CHEMWATCH

Bulletin Board

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CHEMICAL EFFECTS

Nanoplastic impacts on the foliar uptake, metabolism and phytotoxicity of phthalate esters in corn (Zea mays L.) plants

2022-10

Nanoplastic pollution in terrestrial plants is of increasing concern for its negative effects on living organisms. However, the impacts of nanoplastics on chemical processes and plant physiology of phthalate esters (PAEs) remain unclear. The present work offers insight into the foliar uptake, metabolism and phytotoxicity of two typical PAEs, namely, di-n-butyl phthalate (DBP) and di-(2-ethylhexyl) phthalate (DEHP), in corn (Zea mays L.) seedlings and the effects of amino-functionalized polystyrene nanoplastics (PSNPs-NH2). The presence of PSNPs-NH2 increased DBP and DEHP accumulation in the leaves by 1.36 and 1.32 times, respectively. PSNPs-NH2 also promoted the leaf-to-root translocation of DBP and DEHP, with the translocation factor increasing by approximately 1.05- and 1.16-fold, respectively. Furthermore, the addition of PSNPs-NH2 significantly enhanced the transformation of PAEs to their primary metabolites, mono-butyl phthalate and mono(2-ethylhexyl) phthalate in corn leaves and roots. The co-presence of PSNPs-NH2 and PAEs showed stronger impairment of photosystem II efficiency via the downregulation of transporter D1 protein, thus exhibiting a greater inhibitory effect on plant growth. Our findings reveal that nanoplastics promote the foliar uptake and transformation of PAE chemicals in crops and exacerbate their toxicity to crop plants, thereby threatening agricultural safety and human health.

Authors: Haifeng Sun, Chunli Lei, Yihao Yuan, Jianhong Xu, Ming Han

Full Source: Chemosphere 2022 Oct;304:135309. doi: 10.1016/j.chemosphere.2022.135309.

Nanoplastic pollution in terrestrial plants is of increasing concern for its negative effects on living organisms.

Endocrine disrupting chemicals and obesity: the evolving story of obesogens

2021-12

Increase in obesity pandemic all over the world consequently leads to the investigation of possible causes. In addition to the traditional explanation using the so-called caloric model, the field of endocrine disruptors (EDs), especially subgroup called obesogens, offered more light on the pathogenetic mechanisms involved. After the Second World War a correlation between an increased production of exogenous pollutants and actual obesity epidemic was suggested. "Obesogen hypothesis" implies that molecules called obesogens inadequately stimulate the development of adipose cells and lipid accumulation in existing adipose cells, as well as change metabolic balance or hormonal control of appetite and satiety, leading to an increase in body fat mass. The list of obesogens includes some industrial chemicals, biocides, pharmaceuticals, pollutants, and smoke. EDs from the group of obesogens may exert their effects by the impairment in the programming development of adipocytes, by an increase in energetic depot in the adipose tissue, and by influencing neuroendocrine control of appetite and satiety. Increased scientific evidence on obesogens and their mechanisms of action may help to prevent obesity and mitigate deleterious effects of the environment on human life and development. New translational studies are needed to explain the possible mechanism proposed.

Authors: D Micić, S Polovina, D Micić, D Macut

Full Source: Acta endocrinologica (Bucharest, Romania : 2005) Oct-Dec 2021;17(4):503-508. doi: 10.4183/aeb.2021.503.

Absorption, distribution, metabolism, excretion and toxicity of microplastics in the human body and health implications

2022-06-16

Microplastics (MPs; <5 mm) in the biosphere draws public concern about their potential health impacts. Humans are potentially exposed to MPs via ingestion, inhalation, and dermal contact. Ingestion and inhalation are the two major exposure pathways. An adult may consume approximately 5.1 × 103 items from table salts and up to 4.1 × 104 items via drinking water annually. Meanwhile, MP inhalation intake ranges from 0.9 × 104 to 7.9 × 104 items per year. The intake of MPs would be further distributed in different tissues and organs of humans depending on their sizes. The excretion has been discussed with the possible clearance ways (e.g., urine and feces). The review summarized the absorption, distribution, metabolic toxicity and excretion of MPs together with the attached chemicals. Moreover, the potential implications on humans are also discussed from in vitro and in vivo studies, and connecting the relationship between the physicochemical properties and the potential risks. This review will contribute to a better understanding of MPs as culprits and/or vectors linking to potential human health hazards, which will help outline the promising areas for further revealing the possible toxicity pathways.

