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CHEMICAL EFFECTS

Toxicity of the 3,4-Methylenedioxymethamphetamine and Its Enantiomers to Daphnia magna after Isolation by Semipreparative Chromatography

2023-02-02
MDMA (3,4-methylenedioxymethamphetamine) is a chiral psychoactive recreational drug sold in illicit markets as racemate. Studies on the impact of MDMA on aquatic organisms are scarce. While enantioselectivity in toxicity in animals and humans has been reported, none is reported on aquatic organisms. This study aimed to investigate the ecotoxicological effects of MDMA and its enantiomers in Daphnia magna. For that, enantiomers (enantiomeric purity > 97%) were separated by liquid chromatography using a homemade semipreparative chiral column. Daphnids were exposed to three concentrations of (R,S)-MDMA (0.1, 1.0 and 10.0 µg L-1) and two concentrations of (R)- and (S)-enantiomers (0.1 and 1.0 µg L-1) over the course of 8 days. Morphophysiological responses were dependent on the substance form and daphnia development stage, and they were overall not affected by the (R)-enantiomer. Changes in swimming behaviour were observed for both the racemate and its enantiomers, but enantioselective effects were not observed. Reproductive or biochemical changes were not observed for enantiomers whereas a significant decrease in acetylcholinesterase and catalase activity was noted at the highest concentration of (R,S)-MDMA (10 µg L-1). Overall, this study showed that sub-chronic exposure to MDMA racemate and its enantiomers can interfere with morphophysiological and swimming behaviour of D. magna. In general, the (R)-enantiomer demonstrated less toxicity than the (S)-enantiomer.
Authors: Ana Rita Costa, Virgínia M F Gonçalves, Bruno B Castro, João Soares Carrola, Ivan Langa, Ariana Pereira, Ana Rita Carvalho, Maria Elizabeth Tiritan, Cláudia Ribeiro
Full Source: Molecules (Basel, Switzerland) 2023 Feb 2;28(3):1457. doi: 10.3390/molecules28031457.

MDMA (3,4-methylenedioxy-methamphetamine) is a chiral psychoactive recreational drug sold in illicit markets as racemate.

Recent advances in nanomaterials based sustainable approaches for mitigation of emerging organic pollutants

2023-02-09
Emerging pollutants (EPs) are a category of pollutants that are relatively new to the environment and recently garnered a lot of attention. The majority of EPs includes endocrine-disrupting chemicals (EDCs),

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antibiotic resistance genes (ARGs), and pharmaceutical and personal care products (PPCPs). Exposure to contaminated water has been linked to an increase in incidences of malnutrition, intrauterine growth retardation, respiratory illnesses, liver malfunctions, eye and skin diseases, and fatalities. Consequently, there is a critical need for wastewater remediation technologies which are effective, reliable, and economical. Conventional wastewater treatment methods have several shortcomings that can be addressed with the help of nanotechnology. Unique characteristics of nanomaterials (NMs) make them intriguing and efficient alternative in wastewater treatment strategies. This review emphasis on the occurrence of divers emerging organic pollutants (EOPs) in water and their effective elimination via different NMs based methods with in-depth mechanisms. Furthermore, it also delves the toxicity assessment of NMs and critical challenges, which are crucial steps for practical implementations.
Authors: Monika Bhattu, Jagpreet Singh
Full Source: Chemosphere 2023 Feb 9;138072. doi: 10.1016/j.chemosphere.2023.138072.

