CHEMWATCH

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CHEMICAL EFFECTS

Tyre additive chemicals, tyre road wear particles and high production polymers in surface water at 5 urban centres in Queensland, Australia

2022-09-06

Plastics pollution is a global issue impacting every part of our environment. Tyre road wear particle (TRWP) plastics pollution is thought to be one of the largest pollution sources in urban environments. These plastics are also of concern due to the presence of additive chemicals, incorporated during manufacture, that can be released into the surrounding environment. This study aimed to provide information on concentrations of a range of anthropogenic plastics related pollutants in the Australian environment through a scoping study of surface water in 5 key urban centres around Queensland, Australia. Samples were analysed for a suite of 15 common tyre additive chemicals, TRWPs and 6 common high production polymers, and included the new transformation product of concern 6PPD-quinone which has recent reports of causing mass mortality events in certain aquatic species. The additives were ubiquitously detected (2.9-1440 ng/L) with 6PPD-quinone concentrations lower than in previous studies (<0.05-24 ng/L) and TRWPs detected at 18 of the 21 sites (<MDL to between 690 and 1990 µg/L). Of the high production polymers, polyethylene and polypropylene were detected at the highest concentrations (16-1750 and <0.7-37 µg/L respectively) with profiles highly variable between sites. A traffic related additive profile was determined at 7 sites, which all had nearby traffic related sources. Concentrations of additive chemicals were significantly correlated with average daily traffic volumes (p = 0.006), although concentrations of TRWPs were not correlated. Generally, concentrations were in line with or lower than concentrations in other geographical regions, although it is noted samples were collected during the dry season and further sampling during the tropical wet season would be of interest.

Plastics pollution is a global issue impacting every part of our environment.

Authors: Cassandra Rauert, Suzanne Vardy, Benjamin Daniell, Nathan Charlton, Kevin V Thomas

Full Source: The Science of the total environment 2022 Sep 6;852:158468. doi: 10.1016/j.scitotenv.2022.158468

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Molecular fingerprints of polar narcotic chemicals based on heterozygous essential gene knockout library in Saccharomyces cerevisiae

2022-09-07

Cytotoxicity of non-polar narcotic chemicals can be predicted by quantitative structure activity relationship (QSAR) models, but the polar narcotic chemicals' actual cytotoxicity exceeds the predicted values by their chemical structures. This discrepancy indicates that the molecular mechanism by which polar narcotic chemicals exert their toxicity is unclear. Taking advantage of Saccharomyces cerevisiae (yeast) functional genome-wide heterozygous essential gene knockout mutants, we here have identified the specific molecular fingerprints of two main chemical structure groups (phenols and anilines) of polar narcotic chemicals (dichlorophen (DCP), 4-chlorophenol (4-CP), 2, 4, 6-trichlorophenol (TCP), 3, 4-dichloroaniline (DCA) and N-methylaniline (NMA)) and one non-polar narcotic chemical 2, 2, 2-trichloroethanol (TCE). Especially, we identify 33, 57, 54, 46, 59 and 53 responsive strains through exposure to TCE, DCP, 4-CP, TCP, DCA and NMA with three test concentrations, respectively, revealing that these polar narcotic chemicals have more responsive strains than the non-polar narcotic chemical. Remarkably, we find that the molecular fingerprints of polar narcotic chemicals in different chemical structure groups are obviously varied, particularly phenols and anilines have their own specific molecular fingerprints. Interestingly, our results demonstrate that the molecular toxicity mechanisms of anilines are associated with DNA replication, but phenols are related with pathway of RNA degradation. Additionally, we find that the two knockout strains (SME1 and DIS3) and the three knockout strains (TSC11, RSP5 and HSF1) can specifically respond to exposure to phenols and anilines, respectively. Thus, they may be served as potential biomarkers to distinguish phenols from anilines. Collectively, our works demonstrate that the functional genomic platform of yeast essential gene mutants can not only act as an effective tool to identify key specific molecular fingerprints for polar narcotic chemicals, but also help to understand the molecular mechanisms of polar narcotic chemicals.

