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Bulletin Board

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CHEMICAL EFFECTS

Adverse effects of polystyrene nanoplastic and its binary mixtures with nonylphenol on zebrafish nervous system: From oxidative stress to impaired neurotransmitter system

2022-11-03

Micro(nano)plastics generally co-exist with other chemicals in the environment, resulting in inevitable interaction and combined toxic effects on biota. Nevertheless, little is known regarding the interaction of nanoplastics (NPs) with other co-occurring insults. Hereby, we investigated single and combined effects of chronic exposure (45 days) to polystyrene nanoplastic particulates (PS-NPs) and nonylphenol (4-NP) on zebrafish nervous system. Multiple biomarkers concerning with oxidative-stress [catalase (CAT) activity and reduced glutathione (GSH) level], cholinergic system [Acetylcholinesterase (AchE) activity], glutamatergic system [glutamine synthetase (GS) and glutamate dehydrogenase (GDH) activities], energy metabolism [a-ketoglutarate dehydrogenase (a-KGDH) activity], and histological alterations were assessed. Both single and binary exposure to PS-NPs and 4-NP induced oxidative stress through reducing CAT activity and GSH level, in which a more sever effect was noticed in combined exposure. The AchE activity was significantly inhibited only in single treatment groups demonstrating antagonistic interaction between PS-NPs and 4-NP. Effects on GS activity was also alleviated in binary exposure as compared with single exposure to each contaminant. In addition, an increase in GDH activity was noticed in PS-NPs at 10 and 100 µg/L, and simultaneous presence of PS-NPs and 4-NP with a greater response were observed in combined treatments. PS-NPs and 4-NP either in separate or binary mixtures disrupted energy metabolism by deficiency of α-KGDH activity; however, co-exposure to PS-NPs and 4-NP induced more intense adverse impacts on this parameter. Furthermore, histological analysis revealed that 4-NP and PS-NPs, alone or in combination, reduced neural cells. These findings provide new insight into the neurotoxic effects of binary exposure to PS-NPs and 4-NP at environmentally relevant concentrations. Overall, our findings raise concerns about the presence and toxicity of nano-scale plastic particulates and highlight the

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importance of investigating the interaction of Micro(nano)plastics with other environmental irritants.

Authors: Faezeh Aliakbarzadeh, Mohammad Rafiee, Fariba Khodagholi, Mohammad Reza Khorramizadeh, Hamed Manouchehri, Akbar Eslami, Fatemeh Sayehmiri, Anoushiravan Mohseni-Bandpei

ENVIRONMENTAL RESEARCH

Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) soil contamination in Lausanne, Switzerland: Combining pollution mapping and human exposure assessment for targeted risk management

2022-10-29

In December 2020, high soil concentrations of polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) were discovered across large parts of Lausanne, Switzerland. Concentrations reached up to 640 ng TEQWHO-2005/kg dry weight. The most likely source was a former municipal waste incinerator. A three-step, multidisciplinary approach to human health risk assessment was conducted to determine the potential population exposure to PCDD/Fs and identify appropriate preventive measures. First, exposure scenarios were developed based on contaminated land uses. Second, the toxicological risks of different scenarios were evaluated using a toxicokinetic model estimating increases in blood serum PCDD/F concentrations over background concentrations from the general population's food consumption. Third, a detailed geostatistical mapping of PCDD/F soil contamination was performed. Stochastic simulations with an external drift and an anisotropic model of the variogram were generated to incorporate the effects of distance from emission source, topography, and main wind directions on the spatial distribution of PCDD/Fs in topsoil. Three main scenarios were assessed: i) direct ingestion of soil by children in playgrounds; ii) consumption of vegetables from private gardens by children and adults; and iii) consumption of food from livestock and poultry raised on contaminated soil. The worst exposure scenario involved the consumption of eggs from private hen houses, resulting in PCDD/F concentrations in serum an order of magnitude higher than might normally be expected. No relevant increases in serum concentrations were calculated for direct soil ingestion and vegetable consumption, except for cucurbitaceous vegetables.

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Combining mapping and exposure scenario assessment resulted in targeted protective measures for land users, especially concerning food consumption. The results also raised concerns about the potential unsafe consumption of products derived from animals raised on land with PCDD/F concentrations only moderately over environmental background levels.

Authors: David Vernez, Christelle Oltramare, Baptiste Sauvaget, Hélène Demougeot-Renard, Lothar Aicher, Nicolas Roth, Isabelle Rossi, Arianna Radaelli, Sylvain Lerch, Vincent Marolf, Aurélie Berthet
Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Oct 29;316(Pt 1):120441. doi: 10.1016/j.envpol.2022.120441.