Phytotoxicity and genotoxicity of agro-industrial digested sludge hydrochar: The role of heavy metals

2023-02-09
Hydrochar is a new carbonaceous product obtained via hydrothermal carbonization of wet biomass, such as sludges or digested sludges, which often have disposal problems, also due to the presence of contaminants such as heavy metals. The properties of the hydrochar led to an interest in using it as an amendment, but the agro-environmental properties must be considered for its safe use. Raw hydrochar produced by agro-industrial digestate and relative three acidic post-treated hydrochars (for heavy metals removal) have been assessed considering their effect on phytotoxicity, soil, plant growth, mutagenicity, and genotoxicity. The chemical characterization showed the effect of post-treatment on heavy metals contents reduction, except for Cu content (hydrochar, 650 mg/kg; post-treated hydrochars, 940 mg/kg, 287 mg/kg, and 420 mg/kg). The acidic post-treatment also reduces the phytotoxicity compared to raw hydrochar (the germination index at 16 % of hydrochar concentration was: hydrochar, 61.48 %; post-treated hydrochars, 82.27 %, 58.28 %, and 82.26 %), but the low pH and the impact on N-cycle probably have caused the detrimental effect on plant growth of post-treated hydrochar. No mutagenic activity was observed in bacteria using Ames test, while all the samples induced chromosomal aberrations in plant cells (Allium cepa test). The approach adopted, which considers phytotoxicity, plant growth-

Hydrochar is a new carbonaceous product obtained via hydro-thermal carbonization of wet biomass, such as sludges or digested sludges, which often have disposal problems, also due to the pres-ence of contaminants such as heavy metals.

soil effects, and mutagenicity/genotoxicity bioassays has been proven effective for a proper evaluation of organic products derived from waste to promote a sustainable and circular recovery of materials.
Authors: Daniela Bona, Michela Lucian, Donatella Feretti, Silvia Silvestri, Ilaria Zerbini, Fabio Merzari, Antonio Messineo, Maurizio Volpe
Full Source: The Science of the total environment 2023 Feb 9;162138. doi: 10.1016/j.scitotenv.2023.162138.

ENVIRONMENTAL RESEARCH

Extruded polystyrene microplastics as a source of brominated flame retardant additives in the marine environment: long-term field and laboratory experiments

2023-02-04
Microplastics (MPs) in the environment have become a global concern, not only for the physical effects of the plastic particles themselves but also for being vectors of chemical additives. In this context, little is known about the ability of MPs, particularly extruded polystyrene microplastics (XPS-MPs), to release organic chemical additives in the marine environment. In this study, a series of field and laboratory experiments were carried out to determine the leaching behaviour of organic additives including brominated flame retardants from XPS-MPs into seawater. The conducted experiments confirmed a rapid release of bisphenol A (BPA), 2,4,6-tribromophenol (TBP), tetrabromobisphenol A (TBBPA) and hexabromocyclododecane diastereoisomers (α-, β-, and γ-HBCDD) from the studied MPs followed by a slower rate of release over time. The effects of environmental factors on the leaching rates of these additives were also examined. Increasing Dissolved Organic Matter (DOM) concentrations and the temperature of the seawater enhanced the release of additives by increasing their solubility and polymer flexibility. In contrast, pH tested at 7, 7.5 and 8 was found to have a minor effect on additives leaching; and salinity negatively affected the leaching rate likely due to their reduced solubility and reduced diffusion from the MPs. The present study provides empirical evidence of the behaviour of XPS-MPs as a source of organic additives in the marine environment that merit further investigation.

Microplastics (MPs) in the environment have become a global concern, not only for the physical effects of the plastic particles themselves but also for being vectors of chemical additives.

Authors: Badreddine Barhoumi, Marc Metian, François Oberhaensli, Nikolaos Mourgkogiannis, Hrissi K Karapanagioti, Philippe Bersuder, Imma Tolosa
Full Source: Environment international 2023 Feb 4;172:107797. doi: 10.1016/j.envint.2023.107797.

