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CHEMICAL EFFECTS

Volatile organic compound (VOC) emissions and health risk assessment in paint and coatings industry in the Yangtze River Delta, China

2020-10-19

Solvent use and paint consumption are significant source sectors of volatile organic compounds (VOCs) emissions in China. The occupational painters have high risk of health effect due to exposure to high VOCs concentration. However, the toxic components in coating environment have not been carefully identified, and the health risks of VOCs exposure have not been sufficiently assessed. This study collected air samples from nine workshops of three major coating sectors in the Yangtze River Delta of China, namely cargo container coating, ship equipment coating, and furniture coating, to evaluate the non-cancer and cancer risk of toxic VOCs exposure to occupational painters under a normal working condition. The results show that the container coating had highest cancer risk (2.29 × 10-6-5.53 × 10-6) exceeding the safe limit of 1.0 × 10-6, while non-cancer risk of all workshops was lower than acceptable level of 1. Ethylbenzene and 1,2-dichloropropane should be targeted for priority removal during the container coating process in attempt to reduce adverse health effect on the occupational painters. This study helps better understand the health risk of VOCs exposure in coating workshops in China and provides information for policy-makers to formulate possible control of specific toxic compounds during coating process.

Authors: Ziwei Mo, Sihua Lu, Min Shao

Full Source: Environmental pollution (Barking, Essex : 1987) 2020 Oct 19;269:115740. doi: 10.1016/j.envpol.2020.115740.

Solvent use and paint consumption are significant source sectors of volatile organic compounds (VOCs) emissions in China.

Transplacental Transfer of Environmental Chemicals: Roles of Molecular Descriptors and Placental Transporters

2020-12-09

Transplacental transfer of environmental chemicals results in direct risks to fetal development. Although numerous studies have investigated transplacental transfer efficiencies (TTEs) of environmental chemicals, the underlying mechanisms and influencing factors remain poorly understood. The present study aims to synthesize a current state of knowledge on the TTEs of major environmental chemicals and explore the roles of chemicals' molecular descriptors and placental transporters in the transplacental transfer. The results indicate great variations in

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TTEs (median: 0.29-2.86) across 51 chemicals. Chemical-dependent TTEs may partially be attributed to the influences of chemicals' molecular descriptors. Predictive models based on experimental TTEs and 1790 computed molecular descriptors indicate that a very limited number of molecular descriptors, such as the topological polar surface area, may substantially influence and efficiently predict chemicals' TTEs. In addition, molecular docking analyses were conducted to determine the binding affinities between 51 chemicals and six selected transporters, including BCRP, MDR1, hENT1, FRα, SERT, and MRP1. The results reveal transporter- and chemical-dependent binding affinities. Therefore, our study demonstrates that molecular descriptors and placental transporters, among a variety of other factors, can play important roles in the transplacental transfer of environmental chemicals. However, the underlying mechanisms and several important knowledge gaps identified herein require further investigations.

Authors: Jing Li, Xiangfei Sun, Jun Xu, Hongli Tan, Eddy Y Zeng, Da Chen

Full Source: Environmental science & technology 2020 Dec 9. doi: 10.1021/acs.est.0c06778.

Mixture toxicity of thiophanate-methyl and fenvalerate to embryonic zebrafish (Danio rerio) and its underlying mechanism

2020-11-26

Though pesticide mixtures can reflect the real-life situation in the water ecosystem, the quantification of their toxicity is still not fully understood. Combined effects of thiophanate-methyl (THM) and fenvalerate (FEN) on embryonic zebrafish (Danio rerio) and underlying mechanism were conducted in this study. Results showed that the 96-h LC50 values of THM to D. rerio at different growth periods ranged from 12.1 to 26.1 mg L-1, which were lower in comparison with those of FVR ranging from 0.025 to 2.8 mg L-1. Mixture of THM and FVR exhibited a synergetic response to zebrafish embryos. Activities of Cu/Zn-SOD, POD, caspase 3 and caspase 9 were significantly different in most of single and mixture administrations compared with the control group. In addition, five genes (P53, Cu/Zn-sod, crh, ERα and IL-8) associated with oxidative stress, cellular apoptosis, immune system and endocrine system showed greater variations of expressions when administrated to pesticide mixtures compared with single chemicals. Our experimental results exhibited that mixtures of thiophanate-methyl and fenvalerate produced higher toxicity towards aqueous vertebrates than when determined singly. Collectively,