Aquatic environmental fates and risks of benzotriazoles, benzothiazoles, and p-phenylenediamines in a catchment providing water to a megacity of China

2022-11-04

Wearing of vehicle parts could release many chemical additives into the environment, such as benzotriazoles (BTRs), benzothiazoles (BTHs), and p-phenylenediamines (PPDs), which are potentially toxic to wildlife and humans. This study investigates the occurrence, source, and risks of BTRs, BTHs, and PPDs in a source catchment providing water to Guangzhou, a megacity in South China, covering groundwater, surface water, and stormwater. The results showed that BTRs and BTHs were predominant in surface water and groundwater. Unexpectedly, the BTR and BTH concentrations were lower in surface water than groundwater in a third of the paired samples. For the first time, 6 PPD-quinone, a toxic ozonation product of N-(1,3-dimethylbutyl)-N'-phenyl-1,4-phenylenediamine (6 PPD), was extensively detected in source waters. Stormwater decreased the BTR concentrations but increased the 6 PPD-quinone concentrations in surface water owing to their affiliation to suspended particles. From natural to urban segments of Liuxi river, a downstream increasing trend in BTR and BTH concentrations was observed, confirming that they are indicative of urban anthropogenic activities. Strong correlations between industrial activities and BTR or BTH concentrations in surface water indicated that industrial activities were their main sources. Six compounds were prioritized as potentially persistent, mobile, and toxic (PMT) chemicals, combing our monitoring results and REACH criterion. This study improves our understanding of the environmental fates and risks of water-soluble tire-wear chemicals, which provide important information for chemical

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management, and indicates attention should be paid to the risk posed by 6 PPD-quinone in source water.

Authors: Ruiling Zhang, Shizhen Zhao, Xin Liu, Lele Tian, Yangzhi Mo, Xin Yi, Shiyang Liu, Jiaqi Liu, Jun Li, Gan Zhang
Full Source: Environmental research 2022 Nov 4;114721. doi: 10.1016/j.envres.2022.114721.

Ambient fine particulate matter exposures and oxidative protein damage in early pregnant women

2022-11-05

The association between oxidative protein damage in early pregnant women and ambient fine particulate matter (PM2.5) is unknown. We estimated the effect of PM2.5 exposures within seven days before blood collection on serum 3-nitrotyrosine (3-NT) and advanced oxidation protein products (AOPP) in 100 women with normal early pregnancy (NEP) and 100 women with clinically recognized early pregnancy loss (CREPL). Temporally-adjusted land use regression model was applied for estimation of maternal daily PM2.5 exposure. Single-day lag effect of PM2.5 was analyzed using multivariable linear regression model. Net cumulative effect and distributed lag effect of PM2.5 within seven days were analyzed using distributed lag non-linear model. In all 200 subjects, the serum 3-NT were significantly increased with the single-day lag effects (4.72%-8.04% increased at lag 0-2), distributed lag effects (2.32%-3.49% increased at lag 0-2), and cumulative effect within seven days (16.91% increased). The single-day lag effects (7.41%-10.48% increased at lag 0-1), distributed lag effects (3.42%-5.52% increased at lag 0-2), and cumulative effect within seven days (24.51% increased) of PM2.5 significantly increased serum 3-NT in CREPL group but not in NEP group. The distributed lag effects (2.62%-4.54% increased at lag 0-2) and cumulative effect within seven days (20.25% increased) of PM2.5 significantly increased serum AOPP in early pregnant women before the coronavirus disease (COVID-19) pandemic but not after that. In conclusion, PM2.5 exposures were associated with oxidative stress to protein in pregnant women in the first trimester. Wearing masks may be potentially preventive in PM2.5 exposure and its related oxidative protein damage. Whether PM2.5-associated systemic 3-NT increase contributes to the pathogenic mechanisms of spontaneous abortion remains to be further investigated.

Authors: Junnan Yang, Mengyu Chu, Chen Gong, Xian Gong, Bin Han, Li Chen, Jianmei Wang, Zhipeng Bai, Yujuan Zhang
Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Nov 5;120604. doi: 10.1016/j.envpol.2022.120604.

The association between oxidative protein damage in early pregnant women and ambient fine particulate matter (PM2.5) is unknown.