Cytotoxicity of non-polar narcotic chemicals can be predicted by quantitative structure activity relationship (QSAR) models, but the polar narcotic chemicals' actual cytotoxicity exceeds the predicted values by their chemical structures.

Authors: Miao Guan, Wenya Ji, Yue Xu, Lu Yan, Dong Chen, Shengjie Li, Xiaowei Zhang

Full Source: Chemosphere 2022 Sep 7;308(Pt 2):136343. doi: 10.1016/j.chemosphere.2022.136343.

Metabolomics for exposure assessment and toxicity effects of occupational pollutants: current status and future perspectives

2022-09-09

Introduction: Work-related exposures to harmful agents or factors are associated with an increase in incidence of occupational diseases. These exposures often represent a complex mixture of different stressors, challenging the ability to delineate the mechanisms and risk factors underlying exposure-disease relationships. The use of omics measurement approaches that enable characterization of biological marker patterns provide internal indicators of molecular alterations, which could be used to identify bioeffects following exposure to a toxicant. Metabolomics is the comprehensive analysis of small molecule present in biological samples, and allows identification of potential modes of action and altered pathways by systematic measurement of metabolites.

Objectives: The aim of this study is to review the application of metabolomics studies for use in occupational health, with a focus on applying metabolomics for exposure monitoring and its relationship to occupational diseases.

Methods: PubMed, Web of Science, Embase and Scopus electronic databases were systematically searched for relevant studies published up to 2021.

Results: Most of reviewed studies included worker populations exposed to heavy metals such as As, Cd, Pb, Cr, Ni, Mn and organic compounds such as tetrachlorodibenzo-p-dioxin, trichloroethylene, polyfluoroalkyl, acrylamide, polyvinyl chloride. Occupational exposures were associated with changes in metabolites and pathways, and provided novel insight into the relationship between exposure and disease outcomes. The reviewed studies demonstrate that metabolomics provides a powerful ability to identify metabolic phenotypes and bioeffect of occupational exposures.

Conclusion: Continued application to worker populations has the potential to enable characterization of thousands of chemical signals in biological samples, which could lead to discovery of new biomarkers of exposure for chemicals, identify possible toxicological mechanisms, and improved understanding of biological effects increasing disease risk associated with occupational exposure.

Authors: Fatemeh Dehghani, Saeed Yousefinejad, Douglas I Walker, Fariborz Omidi

Full Source: Metabolomics : Official journal of the Metabolomic Society 2022 Sep 9;18(9):73. doi: 10.1007/s11306-022-01930-7.

Introduction: Work-related exposures to harmful agents or factors are associated with an increase in incidence of occupational diseases.

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ENVIRONMENTAL RESEARCH

Neurotoxic effects of environmental contaminants-measurements, mechanistic insight, and environmental relevance

2022-09-05

Pollution is a significant and growing concern for any population regardless of age because these environmental contaminants exhibit different neurodegenerative effects on persons of different ages. These environmental contaminants are the products of human welfare projects like industry, automobile exhaust, clinical and research laboratory extrudes, and agricultural chemicals. These contaminants are found in various forms in environmental matrices like nanoparticles, particulate matter, lipophilic vaporized toxicants, and ultrafine particulate matter. Because of their small size, they can easily cross blood-brain barriers or use different cellular mechanisms for assistance. Other than this, these contaminants cause an innate immune response in different cells of the central nervous system and cause neurotoxicity. Considering the above critiques and current needs, this review summarizes different protective strategies based on bioactive compounds present in plants. Various bioactive compounds from medicinal plants with neuroprotective capacities are discussed with relevant examples. Many in vitro studies on clinical trials have shown promising outcomes using plant-based bioactive compounds against neurological disorders.

Authors: Nadia Afsheen, Sadia Rafique, Hamza Rafeeq, Kanwal Irshad, Asim Hussain, Zille Huma, Vineet Kumar, Muhammad Bilal, Lotfi Aleya, Hafiz M N Iqbal

Full Source: Environmental science and pollution research international 2022 Sep 5. doi: 10.1007/s11356-022-22779-2.

