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CHEMICAL EFFECTS

The variable associations between PFASs and biological aging by sex and reproductive stage in NHANES 1999-2018

2023-03-23

Background: Per- and polyfluoroalkyl substances (PFASs) are endocrine disrupting chemicals that have myriad effects on human physiology. Estrogenic PFASs may influence biological aging by mimicking the activity of endogenous estrogens, which can decrease inflammation and oxidative stress and enhance telomerase activity. We hypothesized that PFAS exposure would be differentially associated with measures of biological aging based on biological sex and reproductive stage.

Methods: We analyzed associations between serum PFAS levels and measures of biological aging for pre- and postmenopausal women and men (n = 3193) using data from the 2003 to 2018 waves of the National Health and Nutrition Examination Survey. Examining PFASs both individually and in mixture models, we investigated four measures of clinical aging (Homeostatic Dysregulation, the Klemera-Doubal Method, Phenotypic Age Acceleration, and Allostatic Load), oxidative stress, and telomere length.

Results: PFOA and PFOS were negatively associated with Phenotypic Age Acceleration (e.g. decelerated aging) for men (B = -0.22, 95% CI: 0.32, -0.12; B = -0.04, 95% CI: 0.06, -0.03), premenopausal women (B = -0.58, 95% CI: 0.83, -0.32; B = -0.15, 95% CI: 0.20, -0.09), and postmenopausal women (B = -0.22, 95% CI: 0.43, -0.01; B = -0.05, 95% CI: 0.08, -0.02). In mixture models, we found net negative effects for Phenotypic Age Acceleration and Allostatic Load for men, premenopausal women, and postmenopausal women. We also found significant mixture effects for the antioxidants bilirubin and albumin among the three sample groups. We found no evidence to support effects on telomere length.

Discussion: Our findings suggest that PFAS exposure may be inversely associated with some measures of biological aging at the relatively low levels of exposure in this sample, regardless of reproductive stage and sex, which does not support our hypothesis. This research provides insights into how PFAS exposure may variably influence aging measures depending on the physiological process investigated.

Authors: C Chaney, K S Wiley
Full Source: Environmental research 2023 Mar 23;115714. doi: 10.1016/j.envres.2023.115714.

Background: Per- and polyfluoroalkyl substances (PFASs) are endocrine disrupting chemicals that have myriad effects on human physiology.

Leaching of herbicides mixtures from pre-exposed agricultural plastics severely impact microalgae

2023-03-21

Farmlands represent a source of aged plastics and pesticides to the surrounding environments. It has been shown that chemicals can be sorbed and desorbed from plastics, but the interaction between plastic and mixtures of pesticides and their effects on freshwater biota has not been assessed yet. The aim of the work was to assess the potential role of agricultural plastics as vectors for a mixture of two herbicides and the impact of the herbicide mixture lixiviated from them towards the freshwater microalga Chlamydomonas reinhardtii. Pristine and aged polyethylene plastics collected from agricultural areas were exposed to the herbicides, bifenox, oxyfluorfen and their mixtures. The microalgae were exposed for 72 h to the leachates desorbed from plastics and the effect was quantified in terms of total chlorophyll content and several physiological parameters assessed by flow cytometry. Our results showed that changes in physicochemical properties (hydroxyl and carbonyl index, hydrophobicity, texture) in aged plastics increased their capacity to retain and to desorb the herbicides. Microalgae exposed to leachates containing bifenox, oxyfluorfen, or their mixture showed reactive oxygen species overproduction, lipid peroxidation, membrane potential hyperpolarization, intracellular pH acidification, and a loss of metabolic activity. The toxicological interactions of the leachate mixture were assessed using the Combination Index (CI)-isobologram method showing antagonism at low effect levels turning to synergism when the effect increased. In this work, we proved the hypothesis that ageing increases the capacity of agricultural plastics to behave as vector for toxic chemicals to the biota.

Authors: Irene Verdú, Miguel González-Pleiter, Francisco Leganés, Francisca Fernández-Piñas, Roberto Rosal
Full Source: Chemosphere 2023 Mar 21;326:138475. doi: 10.1016/j.chemosphere.2023.138475.