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Traffic-Related Air Pollution and Ground-Level Ozone Associated Global DNA Hypomethylation and Bulky DNA Adduct Formation

2023-01-20
Studies have indicated that air pollution, including surface-level ozone (O3), can significantly influence the risk of chronic diseases. To better understand the carcinogenic mechanisms of air pollutants and identify predictive disease biomarkers, we examined the association between traffic-related pollutants with DNA methylation alterations and bulky DNA adducts, two biomarkers of carcinogen exposure and cancer risk, in the peripheral blood of 140 volunteers-95 traffic police officers, and 45 unexposed subjects. The DNA methylation and adduct measurements were performed by bisulfite-PCR and pyrosequencing and 32P-postlabeling assay. Airborne levels of benzo(a)pyrene [B(a)P], carbon monoxide, and tropospheric O3 were determined by personal exposure biomonitoring or by fixed monitoring stations. Overall, air pollution exposure was associated with a significant reduction (1.41 units) in global DNA methylation (95% C.I. -2.65-0.04, p = 0.026). The decrement in ALU repetitive elements was greatest in the policemen working downtown (95% C.I. -3.23--0.49, p = 0.008). The DNA adducts were found to be significantly increased (0.45 units) in the municipal officers with respect to unexposed subjects (95% C.I. 0.02-0.88, p = 0.039), mainly in those who were controlling traffic in downtown areas (95% C.I. 0.39-1.29, p < 0.001). Regression models indicated an increment of ALU methylation at higher B(a)P concentrations (95% C.I. 0.03-0.60, p = 0.032). Moreover, statistical models showed a decrement in ALU methylation and an increment of DNA damage only above the cut-off value of 30 µg/m3 O3. A significant increment of 0.73 units of IL-6 gene methylation was also found in smokers with respect to non-smokers. Our results highlighted the role of air pollution on epigenetic alterations and genotoxic effects, especially above the target value of 30 µg/m3 surface-level O3, supporting the necessity for developing public health strategies aimed to reduce traffic-related air pollution molecular alterations.

Studies have indicated that air pollution, including surface-level ozone (O3), can significantly influence the risk of chronic diseases.

Authors: Armelle Munnia, Valentina Bollati, Valentina Russo, Luca Ferrari, Marcello Ceppi, Marco Bruzzone, Stefano Dugheri, Giulio Arcangeli, Franco Merlo, Marco Peluso
Full Source: International journal of molecular sciences 2023 Jan 20;24(3):2041. doi: 10.3390/ijms24032041.

PHARAMACEUTICAL/TOXICOLOGY

Harmonized human biomonitoring in European children, teenagers and adults: EU-wide exposure data of 11 chemical substance groups from the HBM4EU Aligned Studies (2014-2021)

2023-02-09

As one of the core elements of the European Human Biomonitoring Initiative (HBM4EU) a human biomonitoring (HBM) survey was conducted in 23 countries to generate EU-wide comparable HBM data. This survey has built on existing HBM capacity in Europe by aligning national or regional HBM studies, referred to as the HBM4EU Aligned Studies. The HBM4EU Aligned Studies included a total of 10,795 participants of three age groups: (i) 3,576 children aged 6-12 years, (ii) 3,117 teenagers aged 12-18 years and (iii) 4,102 young adults aged 20-39 years. The participants were recruited between 2014 and 2021 in 11-12 countries per age group, geographically distributed across Europe. Depending on the age group, internal exposure to phthalates and the substitute DINCH, halogenated and organophosphorus flame retardants, per- and polyfluoroalkyl substances (PFASs), cadmium, bisphenols, polycyclic aromatic hydrocarbons (PAHs), arsenic species, acrylamide, mycotoxins (deoxynivalenol (total DON)), benzophenones and selected pesticides was assessed by measuring substance specific biomarkers subjected to stringent quality control programs for chemical analysis. For substance groups analyzed in different age groups higher average exposure levels were observed in the youngest age group, i.e., phthalates/DINCH in children versus teenagers, acrylamide and pesticides in children versus adults, benzophenones in teenagers versus adults. Many biomarkers in teenagers and adults varied significantly according to educational attainment, with higher exposure levels of bisphenols, phthalates, benzophenones, PAHs and acrylamide in participants (from households) with lower educational attainment, while teenagers from households with higher educational attainment have higher exposure levels for PFASs and arsenic. In children, a social gradient was only observed for the non-specific pyrethroid metabolite 3-PBA and di-isodecyl phthalate (DiDP), with higher levels in children from households with higher educational attainment. Geographical variations were seen for all exposure biomarkers. For 15 biomarkers, the available health-based HBM guidance values were exceeded with highest exceedance rates for toxicologically relevant arsenic in teenagers (40%), 3-PBA in children (36%), and between 11 and 14% for total DON, Σ (PFOA + PFNA + PFHxS + PFOS), bisphenol S and cadmium. The infrastructure and harmonized approach succeeded in obtaining comparable European wide internal exposure data for a prioritized set of 11 chemical groups. These data serve as a reference for comparison at the global level, provide a baseline to compare the efficacy of the European Commission's chemical strategy for sustainability and will give leverage to national policy makers for the implementation of targeted measures.