Though pesticide mixtures can reflect the real-life situation in the water ecosystem, the quantification of their toxicity is still not fully understood.

upcoming environmental risk assessments established according to single administrations might not be enough to protect the water ecosystem.
Authors: Yanhua Wang, Lu Lv, Chao Xu, Dou Wang, Guiling Yang, Xinquan Wang, Hongbiao Weng, Qiang Wang
Full Source: The Science of the total environment 2020 Nov 26;756:143754. doi: 10.1016/j.scitotenv.2020.143754.

ENVIRONMENTAL RESEARCH

BTEX compounds leachates from cigarette butts into water environment: A primary study

2020-11-30
Cigarette butts (CBs) are the most abundant types of litter in the environment and may contain toxic chemicals such as BTEX that pose serious risks to the water bodies and health of aquatic organisms. So far there is no systematic study on BTEX compounds (benzene, toluene, ethylbenzene, o-xylene, and p-xylene) leaching from CBs into water environments. In this work, the leaching concentrations of BTEX compounds in deionized water (DW) and river water (RW) samples were studied for the first time. The mean concentrations of benzene, toluene, ethylbenzene, p-xylene, and o-xylene at contact times of 15 min to 1 day in water samples ranged from 0.13 to 0.18, 0.39-0.9, 0.11-0.25, 0.12-0.38, and 0.09-0.19 μgL-1 respectively. Benzene, toluene, ethylbenzene, o-xylene and p-xylene were detected at all contact times in both DW and RW samples. There were no significant differences of the leachate levels of BTEX compounds between DW and RW samples. The highest and lowest mean concentration levels in both DW and RW samples were determined for toluene and o-xylene respectively. The time after smoking had a significant effect on BTEX levels in leachates. The concentration levels of benzene, toluene, ethylbenzene, o-xylene and p-xylene leachates in water samples, after only 15 min, were reduced by 100, 93, 70, 68, and 59 percent respectively. Our data revealed that leached concentrations of benzene did not exceed the Water Framework Directive (WFD) guidelines, but with regard to the amount of CBs littered each year and other toxic chemicals contents of CBs this can still be a threat for aquatic creatures and possibly humans as well. Further studies are needed to cover the knowledge gap on the toxic leachates from CBs into water systems.
Authors: Sina Dobaradaran, Torsten C Schmidt, Wiebke Kaziur-Cegla, Maik A Jochmann
Full Source: Environmental pollution (Barking, Essex : 1987) 2020 Nov 30;269:116185. doi: 10.1016/j.envpol.2020.116185.

Cigarette butts (CBs) are the most abundant types of litter in the environment and may contain toxic chemicals such as BTEX that pose serious risks to the water bodies and health of aquatic organisms.

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Pollution assessment and land use land cover influence on trace metal distribution in sediments from five aquatic systems in southern USA

2021-01
Trace elements and heavy metals concentrate in aquatic sediments, potentially endangering benthic organisms. Comparing the concentration of metals in different aquatic bodies will help evaluate their accumulation and distribution characteristics within these systems. Metal pollution and enrichment indices in sediments from diverse aquatic systems in Southern USA, including agricultural ponds, man-made reservoir, river, swamp, and coastal environment were investigated. Following total digestion of the sediments, the concentrations of chromium (Cr), cobalt (Co), copper (Cu), zinc (Zn), arsenic (As), selenium (Se), cadmium (Cd), antimony (Sb), lead (Pb), and uranium (U) were measured using inductively coupled plasma-mass spectrometry (ICP-MS). Pb was found to be highly enriched in the sediment samples from all five environments. The samples from coastal and agricultural ponds showed highest degree of anthropogenic modification (enrichment factor >10), especially with Se, U, and Pb. Agricultural ponds, previously unknown as a metal hotspot, had the most deteriorated sediment quality as determined by high pollution load index (>1) and contamination factor (>6) for Cd and U. Principal component analysis comparing land use land cover distribution surrounding the aquatic systems to metal concentrations confirmed that agriculture-related land activities correlated well with majority of the metals. Overall, compared to agricultural ponds and coastal regions, sediments in river, swamp and man-made reservoir systems contained relatively fewer metal pollutants, the former two serving as collection points for metal-laden fertilizers and chemicals. The research provides key insights into simultaneously comparing metal accumulation in multiple water bodies and is useful to test and develop effective sediment quality guidelines.
Authors: Varun Paul, M S Sankar, Shannon Vattikuti, Padmanava Dash, Zikri Arslan
Full Source: Chemosphere 2021 Jan;263:128243. doi: 10.1016/j.chemosphere.2020.128243.