Correlation Between Toxic Elements and Pesticide Residues in Medicinal Herbs Available in Pharmaceutical Market

2023-03-25

The use of medicinal plants for self-medication of minor health conditions has become a widespread practice in contemporary society. Few consumes, however, question the contamination of these products with toxic factors resulting from the planet's increasingly polluted environment.

Farmlands represent a source of aged plastics and pesticides to the surrounding environments.

Technical

This paper presents the levels of five toxic elements (As, Cr, Pb, Cd, and Hg) and nine organochlorine pesticides (hexachlorobenzene (HCB), lindane, heptachor, aldrin, dieldrin, endrin, p,p'DDE, p,p'DDD, and p,p'DDT) in 14 brands of regularly consumed medicinal products in Romania. The toxic elements content was determined using energy-dispersive X-ray fluorescence (EDXRF) technique, and organochlorine pesticide residues (OPCs) were quantified using gas-chromatographic method, equipped with electron capture detector (GC-ECD). The results show that in the case of Cr, Cd, and Hg, the concentrations exceeded the limit values established by World Health Organisation (WHO) for raw herbal material. The higher level of OPCs (such as p,p'DDD, p,p'DDT, aldrin, and dieldrin) was found in the samples of Hypericum perforatum-St. John's wort, Crataegus monogyna-hawthorn, and Epilobium parviflorum-hoary willowherb. The correlations between the content of toxic elements and pesticides were determined by statistical analysis. Hierarchical clustering technique was used to detect natural grouping between the toxic elements and pesticides. For herb samples, four clusters were identified, the strongest correlated cluster consisting of Pb, HCB, Cr, and Hg. A further analysis within this cluster suggested that Cr levels are statistically different from the rest of the elements.
Authors: Mihaela Mirela Bratu, Semaghiul Birghila, Corina Birghila, Valentina Coatu, Diana Andreea Danilov, Naliana Lupascu, Dan Vasiliu, Marius Daniel Radu
Full Source: Biological trace element research 2023 Mar 25. doi: 10.1007/s12011-023-03642-y.

Strong relations of peroxyacetyl nitrate (PAN) formation to alkene and nitrous acid during various episodes

2023-03-21
Peroxyacetyl nitrate (PAN) is one of the critical secondary pollutants in photochemical smog. This study investigated the relationship between PAN and PAN precursors with the Regional Atmospheric Chemical Mechanism version 2 model in six episodes recorded in Zhengzhou. In all episodes, peroxyacetyl radical (PA) was primarily produced by acetaldehyde oxidation, with more than 70% contributions. In photochemical episodes and photochemical-haze co-occurring episodes (combined episodes), methylglyoxal secondarily contributes 8.1%-10.6% to PA while in haze pollution, the propagation of other radicals to PA is the second most important source (12.0%-19.1%). Among anthropogenic non-methane hydrocarbons, alkene restricted PAN formation as first-generation precursors, with the relative incremental reactivity of

Peroxyacetyl nitrate (PAN) is one of the critical secondary pollutants in photochemical smog.

PAN (RIRPAN) more than 0.6 during three-type episodes. Nitrous acid (HONO) also played important role in PAN formation. Especially during photochemical episodes, RIRPAN(HONO) reached 0.79, which was comparable to the RIRPAN value of alkene. Through sensitivity analysis of the relative formation of PAN to O3 (the amount of PAN generated when 100 ppb O3 formed), HONO was identified as the key precursor of PAN in haze pollution by promoting the oxidation of NMHC, while alkene predominated the relative formation of PAN to O3 in photochemical and combined pollution through producing acetaldehyde. The sensitivity of PAN to HONO is obviously enhanced with higher NOx/VOC ratios during photochemical and combined pollution.
Authors: Xueqi Qiao, Mei Sun, Yifei Wang, Dong Zhang, Ruiqin Zhang, Bu Zhao, Jianbo Zhang
Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Mar 21;326:121465. doi: 10.1016/j.envpol.2023.121465.