Technical

Air pollution during the perinatal period and neurodevelopment in children: A national population study in Taiwan

2022-11-09

Aim: To evaluate the association between ambient particulate matter no larger than 2.5 μm in diameter (PM2.5) during the prenatal and postnatal periods and infant neurodevelopmental parameters.

Method: We conducted a population-based birth cohort study using the Taiwan Birth Cohort Study. Participants were assessed for developmental conditions through home interviews at 6 months and 18 months of age. Exposure to PM2.5 of mothers and infants during perinatal periods was estimated using hybrid kriging/land-use regression. The exposure was linked to each participant by home address. Logistic regression was then conducted to determine the risk of neurodevelopmental delay in relation to PM2.5 .

Results: A total of 17 683 term singletons without congenital malformations were included in the final analysis. PM2.5 during the second trimester was associated with increased risks of delays in gross motor neurodevelopmental milestones (adjusted odds ratio [aOR] 1.09 per 10 μg/m3 increase in exposure to PM2.5). Delayed fine motor development was also found to be related to exposure to PM2.5 in the second and third trimesters (aOR 1.06), as was personal-social skill (aOR 1.11 for the second trimester and 1.06 for the third). These neurodevelopmental parameters were unrelated to postnatal PM2.5 exposure.

Interpretation: Exposure to ambient PM2.5 during pregnancy was significantly related to delay in gross motor, fine motor, and personal-social development in this population-based study.

Authors: Ping Shih, Tung-Liang Chiang, Chih-Da Wu, Bih-Ching Shu, For-Wey Lung, Yue Leon Guo

Full Source: Developmental medicine and child neurology 2022 Nov 9. doi: 10.1111/dmcn.15430.

PHARMACEUTICAL/TOXICOLOGY

Impact of mixtures of persistent organic pollutants on breast cancer aggressiveness

2022-11-03

Introduction: Breast cancer (BC) is frequent with a poor prognosis in case of metastasis. The role of the environment has been poorly evaluated in its

Aim: To evaluate the association between ambient particulate matter no larger than 2.5 μm in diameter (PM2.5) during the prenatal and postnatal periods and infant neurodevelopmental parameters.

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Technical

progression. We searched to assess whether a mixture of pollutants could be responsible of BC aggressiveness.

Methods: Patients undergoing surgery for their BC were prospectively included in the METAPOP cohort. Forty-two POPs were extracted, among them 17 dioxins (PCDD/F), 16 polychlorobiphenyls (PCB), 8 polybromodiphenylethers (PBDE) and 2,2',4,4',5,5'-hexabromobiphenyl (PBB153) were measured in the adipose tissue surrounding the tumor. BC aggressiveness was defined using tumor size and metastasis (distant or lymph nodes). Two complementary models were used to evaluate the impact of the mixture of pollutants: the BKMR (Bayesian Kernel machine regression) and WQS (weighted quantile sum regression) models. The WQS estimates the weight (positive or negative) of a certain chemical based on its quantile and the BKMR model applies a kernel-based approach to estimate posterior inclusion probabilities. The sub-group of patients with a body mass index (BMI) > 22 kg/ m2 was also analyzed.

Results: Ninety-one patients were included. Of these, 38 patients presented a metastasis, and the mean tumor size was 25.4 mm. The mean BMI was 24.5 kg/m2 (+/- 4.1). No statistical association was found in the general population. However, in patients with a BMI > 22 kg/ m2, our mixture was positively associated with tumor size (OR: 9.73 95 %CI: 1.30-18.15) and metastasis (OR = 3.98 95 %CI = 1.09-17.53) using the WQS model. Moreover, using the BKMR model on chemical families, dioxin like chemicals and PCDD were associated with a higher risk of metastasis.

Discussion: These novel findings identified a mixture associated with breast cancer aggressiveness in patients with a BMI > 22 kg/ m2.

Authors: Louise Benoit, Meriem Koual, Céline Tomkiewicz, Anne-Sophie Bats, Jean-Philippe Antignac, Xavier Coumoul, Robert Barouki, German Cano-Sancho

Full Source: Environment international 2022 Nov 3;170:107615. doi: 10.1016/j.envint.2022.107615.

Association between exposure to perfluoroalkyl substances and uric acid in Chinese adults

2022-11-06

Background: A growing body of evidence suggests the deleterious effects of perfluoroalkyl substances (PFASs) on kidney, but little is known on the association between PFASs joint exposure and uric acid.