Trace elements and heavy metals concentrate in aquatic sediments, potentially endangering benthic organisms.

Emerging green solvents and their applications during pesticide analysis in food and environmental samples

2021-02-01
Green solvents reduce secondary pollution of the environment during pesticide pre-concentration in food and environmental matrices. Ionic

liquids are among the green solvents that are widely used during pesticides analysis. Their physico-chemical properties can be easily modified by changing the cation/anion combinations in their structures. This paper critically reviews the application of ionic liquids during pre-concentration of pesticides in food and environmental samples. Another group of green, designer solvents is composed of deep eutectic solvents. They are synthesised simply by mixing hydrogen bond donors and hydrogen bond acceptors. Their contributions during pesticide pre-concentration are reviewed critically in this paper. The use of supramolecular solvents during pesticide pre-concentration is gaining popularity among researchers. They are green, water-immiscible solvents composed of three-dimensional amphiphilic aggregates and their applications during pesticide pre-concentration are reviewed in this paper. The amount of chemicals used during pesticide analysis can be reduced by using switchable solvents. This paper also gives a critical review of the applications of switchable solvents during micro-extraction of pesticides in food and environmental samples. In addition, the challenges associated with the use of these green solvents are discussed in this review as well as the future prospects.

Authors: Herbert Musarurwa, Nikita Tawanda Tavengwa

Full Source: Talanta 2021 Feb 1;223(Pt 1):121507. doi: 10.1016/j.talanta.2020.121507.

OCCUPATIONAL

[Effects of occupational nickel exposure on glycemic parameters in workers]

2020-11-20

Objective: To explore the effect of occupational nickel exposure on blood glucose related indicators of workers.

Objective: To explore the effect of occupational nickel exposure on blood glucose related indicators of workers. Methods: In March 2019, five electroplating enterprises and one plastic hardware enterprise were selected by cluster sampling method. 159 nickel plating workers were selected as the contact group, and 66 administrative personnel of the same enterprise were selected as the control group. The serum nickel concentration, fasting blood glucose (FPG) , fasting insulin (FIns) and glycosylated hemoglobin (HbA1c) were measured in the contact group and the control group. The differences of blood glucose related indexes between the two groups were compared, and the risk factors of abnormal blood glucose indexes were analyzed. Results: Compared with the control group, the blood nickel concentration and detection rate of nickel in the contact group were higher, the levels of FIns were lower, and the proportion of HbA1c was higher in the contact group (P<0.05) . Stratified analysis showed that compared with the control group, the blood glucose index of men in the contact group changed significantly (P<0.05) ; logistic regression analysis showed that male was an independent influencing factor for decreased FIns (OR=8.264, P<0.05) . Conclusion: Long term exposure to nickel can affect the blood glucose related indexes such as fins and HbA1c.

Authors: X Liu, L X Zhong, D Jiang, Y Chen, W Gong, M Lv

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 2020 Nov 20;38(11):843-845. doi: 10.3760/cma.j.cn121094-20190927-00405.

Association of exposure to manganese and fine motor skills in welders - results from the WELDOX II study

2020-12-07

The aim of this study was to evaluate the effect of exposure to manganese (Mn) on fine motor functions.

The aim of this study was to evaluate the effect of exposure to manganese (Mn) on fine motor functions. A total of 48 welders and 30 unexposed workers as controls completed questionnaires, underwent blood examinations, and a motor test battery. The shift exposure of welders to respirable Mn was measured with personal samplers. For all subjects accumulations of Mn in the brain were assessed with T1-weighted magnetic resonance imaging. Welders showed normal motor functions on the Movement Disorder Society-Sponsored Revision of the Unified Parkinson Disease Rating Scale part III. Furthermore welders performed excellent on a steadiness test, showing better results than controls. However, welders were slightly slower than controls in motor tests. There was no association between fine motor test results and the relaxation rates R1 in globus pallidus and substantia nigra as MRI-based biomarkers to quantify Mn deposition in the brain.