Pollution is a significant and growing concern for any population regardless of age because these environmental contaminants exhibit different neurodegenerative effects on persons of different ages.

Priority pesticides in Chile: predicting their environmental distribution, bioaccumulation, and transport potential

2022-09-07

Agriculture is one of the main economic activities in Chile and is associated with extensive use of pesticides, which can represent a risk to the environment and to human health. Currently, there are over 400 pesticides approved for commerce in Chile, including chemicals banned in other countries (e.g., flocoumafen, chlorfenapyr). An empirical analysis of their potential environmental effects is difficult due to this large number, thus opening the doors for the use of computational tools

for prioritization efforts based on their persistence, bioaccumulation, and transport potential in the environment. The main objectives of this study were to estimate the properties and environmental distribution of pesticides approved for commerce in Chile and to generate a priority list for further evaluation in local environments. We used the EPI Suite interface to estimate the distribution coefficients, half-lives, and bioaccumulation potential of all pesticides registered in the Chilean Agriculture and Livestock Services (SAG). Additionally, the Pov & LRTP Screening Tool was used to estimate their overall persistence and long-range transport potential in the environment. The results were used to develop a P-B-LRT score, which considered persistence, bioaccumulation, and long-range transport potential. All pesticides were compared to a group of polychlorinated biphenyls (PCBs), used as reference compounds, to generate a list of priority pesticides with Persistent Organic Pollutants characteristics (POP-like). The results showed that most pesticides were distributed between the organic phase and water, where they also showed the longest half-lives and bioaccumulation potential. A group of 21 pesticides showed relatively high P-B-LRT scores, compared to PCBs, and were classified as priority compounds. The list was further refined based on the volume of sales for each pesticide. This article is protected by copyright. All rights reserved. © 2022 SETAC.

Authors: Carolina Concha, Carlos A Manzano

Full Source: Integrated environmental assessment and management 2022 Sep 7. doi: 10.1002/ieam.4680.

Environmental contamination status with common ingredients of household and personal care products exhibiting endocrine-disrupting potential

2022-09-09

The continuous use of household and personal care products (HPCPs) produces an immense amount of chemicals, such as parabens, bisphenols, benzophenones and alkylphenol ethoxylates, which are of great concern due to their well-known endocrine-disrupting properties. These chemicals easily enter the environment through man-made activities, thus contaminating the biota, including soil, water, plants and animals. Thus, on top of the direct exposure on account of their presence in HPCPs, humans are also susceptible to secondary indirect exposure attributed to the ubiquitous environmental contamination. The aim of this review was therefore to examine the sources and occurrence of these noteworthy contaminants (i.e. parabens, bisphenols, benzophenones, alkylphenol ethoxylates), to summarise the available research on their environmental

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presence and to highlight their bioaccumulation potential. The most notable environmental contaminants appear to be MeP and PrP among parabens, BPA and BPS among bisphenols, BP-3 among benzophenones and NP among alkylphenols. Their maximum detected concentrations in the environment are mostly in the range of ng/L, while in human tissues, their maximum concentrations achieved µg/L due to bioaccumulation, with BP-3 and nonylphenol showing the highest potential to bioaccumulate. Finally, of another great concern is the fact that even the unapproved parabens and benzophenones have been detected in the environment.

Authors: Veronika Klančič, Martina Gobec, Žiga Jakopin

Full Source: Environmental science and pollution research international 2022 Sep 9. doi: 10.1007/s11356-022-22895-z.

PHARMACEUTICAL/TOXICOLOGY

Colorectal cancer and occupational exposure to solar ultraviolet B radiation in Denmark

2022-09-06

Objectives: Solar ultraviolet B radiation (UV) may reduce the risk of cancer, including colorectal cancer (CRC), although the evidence is inconclusive. To contribute with evidence, the present largescale register-based nested case-control study aimed to investigate the association between occupational UV exposure and CRC in Denmark.

Methods: The Danish Cancer Registry was used to identify a total of 12,268 men and women diagnosed with primary CRC before age 70. Five controls matched on year of birth and sex, alive and free of CRC at the time of diagnosis of the index case were randomly selected from The Danish Civil Registration System. Occupational UV exposure was assessed by obtainment of full employment history from the Danish Supplementary Pension Fund Register, which was linked to a job exposure matrix. Conditional logistic regression was used to estimate odds ratios (ORs) with corresponding 95% confidence intervals.