ENVIRONMENTAL RESEARCH

Phthalates contamination in the coastal and marine sediments of Rio de Janeiro, Brazil

2023-03-23
Coastal and marine environments have been strongly influenced by anthropogenic activities, which may lead to high concentrations of different pollutants in sediments. Our study aimed to assess sediment contamination by polycyclic aromatic hydrocarbons (PAHs), phthalates (PAEs) and bisphenol A (BPA) in nine coastal and marine environments at Rio de Janeiro-Brazil. Physical and chemical water variables, grain-size parameters, moisture, and organic-matter content in sediments were assessed by sampling station. Multivariate analysis evidenced environmental differences between coastal lagoon and oceanic beaches, mostly influenced by marine waters. Differences among bay's beaches were mostly evidenced by sediment characteristics. PAHs and BPA were not detected in samples. For the first time, PAEs were found in sediments at Rio de Janeiro coast (South Atlantic). DEHP was detected in all coastal and marine environments, DBP was found in coastal lagoon and three marine environments. DnOP and DINP were solely found in the coastal lagoon.
Authors: Raquel A F Neves, Agatha Miralha, Tâmara B Guimarães, Rayane Sorrentino, Mônica R C Marques Calderari, Luciano N Santos
Full Source: Marine pollution bulletin 2023 Mar 23;190:114819. doi: 10.1016/j.marpolbul.2023.114819.

Coastal and marine environments have been strongly influenced by anthropogenic activities, which may lead to high concentrations of different pollutants in sediments.

Sex-specific association of exposure to air pollutants and Nrf2 gene expression and inflammatory biomarkers in exhaled breath of healthy adolescents

2023-03-21

Studies investigating the nuclear factor erythroid 2-related factor 2 (Nrf2) expression levels in the respiratory system of healthy subjects are scarce. Moreover, separate studies on the health-related outcomes of air pollution for each sex are limited. The current panel study investigated sex-specific Nrf2 expression levels and related oxidative stress and inflammatory responses among healthy adolescents exposed to PM2.5, PM10, O3, and PM2.5-bounded metals in a high traffic region. Forty-nine healthy nonsmoking subjects participated in the study for five consecutive months (Nov. 2019 to Feb. 2020). Each subject was asked to provide 1 mL of exhaled breath condensate (EBC). Data were analyzed using linear mixed-effects models. The results showed that PM10, PM2.5, O3, and PM2.5-bounded metals were negatively linked to Nrf2 expression level in EBC of females with -58.3% (95% CI: 79.5, -15.4), -32.1% (95% CI: -50.3, -7.1), -76.2% (95% CI: -92.6, -23.9), and -1.9 (95% CI: -3.4, -0.4), respectively. While our results presented no significant association between the studied pollutants and Nrf2 gene expression in males, significant associations were observed between the pollutants and total nitric oxide (NOx), interleukins 6 (IL-6), and tumor necrosis factor-alpha (TNF-α) in the EBC of females. In the case of males, only EBC cytokines showed a significant association with air pollutants. Overall, this study suggests that exposure to ambient air pollutants may affect the respiratory system with biologically different mechanisms in males and females. PM2.5 concentration had a positive correlation with exhaled TNF-α and IL6 values in females while positive correlation with TNF-α and negative correlation with IL6 values in males. O3 had a negative correlation with TNF-α in males.

Authors: Zahra Sabeti, Atefeh Ansarin, Khalil Ansarin, Venus Zafari, Ensiyeh Seyedrezazadeh, Mohammad Shakerkhatibi, Mohammad Asghari-Jafarabadi, Saeed Dastgiri, Khaled Zoroufchi Benis, Maryam Sepehri, Zhila Khamnian

Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Mar 21;326:121463. doi: 10.1016/j.envpol.2023.121463.

> Studies investigating the nuclear factor erythroid 2-related factor 2 (Nrf2) expression levels in the respiratory system of healthy subjects are scarce.