Authors: Anne Lotz, Beate Pesch, Swaantje Casjens, Martin Lehnert, Wolfgang Zschiesche, Dirk Taeger, Chien-Lin Yeh, Tobias Weiss, Tobias Schmidt-Wilcke, Clara Quetscher, Stefan Gabriel, Maria Angela Samis Zella, Dirk Woitalla, Ulrike Dydak, Christoph van Thriel, Thomas Brüning, Thomas Behrens

Full Source: Neurotoxicology 2020 Dec 7;S0161-813X(20)30210-2. doi: 10.1016/j.neuro.2020.12.003.

PHARMACEUTICAL/TOXICOLOGY

Physiology of a Hybrid Pathway for Nicotine Catabolism in Bacteria

2020-11-12

Nicotine is a major N-heterocyclic aromatic alkaloid produced in tobacco plants and the main toxic chemical in tobacco waste. Due to its complex physiological effects and toxicity, it has become a concern both in terms of public health and the environment. A number of bacteria belonging to the genera Arthrobacter and Pseudomonas can degrade nicotine via the pyridine and pyrrollidine pathways. Recently, a novel hybrid of the pyridine and pyrrolidine pathways (also known as the VPP pathway) was found in the Rhizobiale group bacteria Agrobacterium tumefaciens S33, Shinella sp. HZN7 and Ochrobactrum sp. SJY1 as well as in other group bacteria. The special mosaic pathway has attracted much attention from microbiologists in terms of the study of their molecular and biochemical mechanisms. This will benefit the development of new biotechnologies in terms of the use of nicotine, the enzymes involved in its catabolism, and the microorganisms capable of degrading the alkaloid. In this pathway, some metabolites are hydroxylated in the pyridine ring or modified in the side chain with active groups, which can be used as precursors for the synthesis of some important compounds in the pharmaceutical and agricultural industries. Moreover, some enzymes may be used for industrial biocatalysis to transform pyridine derivatives into desired chemicals. Here, we review the molecular and biochemical basis of the hybrid nicotine-degrading pathway and discuss the electron transport in its oxidative degradation for energy conservation and bacterial growth.

Authors: Haiyan Huang, Jinmeng Shang, Shuning Wang

Full Source: Frontiers in microbiology 2020 Nov 12;11:598207. doi: 10.3389/fmicb.2020.598207.

Investigation of protective effect of ellagic acid in phthalates-induced reproductive damage

2020-12-08

Phthalates that people are exposed to every day are toxic carcinogenic chemicals with proven harmful effects on growth and reproduction. Ellagic acid (EA) is a polyphenol derivative known for its antioxidant properties. We hypothesized that the possible reproductive damage mechanism of phthalates is oxidative attack and ellagic acid could have a protective effect against radical forms in the body through its antioxidant properties. Thirty-two male rats were randomly divided into 4 groups, with 8 rats in each. Phthalate (DBP) was administered intraperitoneally and EA acid through gastric oral gavage (phthalate group 500 mg/kg/day DBP; EA group 2 mg/kg/day ellagic acid; the treatment group 500 mg/kg/day DBP and 2 mg/kg/day EA). The vehicle of DBP and EA, carboxymethyl cellulose was administered to control group. At the end of 4 weeks the testis tissue samples were taken under mild anesthesia. Tissue malondialdehyde, antioxidant parameters, sperm motility, sperm density and abnormal spermatozoon ratios were determined. Analysis was performed with One Way ANOVA test using SPSS 12.0 program. As a result; it has been shown that DBP causes oxidative damage by increasing the malondialdehyde level and decreasing antioxidant parameters, increased abnormal sperm rate and decreased sperm motility and concentration and histopathological damage so this damage is inhibited by the antioxidant activity of ellagic acid.

Authors: Neşe Başak Türkmen, İdris Ayhan, Aslı Taşlıdere, Muhterem Aydın, Osman Çiftçi

Full Source: Drug and chemical toxicology 2020 Dec 8;1-14. doi: 10.1080/01480545.2020.1853764.

Nicotine is a major N-heterocyclic aromatic alkaloid produced in tobacco plants and the main toxic chemical in tobacco waste.