, but were weak for DBDPE and BDE209.

Authors: Zhihua Qiao, Cong Lu, Yanna Han, Kailun Luo, Mengru Fu, Shanqi Zhou, Cheng Peng, Wei Zhang

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Aug 1;310:119877. doi: 10.1016/j.envpol.2022.119877.

Association between occupational exposure to chemical or physical factors and sleep disturbance: An analysis of the fifth Korean Working Conditions Survey

2022-08-01

Objective: A range of risk factors in occupational environments can negatively affect the sleep of workers. Although psychosocial factors have been emphasized in various studies, few have reported on the relationship between physical or chemical exposure in the workplace and sleep disturbances. Thus, this study aimed to investigate the relationship

Brominated flame retardants (BFRs) are widely used because of their excellent flame retardant performance and are frequently detected in the soil environment.

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between occupational exposure to physical or chemical factors and sleep disturbances.

Design: Cross-sectional study.

Setting: Data from the fifth Korean Working Conditions Survey (KWCS).

Participants: The target population of the fifth KWCS was economically active individuals aged 15 years or older in all Korean households in 2017, resulting in a total study population of 50,176 participants. After excluding the unemployed, full-time students, homemakers, and the retired, 36,996 employees were included in the current study.

Measurements: Exposure to occupational physical or chemical risk factors was assessed by multiplying the exposure scales of physical or chemical risk factors and weekly working hours. Sleep disturbance was estimated using the Minimal Insomnia Symptom Scale.

Results: In the fully adjusted logistic regression model, exposure to the following risk factors was positively associated with sleep disturbance: vibration (odds ratio [OR], 1.74); noise (OR, 2.28); high temperatures (OR, 2.43); low temperatures (OR, 2.51); smoke, fume, and dust (OR, 2.12); vapors of solvents or thinners (OR, 3.78); chemical substances (OR, 3.78); and environmental smoking (OR, 5.03).

Conclusions: The results of this study provide evidence of a relationship between occupational exposure to physical or chemical factors and sleep disturbances.

Authors: Seong-Sik Cho, Mo-Yeol Kang

Full Source: Sleep health 2022 Aug 1;S2352-7218(22)00087-0. doi: 10.1016/j.sleh.2022.06.004.

Acute respiratory distress after exposure to chlorine dioxide-based disinfectant

2022-08-06

A hospital cleaner developed acute respiratory distress after working with a chlorine dioxide-based disinfectant. The content of chlorine dioxide in the product is below the limit that would require the product to be labelled as hazardous to health, but we show with a simple estimation that the relevant threshold limit values for chlorine dioxide in the working atmosphere may be exceeded under normal use of the product. This may have implications for risk assessment of the use of such chlorine dioxide-based disinfectants and may warrant stricter regulations for labelling these products.

Authors: Erlend Hassel, Hans Thore Smedbold, Hilde Brun Lauritzen

Full Source: Occupational medicine (Oxford, England) 2022 Aug 6;kqac078. doi: 10.1093/occmed/kqac078.

A hospital cleaner developed acute respiratory distress after working with a chlorine dioxide-based disinfectant.