As one of the core elements of the European Human Biomonitoring Initiative (HBM4EU) a human biomonitoring (HBM) survey was conducted in 23 countries to generate EU-wide comparable HBM data.

Authors: Eva Govarts, Liese Gilles, Laura Rodriguez Martin, Tiina Santonen, Petra Apel, Paula Alvito, Elena Anastasi, Helle Raun Andersen, Anna-Maria Andersson, Lenka Andryskova, Jean-Philippe Antignac, Brice Appenzeller, Fabio Barbone, Zohar Barnett-Itzhaki, Robert Barouki, Tamar Berman, Wieneke Bil, Teresa Borges, Jurgen Buekers, Ana Cañas-Portilla, Adrian Covaci, Zsofia Csako, Elly Den Hond, Darina Dvorakova, Lucia Fabelova, Tony Fletcher, Hanne Frederiksen, Catherine Gabriel, Catherine Ganzleben, Thomas Göen, Thorhallur I Halldorsson, Line S Haug, Milena Horvat, Pasi Huuskonen, Medea Imboden, Marta Jagodic Hudobivnik, Beata Janasik, Natasa Janev Holcer, Spyros Karakitsios, Andromachi Katsonouri, Jana Klanova, Venetia Kokaraki, Tina Kold Jensen, Jani Koponen, Michelle Laeremans, Federica Laguzzi, Rosa Lange, Nora Lemke, Sanna Lignell, Anna Karin Lindroos, Joana Lobo Vicente, Mirjam Luijten, Konstantinos C Makris, Darja Mazej, Lisa Melymuk, Matthieu Meslin, Hans Mol, Parisa Montazeri, Aline Murawski, Sónia Namorado, Lars Niemann, Stefanie Nübler, Baltazar Nunes, Kristin Olafsdottir, Lubica Palkovicova Murinova, Nafsika Papaioannou, Susana Pedraza-Diaz, Pavel Piler, Veronika Plichta, Michael Poteser, Nicole Probst-Hensch, Loïc Rambaud, Elke Rauscher-Gabernig, Katarina Rausova, Sylvie Remy, Margaux Riou, Valentina Rosolen, Christophe Rousselle, Maria Rüther, Denis Sarigiannis, Maria J Silva, Zdenka Šlejkovec, Janja Snoj Tratnik, Anja Stajnko, Tamas Szigeti, José V Tarazona, Cathrine Thomsen, Žiga Tkalec, Hanna Tolonen, Tomas Trnovec, Maria Uhl, An Van Nieuwenhuyse, Elsa Vasco, Veerle J Verheyen, Susana Viegas, Anne Marie Vinggaard, Nina Vogel, Katrin Vorkamp, Wojciech Wasowicz, Till Weber, Sona Wimmerova, Marjolijn Woutersen, Philipp Zimmermann, Martin Zvonar, Holger Koch, Marike Kolossa-Gehring, Marta Esteban López, Argelia Castaño, Lorraine Stewart, Ovnair Sepai, Greet Schoeters

Full Source: International journal of hygiene and environmental health 2023 Feb 9;249:114119. doi: 10.1016/j.ijheh.2023.114119.