Results: We observed an inverse association between longer duration of UV exposure and CRC in women (≥20 years: OR = 0.84, 95% CI: 0.69-1.03), while no noteworthy associations were observed in men. When focusing on colon cancer only, longer duration of UV exposure (>20 years: OR = 0.92, 95% CI: 0.83-1.01) and higher cumulative UV exposure (highest exposure category: OR = 0.90, 95% CI: 0.83-0.99) were indicated to lower the risk in the study population including both men and women, although

Objectives: Solar ultraviolet B radiation (UV) may reduce the risk of cancer, including colorectal cancer (CRC), although the evidence is inconclusive.

the risk reduction appeared to be more evident for women. No consistent risk patterns were observed for rectal cancer.
Conclusions: The present study suggests a modest protective effect from long-term occupational UV exposure on the risk of colon cancer. The effect may be greater in women and these findings need further attention in future large-scale studies.
Authors: Julie Elbaek Pedersen, Johnni Hansen
Full Source: Environmental research 2022 Sep 6;215(Pt 1):114260. doi: 10.1016/j.envres.2022.114260.

Suspect and non-targeted screening-based human biomonitoring identified 74 biomarkers of exposure in urine of Slovenian children

2022-09-02
Human exposure to organic contaminants is widespread. Many of these contaminants show adverse health effects on human population. Human biomonitoring (HBM) follows the levels and the distribution of biomarkers of exposure (BoE), but it is usually done in a targeted manner. Suspect and non-targeted screening (SS/NTS) tend to find BoE in an agnostic way, without preselection of compounds, and include finding evidence of exposure to predicted, unpredicted known and unknown chemicals. This study describes the application of high-resolution mass spectrometry (HRMS)-based SS/NTS workflow for revealing organic contaminants in urine of a cohort of 200 children from Slovenia, aged 6-9 years. The children originated from two regions, urban and rural, and the latter were sampled in two time periods, summer and winter. We tentatively identified 74 BoE at the confidence levels of 2 and 3. These BoE belong to several classes of pharmaceuticals, personal care products, plasticizers and plastic related products, volatile organic compounds, nicotine, caffeine and pesticides. The risk of three pesticides, atrazine, amitraz and diazinon is of particular concern since their use was limited in the EU. Among BoE we tentatively identified compounds that have not yet been monitored in HBM schemes and demonstrate limited exposure data, such as bisphenol G, polyethylene glycols and their ethers. Furthermore, 7 compounds with unknown use and sources of exposure were tentatively identified, either indicating the entry of new chemicals into the market, or their metabolites and transformation products. Interestingly, several BoE showed location and time dependency. Globally, this study presents high-throughput approach to SS/NTS for HBM. The results shed a light on the exposure of

Human exposure to organic contaminants is widespread.

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Slovenian children and raise questions on potential adverse health effects of such mixtures on this vulnerable population.
Authors: Žiga Tkalec, Garry Codling, Janja Snoj Tratnik, Darja Mazej, Jana Klánová, Milena Horvat, Tina Kosjek
Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Sep 2;313:120091. doi: 10.1016/j.envpol.2022.120091.

OCCUPATIONAL

Developing human biomonitoring as a 21st century toolbox within the European exposure science strategy 2020-2030