Fate and Exposure Assessment of Pb Leachate from Hypothetical Breakage Events of Perovskite Photovoltaic Modules

2023-03-26

Emerging lead halide perovskite (LHP) photovoltaics are undergoing intense research and development due to their outstanding efficiency and potential for low manufacturing costs that render them competitive with existing photovoltaic (PV) technologies. While today's efforts are focused on stability and scalability of LHPs, the toxicity of lead (Pb) remains a major challenge to their large-scale commercialization. Here, we present a screening-level, EPA-compliant model of fate and transport of Pb leachate in groundwater, soil, and air, following hypothetical catastrophic breakage of LHP PV modules in conceptual utility-scale sites. We estimated exposure point concentrations of Pb in each medium and found that most of the Pb is sequestered in soil. Exposure point concentrations of Pb from the perovskite film fell well below EPA maximum permissible limits in groundwater and air even upon catastrophic release from PV modules at large scales. Background Pb levels in soil can influence soil regulatory compliance, but the highest observed concentrations of perovskite-derived Pb would not exceed EPA limits under our assumptions. Nonetheless, regulatory limits are not definitive thresholds of safety, and the potential for increased bioavailability of perovskite-derived Pb may warrant additional toxicity assessment to further characterize public health risks.

Authors: Sherif A Khalifa, Sabrina Spatari, Aaron T Fafarman, Vasilis M Fthenakis, Patrick L Gurian, Mira S Olson, Jason B Baxter

Full Source: Environmental science & technology 2023 Mar 26. doi: 10.1021/acs.est.2c05815.

PHARMACEUTICAL/TOXICOLOGY

A cross-sectional analysis of ambient fine particulate matter (PM2.5) exposure and haemoglobin levels in children aged under 5 years living in 36 countries

2023-03-23

Low haemoglobin (Hb) concentrations and anaemia in children have adverse effects on development and functioning, some of which may have consequences in later life. Exposure to ambient air pollution is reported to be associated with anaemia, but there is little evidence specific to low- and middle-income countries (LMICs), where childhood anaemia

> Emerging lead halide perovskite (LHP) photovoltaics are undergoing intense research and development due to their outstanding efficiency and potential for low manufacturing costs that render them competitive with existing photovoltaic (PV) technologies.

prevalence is greatest. We aimed to determine if long-term ambient fine particulate matter (≤2.5 µm in aerodynamic diameter [PM2.5]) exposure was associated with Hb levels and the prevalence of anaemia in children aged <5 years living in 36 LMICs. We used Demographic and Health Survey data, collected between 2010 and 2019, which included blood Hb measurements. Satellite-derived estimates of annual average PM2.5 was the main exposure variable, which was linked to children's area of residence. Anaemia was defined according to standard World Health Organization guidelines (Hb < 11 g/dL). The association of PM2.5 with Hb levels and anaemia prevalence was examined using multivariable linear and logistic regression models, respectively. We examined whether the effects of ambient PM2.5 were modified by a child's sex and age, household wealth index, and urban/rural place of residence. Models were adjusted for relevant covariates, including other outdoor pollutants and household cooking fuel. The study included 154,443 children, of which 89,904 (58.2%) were anaemic. The country-level prevalence of anaemia ranged from 15.8% to 87.9%. Mean PM2.5 exposure was 33.0 (±21.6) µg/m3. The adjusted model showed that a 10 µg/m3 increase in annual PM2.5 concentration was associated with greater odds of anaemia (OR = 1.098 95% CI: 1.087, 1.109). The same increase in PM2.5 was associated with a decrease in average Hb levels of 0.075 g/dL (95% CI: 0.081, 0.068). There was evidence of effect modification by household wealth index and place of residence, with greater adverse effects in children from lower wealth quintiles and children in rural areas. Exposure to annual PM2.5 was cross-sectionally associated with decreased blood Hb levels, and greater risk of anaemia, in children aged <5 years living in 36 LMICs.

Authors: Daniel B Odo, Ian A Yang, Sagnik Dey, Melanie S Hammer, Aaron van Donkelaar, Randall V Martin, Guang-Hui Dong, Bo-Yi Yang, Perry Hystad, Luke D Knibbs
Full Source: Environmental research 2023 Mar 23;227:115734. doi: 10.1016/j.envres.2023.115734.