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Climate Toxicity: an increasingly relevant clinical issue in Cancer Care

2023-02-09

In recent years the terms time and financial toxicities have entered the vocabulary of cancer care. We would like to introduce another toxicity: climate toxicity. Climate toxicity is a double-edge sword in cancer care. Increasing cancer risk by exposure to carcinogens, and consequently increasing treatment requirements leads to ever growing damage to our environment. This article assesses the impact of climate change on patients, the climate toxicity caused by both healthcare workers and healthcare facilities, and suggests actions that may be taken mitigate them.

Authors: Catherine S Weadick, Rachel J Keogh, Hailey K Carroll, Sandra Boldrin, Eibhlin Mulroe, Lucy Murphy, Bryan Sheils, Aisling Barry, Seamus O'Reilly

Full Source: Journal of cancer policy 2023 Feb 9;100410. doi: 10.1016/j.jcpo.2023.100410.

OCCUPATIONAL

Integration of proteomic and metabolomic analyses: New insights for mapping informal workers exposed to potentially toxic elements

2023-01-25

Occupational exposure to potentially toxic elements (PTEs) is a concerning reality of informal workers engaged in the jewelry production chain that can lead to adverse health effects. In this study, untargeted proteomic and metabolomic analyses were employed to assess the impact of these exposures on informal workers' exposome in Limeira city, São Paulo state, Brazil. PTE levels (Cr, Mn, Ni, Cu, Zn, As, Cd, Sn, Sb, Hg, and Pb) were determined in blood, proteomic analyses were performed for saliva samples (n = 26), and metabolomic analyses in plasma (n = 145) using ultra-high performance liquid chromatography (UHPLC) coupled with quadrupole-time-of-flight (Q-TOF) mass spectrometry. Blood PTE levels of workers, controls, and their family members were determined by inductively coupled plasma-mass spectrometry (ICP-MS). High concentration levels of Sn and Cu were detected in welders' blood ($p < 0.001$). Statistical analyses were performed using MetaboAnalyst 4.0. The results showed that 26 proteins were upregulated, and 14 proteins downregulated on the welder group, and thirty of these proteins were also correlated with blood Pb, Cu, Sb, and Sn blood levels in the welder group ($p < 0.05$). Using gene ontology analysis of these 40 proteins revealed the biological processes related to the upregulated proteins were translational initiation, SRP-dependent co-translational protein targeting to membrane, and viral transcription. A Metabolome-Wide Association Study (MWAS) was performed to search for associations between blood metabolites and exposure groups. A pathway enrichment analysis of significant features from the MWAS was then conducted with Mummichog. A total of 73 metabolomic compounds and 40 proteins up or down-regulated in welders were used to perform a multi-omics analysis, disclosing seven metabolic pathways potentially disturbed by the informal work: valine leucine and isoleucine biosynthesis, valine leucine and isoleucine degradation, arginine and proline metabolism, ABC transporters, central carbon metabolism in cancer, arachidonic acid metabolism and cysteine and methionine metabolism. The majority of the proteins found to be statistically up or downregulated in welders also correlated with at least one blood PTE level, providing insights into the biological responses to PTE exposures in the informal work exposure scenario. These findings shed new light on the effects of occupational activity on workers' exposome, underscoring the harmful effects of PTE.

Authors: Alda Neis Miranda Araujo, Isabelle Nogueira Leroux, Danielle Zildeana Sousa Furtado, Ana Paula Sacone da Silva Ferreira, Bruno Lemos Batista, Heron Dominguez Torres Silva, Evangelos Handakas, Nilson Antônio Assunção, Kelly Polido Kaneshiro Olympio

Full Source: Frontiers in public health 2023 Jan 25;10:899638. doi: 10.3389/fpubh.2022.899638.

In recent years the terms time and financial toxicities have entered the vocabulary of cancer care.