Methods: Serum PFASs concentrations were measured in 661 participants recruited from Tianjin, China using liquid chromatography/mass spectrometry. The associations of single PFASs exposure with uric acid levels and hyperuricemia were assessed using multivariable linear and

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logistic regression models, respectively. Restricted cubic spline models were established to investigate the dose-response relationships between PFASs concentrations and uric acid levels. Bayesian Kernel Machine Regression (BKMR) model with a hierarchical variable selection was performed to assess the joint effect of PFASs on uric acid.
Results: Potassium perfluoro-1-octanesulfonate (PFOS) and perfluoro-n-octanoic acid (PFOA) were the dominated contributors with median concentrations of 16.80 ng/ml and 9.42 ng/ml, respectively. Increased PFOA concentration (per log2-unit) was associated with elevated uric acid level (β = 0.088, 95% CI: 0.033-0.143) and higher risk of hyperuricemia (OR = 1.134, 95% CI: 1.006-1.289). Conversely, the estimated change of uric acid associated with log2-unit increment in perfluoro-n-decanoic acid (PFDA) was -0.081 mg/dL (95% CI: 0.154, -0.009). A significant linear dose-response pattern was found between log2-transformed PFOA concentration and uric acid level. BKMR analyses indicated a non-significant overall effect of PFASs mixture on uric acid.
Conclusions: Significant associations between PFOA and PFDA and uric acid, and between PFOA and hyperuricemia were found in the single-pollutant models, but the joint effect of PFASs mixture on uric acid was not observed in the BKMR model, which provided new insights in regulation policies and risk assessment of PFASs.
Authors: Ze Yang, Kun Men, Jiaxin Guo, Ruifang Liu, Hongbo Liu, Jiemin Wei, Jingyun Zhang, Liangpo Liu, Xiaohui Lin, Mingyue Zhang, Yong Liu, Yu Chen, Nai-Jun Tang
Full Source: Chemosphere 2022 Nov 6;137164. doi: 10.1016/j.chemosphere.2022.137164.

OCCUPATIONAL

Health status of petrochemical workers: a narrative review
2022-03
Professional exposure to benzene has been extensively investigated by occupational medicine, leading to strict regulation of exposure threshold values. However, the petrochemical industry utilizes many chemical substances, whose exposure, without effective control and mitigation actions, could influence the health status over time. The aim of this narrative review is to describe health status of petrochemical workers related to occupational exposures, inquiring literature from 1980 to present. We used the PubMed and Web of Science search engines. As regards non-neoplastic diseases, despite heterogeneous prevalence estimates, we could say that standardized mortality rate (SMR) for

Professional exposure to benzene has been extensively investigated by occupational medicine, leading to strict regulation of exposure threshold values.

hypertension, hypercholesterolemia and diabetes does not increase overall, compared to reference populations; a possible explanation may be the "healthy worker effect". Attention should be paid to color disperception and respiratory symptoms, due to toxic or irritating substances exposure. Studies concerning neoplastic pathology have mainly investigated mortality outcomes, finding no increase in cancer, except for melanoma or other skin cancers and leukemia. As regards the former, however, it is not excluded that other risk factors may contribute (e.g. UV rays in offshore workers), while for leukemia, only the most recent studies have analyzed various subtypes of hematopoietic tumors, highlighting a possible risk for the development of myelodysplastic syndrome. The risk of pleural mesothelioma was also increased, likely due to asbestos exposures, while the risk of death from prostate cancer remains controversial.
Authors: Federico Fassio, Martino Bussa, Enrico Oddone, Ottavia Eleonora Ferraro, Mariangela Valentina Puci, Anna Morandi, Fabio Castaldo, Massimo Broi, Filippo Uberti, Simona Villani, Cristina Montomoli, Maria Cristina Monti
Full Source: Giornale italiano di medicina del lavoro ed ergonomia 2022 Mar;44(1):51-58.

ROS and ERK Pathway Mechanistic Approach on Hepatic Insulin Resistance After Chronic Oral Exposure to Cadmium NOAEL Dose
2022-11-08
Cadmium is a critical toxic agent in occupational and non-occupational settings and acute and chronic environmental exposure situations that have recently been associated with metabolic disease development. Until now, the no observed adverse effect level (NOAEL) of cadmium has not been studied regarding insulin resistance development. Therefore, we aimed to monitor whether chronic oral exposure to cadmium NOAEL dose induces insulin resistance in Wistar rats and investigate if oxidative stress and/or inflammation are related. Male Wistar rats were separated into control (standard normocalorie diet + water free of cadmium) and cadmium groups (standard normocalorie diet + drinking water with 15 ppm CdCl2). At 15, 30, and 60 days, oral glucose tolerance, insulin response, and insulin resistance were analyzed using mathematical models. In the liver glycogen, triglyceride, pro- and anti-inflammatory cytokines, cadmium, zinc, metallothioneins, and redox balance were quantified. Immunoreactivity analysis of proteins involved in metabolic and mitogenic insulin signaling was performed. The results showed