OCCUPATIONAL

Industry, occupation, and exposure history of mesothelioma patients in the U.S. National Mesothelioma Virtual Bank, 2006-2022

2022-12-29
Background: Malignant mesothelioma is associated with environmental and occupational exposure to certain mineral fibers, especially asbestos.

> Background: Malignant mesothelioma is associated with environmental and occupational exposure to certain mineral fibers, especially asbestos.

This study aims to examine work histories of mesothelioma patients and their survival time.
Method: Using the NIOSH Industry and Occupation Computerized Coding System, we mapped occupations and industries recorded for 748 of 1444 patients in the U.S. National Mesothelioma Virtual Bank (NMVB) during the period 2006-2022. Descriptive and survival analyses were conducted.
Results: Among the 1023 industries recorded for those having mesothelioma, the most frequent cases were found for those in manufacturing (n = 225, 22.0%), construction (138, 13.5%), and education services (66, 6.5%); among the 924 occupation records, the most frequent cases were found for those in construction and extraction (174, 18.8%), production (145, 15.7%), and management (84, 9.1%). Males (583) or persons aged >40 years (658) at the time of diagnosis tended to have worked in industries traditionally associated with mesothelioma (e.g., construction), while females (163) or persons aged 20-40 years (27) tended to have worked in industries not traditionally associated with mesothelioma (e.g., health care). Asbestos, unknown substances, and chemical solvents were the most frequently reported exposure, with females most often reporting an unknown substance. A multi-variable Cox Hazard Regression analysis showed that significant prognostic factors associated with decreased survival in mesothelioma cases are sex (male) and work experience in utility-related industry, while factor associated with increased survival are epithelial or epithelioid histological type, prior history of surgery and immunotherapy, and industry experience in accommodation and food services.
Conclusion: The NMVB has the potential of serving as a sentinel surveillance mechanism for identifying industries and occupations not traditionally associated with mesothelioma. Results indicate the importance of considering all potential sources of asbestos exposures including occupational, environmental, and extra-occupational exposures when evaluating mesothelioma patients and advising family members.
Authors: Yuhe Gao, Jacek M Mazurek, Yaming Li, David Blackley, David N Weissman, Shirley V Burton, Waqas Amin, Douglas Landsittel, Michael J Becich, Ye Ye
Full Source: Environmental research 2022 Dec 29;115085. doi: 10.1016/j.envres.2022.115085.

A systematic review of the effectiveness of dust control measures adopted to reduce workplace exposure

2023-03-25

The recent increase in silicosis cases in several countries casts doubt on dust control practices and their effectiveness in preventing respirable crystalline silica (RCS) exposure. Apart from silicosis, RCS may lead to other illnesses, health-related quality of life losses for workers and their families, and economic losses for companies. Thus, this systematic literature review examined the effectiveness of interventions employed to prevent exposure to RCS and increase the use of dust control measures. The review used keywords related to dust control interventions to search seven databases. Search results were screened and extracted for synthesis. The narrative synthesis showed the extent of research investment in China. In several designs and combinations, the interventions utilized water, surfactant, foam, and air currents to reduce dust exposure. These interventions offer varying degrees of dust control effectiveness against RCS and respirable dust. Although evidence indicates that interventions significantly decrease dust concentration levels, the control measures in place may not effectively prevent workplace overexposure to RCS. The review found that education and training interventions are employed to improve dust controls and respiratory protective equipment (RPE) use. Also, marketing strategies promote the use of RPE. These interventions can increase the frequency of use of RPE and the adoption of best practice dust control measures. Interventions increase knowledge, awareness, and attitudes about RPE usage and generate positive perceptions while reducing misconceptions. However, the benefits obtained from an intervention may diminish after its implementation, indicating that the interventions may not continually motivate workers to adopt control measures or use RPE.

Authors: Frederick Anlimah, Vinod Gopaldasani, Catherine MacPhail, Brian Davies

Full Source: Environmental science and pollution research international 2023 Mar 25. doi: 10.1007/s11356-023-26321-w.

The recent increase in silicosis cases in several countries casts doubt on dust control practices and their effectiveness in preventing respirable crystalline silica (RCS) exposure.