Authors: Pengfei Wu, Siyi Lin, Guodong Cao, Jiabin Wu, Hangbiao Jin, Chen Wang, Ming Hung Wong, Zhu Yang, Zongwei Cai

Full Source: Journal of hazardous materials 2022 Jun 16;437:129361. doi: 10.1016/j.jhazmat.2022.129361.

Microplastics (MPs; <5 mm) in the biosphere draws public concern about their potential health impacts.

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ENVIRONMENTAL RESEARCH

Structure-related endocrine-disrupting potential of environmental transformation products of benzophenone-type UV filters: A review

2022-05-15

Benzophenone-type UV filters (BPs) represent a very diverse group of chemicals that are used across a range of industrial sectors around the world. They are found within different environmental compartments (e.g. surface water, groundwater, wastewater, sediments and biota) at concentrations ranging from ng/L to mg/L. Some are known as endocrine disruptors and are currently within the scope of international regulations. A structural alert for high potential of endocrine disrupting activity was assigned to 11 BP derivatives. Due to the widespread use, distribution and disruptive effects of some BPs, knowledge of their elimination pathways is required. This review demonstrates that biodegradation and photolytic decomposition are the major elimination processes for BP-type UV filters in the environment. Under aerobic conditions, transformation pathways have only been reported for BP, BP-3 and BP-4, which are also the most common derivatives. Primary biodegradation mainly results in the formation of hydroxylated BPs, which exhibit a structure-related increase in endocrine activity when compared to their parent substances. By combining 76 literature-based transformation products (TPs) with in silico results relating to their receptor activity, it is demonstrated that 32 TPs may retain activity and that further knowledge of the degradation of BPs in the environment is needed.

Authors: Lale Carstensen, Stephan Beil, Hilmar Börnick, Stefan Stolte

Full Source: Journal of hazardous materials 2022 May 15;430:128495. doi: 10.1016/j.jhazmat.2022.128495.

Benzophenone-type UV filters (BPs) represent a very diverse group of chemicals that are used across a range of industrial sectors around the world.

Ionic liquids as potentially hazardous pollutants: Evidences of their presence in the environment and recent analytical developments

2022-06-16

Ionic liquids (ILs) are considered to be very promising group of chemicals and the number of their potential applications is growing rapidly. However, while these compounds were originally proposed as a green alternative to classical solvents, there are certain doubts as to whether this classification is correct. Although in recent years there have been first reports published proving the presence of some ILs in the environment and even in human blood, at this point the scale of this possible problem is not yet fully understood. However, there is no doubt that as the number of ILs applications increases, analytical capabilities for rapid detection of possible environmental contamination should be also considered. Therefore, in this review paper, recent evidences for the ILs environmental contamination as well as analytical achievements related to the extraction of ILs from various environmental matrices have been summarized and important gaps and future perspectives have been pointed out. Based on the presented data it might be concluded that there is the urgent need for further development towards risk assessment of these potential environmental contaminants.

Authors: Jakub Maculewicz, Klaudia Świacka, Piotr Stepnowski, Joanna Dołżonek, Anna Białk-Bielińska

Full Source: Journal of hazardous materials 2022 Jun 16;437:129353. doi: 10.1016/j.jhazmat.2022.129353.

PHARMACEUTICAL/TOXICOLOGY

Association between urinary polycyclic aromatic hydrocarbon metabolites and diabetes mellitus among the US population: a cross-sectional study

2022-06-25

Background: The primary aim of this study is to examine the association between urinary polycyclic aromatic hydrocarbons (PAHs) and diabetes mellitus (DM) among the US population.