Pleural plaques and the role of exposure to mineral particles in the Asbestos Post-Exposure Survey

2023-02-09

Background: Previous studies have inconsistently reported associations between Refractory Ceramic Fibers (RCF) or Mineral Wool Fibers (MWF) and the presence of pleural plaques (PP). Moreover, all these studies were based on Chest X-Ray, known to be associated with a poor sensitivity for the diagnosis of PP.

Research question: Does the risk of pleural plaques increase with cumulative exposure to RCF, MWF and silica? and if yes, do these dose-response relationships depend on the co-exposure to asbestos or conversely, are the dose-response relationships for asbestos modified by co-exposure to RCF, MWF and silica?

Background: Previous studies have inconsistently reported associations between Refractory Ceramic Fibers (RCF) or Mineral Wool Fibers (MWF) and the presence of pleural plaques (PP).

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Study design and methods: Volunteer workers were invited to participate in a CT-scan screening program for asbestos-related diseases in France. Asbestos exposure was assessed by industrial hygienists and exposure to RCF, MWF and silica was determined by using Job-Exposure Matrices. A Cumulative Exposure Index (CEI) was then calculated for each subject and separately for each of the 4 mineral particle exposures. All available CT-scans were submitted to randomized, double reading by a panel of radiologists.
Results: In this cohort of 5,457 subjects, we found a significant dose-response relationships, after adjustment for asbestos exposure between CEI to RCF or MWF and the risk of PP (OR= 1.29 [1.00-1.67] and OR= 1.84 [1.49-2.27] for the highest CEI quartile respectively). Moreover, significant interactions were found between asbestos on one side and respectively MWF or RCF on the other side.
Interpretation: This study suggests the existence of a significant association between exposure to RCF and MWF and the presence of PP in a large population previously exposed to asbestos and screened by CT-scan.
Authors: Christophe Paris, Isabelle Thaon, François Laurent, Anastasia Saade, Pascal Andujar, Patrick Brochard, Julia Benoist, Benedicte Clin, Gilbert Ferretti, Antoine Gislard, Cecile Gramond, Pascal Wild, Aude Lacourt, Fleur Delva, Jean-Claude Pairon
Full Source: Chest 2023 Feb 9;S0012-3692(23)00176-9. doi: 10.1016/j.chest.2023.02.004.

Helmet-Mounted Real-Time Toxic Gas Monitoring and Prevention System for Workers in Confined Places

2023-02-01
Occupational health and safety hazards associated with confined places are mainly caused by exposure to toxic gases and oxygen deficiency. Lack of awareness, inappropriate monitoring, and improper evacuation methods can lead to worker fatalities. Although previous studies have attempted to develop systems to solve this issue, limited research is available on their application in confined places. In this study, a real-time helmet-mounted system was developed to monitor major toxic gases (methane (CH4), hydrogen sulfide (H2S), ammonia (NH3), and carbon monoxide (CO)), oxygen, temperature, and humidity. Workers outside and inside confined spaces receive alerts every second to immediately initiate the rescue operation in the event of a hazard. The test results of a confined environment (wastewater treatment unit) highlighted that concentrations of CH4 and H2S were predominant (13 ppm). Compared

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to normal atmosphere, CH4 concentration was 122- and 130-fold higher in the landfill and digestion tanks, respectively, while H2S was 36- and 19-fold higher in the primary and secondary clarifiers, respectively. The oxygen content (18.2%) and humidity (33%) were below the minimum required limits. This study will benefit future research to target appropriate toxic gas monitoring and alert workers by studying the existing issues and associated factors in confined places.
Authors: Janani Priyanka Perumpally Rajakumar, Jae-Ho Choi
Full Source: Sensors (Basel, Switzerland) 2023 Feb 1;23(3):1590. doi: 10.3390/s23031590.

Occupational health and safety hazards associated with confined places are mainly caused by exposure to toxic gases and oxygen deficiency.