Cadmium is a critical toxic agent in occupational and non-occupational settings and acute and chronic environmental exposure situations that have recently been associated with metabolic disease development.

that a cadmium NOAEL dose after 15 days of exposure causes ROS and mitogenic arm of insulin signaling to increase while hepatic glycogen diminishes. At 30 days, Cd accumulation accentuated ROS production, hepatic triglyceride overaccumulation, and mitogenic signals that develop insulin resistance. Finally, inflammation and lipid peroxidation appear after 60 days of Cd exposure, while lipids and carbohydrate homeostasis deteriorate. In conclusion, environmental exposure to cadmium NAOEL dose causes hepatic Cd accumulation and ROS overproduction that chronically declines the antioxidant defense, deteriorates metabolic homeostasis associated with the mitogenic pathway of insulin signaling, and induces insulin resistance.

Authors: Victor Enrique Sarmiento-Ortega, Diana Moroni-González, Alfonso Diaz, Eduardo Brambila, Samuel Treviño
Full Source: Biological trace element research 2022 Nov 8. doi: 10.1007/s12011-022-03471-5.

[PAHs exposure and its association with oxidative stress and neurotransmitter levels in coal miners]

2022-10-20
Objective: To learn the investigate of polycyclic aromatic hydrocarbons (PAHs) and to explore the association between PAHs exposure and oxidative stress' neurotransmitter levels in coal miners. Methods: A cross-sectional survey was conducted in 652 coal miners (239 in the underground first line group, 280 in the underground auxiliary group and 133 in the surface group) from April to June 2017. The levels of urinary monohydroxy PAHs metabolites (OH-PAHs) , oxidative stress and neurotransmitters in blood were determined. A linear regression model was used to evaluate the correlation between OH-PAHs and oxidative stress' neurotransmitter levels. The mediating role of oxidative stress between urinary OH-PAHs and neurotransmitters change was assessed by mediation analysis. Results: The levels of 2-hydroxynaphthalene (2-NAP) 2-hydroxy uorene (2-FLU) 1-hydroxypyrene (1-OHP) in urine OH-PAHs of coal miners in different workplaces were significantly different (H=33.64, 9.63, 26.82, P<0.01, =0.008, <0.01) . The levels of neurotransmitters [5-hydroxytryptamine (5-HT) , norepinephrine (NE) , epinephrine (E) , dopamine (DA) , acetylcholine (Ach) , acetylcholinesterase (AChE)] and oxidative stress [malondialdehyde (MDA) (F=36.81, 15.58, 79.16, 179.58, 33.48, 67.63, 4.96, P<0.01)] in the blood of three groups of coal miners were significantly different. After controlling the potential confounding factors, NE content was negatively correlated with 2-FLU level, and AChE activity was also negatively correlated with 1-OHP level (β=-134.99, 95%

Objective: To learn the investigate of polycyclic aromatic hydrocarbons (PAHs) and to explore the association between PAHs exposure and oxidative stress' neurotransmitter levels in coal miners.

CI: -250.74~-19.23, P=0.02; β=-0.80, 95%CI: -1.54~-0.05, P=0.036) . Positive correlation was found between Ach content and 9-hydroxyphenanthrene (9-PHE) level, AChE activity was also positively correlated with 2-NAP level and 9-PHE level (β=0.96, 95%CI: 0.26~1.64, P=0.007; β=1.78, 95%CI: 0.75~2.82, P=0.001; β=0.77, 95%CI: 0.07~1.47, P=0.031) . In addition, superoxide dismutase activity was correlated with 1-OHP level and AChE activity (β=0.32, 95%CI: 0.02~0.62, P=0.034; β=-0.23, 95%CI: -0.43~-0.02, P=0.032) . Mediation analysis indicated that 1-OHP level may directly affect AChE activity (P<0.05) . Conclusion: The level of PAHs in underground coal miners is relatively higher, and may lead to changes of neurotransmitter levels. The mediating effect of oxidative stress has not been observed.

Authors: H Y Hu, B Zhang, L Y Yang, L Zhou, Y Wang, F Wang
Full Source: Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases 2022 Oct 20;40(10):727-732. doi: 10.3760/cma.j.cn121094-20210315-00150.