2022-08-28
Human biomonitoring (HBM) is a crucial approach for exposure assessment, as emphasised in the European Commission's Chemicals Strategy for Sustainability (CSS). HBM can help to improve chemical policies in five major key areas: (1) assessing internal and aggregate exposure in different target populations; 2) assessing exposure to chemicals across life stages; (3) assessing combined exposure to multiple chemicals (mixtures); (4) bridging regulatory silos on aggregate exposure; and (5) enhancing the effectiveness of risk management measures. In this strategy paper we propose a vision and a strategy for the use of HBM in chemical regulations and public health policy in Europe and beyond. We outline six strategic objectives and a roadmap to further strengthen HBM approaches and increase their implementation in the regulatory risk assessment of chemicals to enhance our understanding of exposure and health impacts, enabling timely and targeted policy interventions and risk management. These strategic objectives are: 1) further development of sampling strategies and sample preparation; 2) further development of chemical-analytical HBM methods; 3) improving harmonisation throughout the HBM research life cycle; 4) further development of quality control / quality assurance throughout the HBM research life cycle; 5) obtain sustained funding and reinforcement by legislation; and 6) extend target-specific communication with scientists, policymakers, citizens and other stakeholders. HBM approaches are essential in risk assessment to address scientific, regulatory and societal challenges. HBM requires full and strong support from the scientific and regulatory domain to reach

Human biomonitoring (HBM) is a crucial approach for exposure assessment, as emphasised in the European Commission's Chemicals Strategy for Sustainability (CSS).

its full potential in public and occupational health assessment and in regulatory decision-making.
Authors: Maryam Zare Jeddi, Nancy B Hopf, Henriqueta Louro, Susana Viegas, Karen S Galea, Robert Pasanen-Kase, Tiina Santonen, Vicente Mustieles, Mariana F Fernandez, Hans Verhagen, Stephanie K Bopp, Jean Philippe Antignac, Arthur David, Hans Mol, Robert Barouki, Karine Audouze, Radu-Corneliu Duca, Peter Fantke, Paul Scheepers, Manosij Ghosh, An Van Nieuwenhuyse, Joana Lobo Vicente, Xenia Trier, Loïc Rambaud, Clémence Fillol, Sebastien Denys, André Conrad, Marike Kolossa-Gehring, Alicia Paini, Jon Arnot, Florian Schulze, Kate Jones, Ovnair Sepai, Imran Ali, Lorraine Brennan, Emilio Benfenati, Francesco Cubadda, Alberto Mantovani, Alena Bartonova, Alison Connolly, Jaroslav Slobodnik, Yuri Bruinen de Bruin, Jacob van Klaveren, Nicole Palmen, Hubert Dirven, Trine Husøy, Cathrine Thomsen, Ana Virgolino, Martin Röösli, Tim Gant, Natalie von Goetz, Jos Bessems
Full Source: Environment international 2022 Aug 28;168:107476. doi: 10.1016/j.envint.2022.107476.

Occupational acute argon gas poisoning: A case report

2022-09-09
Rationale: Intentional or unintentional exposure to asphyxiating gases is a significant public health concern worldwide. Argon poisoning is fatal, and its onset is primarily due to neurological damage.
Patient concerns: A 22-year-old man was admitted to the hospital for argon gas poisoning. While working in a plant containing argon gas, he suddenly lost consciousness, recovered consciousness slightly after on-site treatment, answered questions, and had impaired memory, sensory dullness, normal cognition, and symptoms of dizziness and headache.
Diagnosis: Asphyxiating gas poisoning (argon gas poisoning), metabolic encephalopathy, and hepatic insufficiency.
Interventions: Immediately after admission, the patient was treated with nasal cannula oxygen 3 L/min and hyperbaric oxygen therapy once a day. Mecobalamin tablets 500 μg were given orally 3 times a day. Oral Ginkgo biloba extract tablets 40 mg 3 times a day.
Outcome: The patient was discharged after treatment with hyperbaric oxygen therapy and nerve-nourishing drugs, with no discomfort, clear consciousness, and good memory, and was followed up by telephone for 2 consecutive months, and the patient is now in good condition with no discomfort.
Lesson: This case describes the pathogenesis, neurological damage, and rescue process of argon gas poisoning. Argon poisoning was found

Rationale: Intentional or unintentional exposure to asphyxiating gases is a significant public health concern worldwide.

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to damage bilateral cerebellar hemispheres and bilateral hippocampal regions, affecting the patient's consciousness and memory, and was found to cause abnormal liver function and heart rate disorders.
Authors: Yongkai Li, Jianzhong Yang
Full Source: Medicine 2022 Sep 9;101(36):e30491. doi: 10.1097/MD.0000000000030491.