Methods: We used data from the National Health and Nutritional Examination Survey 2003-16, which is a nationally representative population-based survey of the US non-institutionalized population. Logistic regression analysis was performed to evaluate the association between urinary PAHs and the prevalence of DM using odds ratios (ORs) and 95% confidence intervals (CIs).

Results: The study sample including 13 792 individuals ≥18 y of age. The average ages of the three PAH tertiles were 42.56±19.67, 42.21±19.51 and 43.39±17.99 y. An increased risk of DM was found with increased odds for the second (OR 1.56 [95% CI 1.36 to 1.79]) and third tertile (OR 1.79 [95% CI 1.55 to 2.06)] of urinary PAH as compared with the first tertile. Similarly, higher chances of DM were observed in the second (men: OR 1.42 [95% CI 1.18 to 1.71]; women: OR 1.76 [95% CI 1.44 to 2.14]) and third tertile (men: OR 1.69 [95% CI 1.38 to 2.08]; women: OR 1.79 [95% CI 1.46 to 2.19]) of urinary PAHs as compared with the first tertile in both men and women.

Background: The primary aim of this study is to examine the association between urinary polycyclic aromatic hydrocarbons (PAHs) and diabetes mellitus (DM) among the US population.

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Conclusions: A population-based cross-sectional study found a positive association between urinary PAHs and DM in the US population.
Authors: Manthar Ali Mallah, Til Bahadur Basnet, Mukhtiar Ali, Fuwei Xie, Xiang Li, Feifei Feng, Wei Wang, Pingping Shang, Qiao Zhang
Full Source: International health 2022 Jun 25;ihac029. doi: 10.1093/inthealth/ihac029.

Triclosan and triclocarban as potential risk factors of colitis and colon cancer: Roles of gut microbiota involved

2022-06-17
In recent decades there has been a dramatic increase in the incidence and prevalence of inflammatory bowel disease (IBD), a chronic inflammatory disease of the intestinal tissues and a major risk factor of developing colon cancer. While accumulating evidence supports that the rapid increase of IBD is mainly caused by exposure to environmental risk factors, the identities of the risk factors, as well as the mechanisms connecting environmental exposure with IBD, remain largely unknown. Triclosan (TCS) and triclocarban (TCC) are high-volume chemicals that are used as antimicrobial ingredients in consumer and industrial products. They are ubiquitous contaminants in the environment and are frequently detected in human populations. Recent studies showed that exposure to TCS/TCC, at human exposure-relevant doses, increases the severity of colitis and exacerbates colon tumorigenesis in mice, suggesting that they could be risk factors of IBD and associated diseases. The gut toxicities of these compounds require the presence of gut microbiota, since they fail to induce colonic inflammation in mice lacking the microbiota. Regarding the functional roles of the microbiota involved, gut commensal microbes and specific microbial β-glucuronidase (GUS) enzymes mediate colonic metabolism of TCS, leading to metabolic reactivation of TCS in the colon and contributing to its subsequent gut toxicity. Overall, these results support that these commonly used compounds could be environmental risk factors of IBD and associated diseases through gut microbiota-dependent mechanisms.
Authors: Katherine Z Sanidad, Guangqiang Wang, Anand Panigrahy, Guodong Zhang
Full Source: The Science of the total environment 2022 Jun 17;842:156776. doi: 10.1016/j.scitotenv.2022.156776.

In recent decades there has been a dramatic increase in the incidence and prevalence of inflammatory bowel disease (IBD), a chronic inflammatory disease of the intestinal tissues and a major risk factor of developing colon cancer.

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Technical
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OCCUPATIONAL

Fungicides and bees: a review of exposure and risk

2022-07
Fungicides account for more than 35% of the global pesticide market and their use is predicted to increase in the future. While fungicides are commonly applied during bloom when bees are likely foraging on crops, whether real-world exposure to these chemicals - alone or in combination with other stressors - constitutes a threat to the health of bees is still the subject of great uncertainty. The first step in estimating the risks of exposure to fungicides for bees is to understand how and to what extent bees are exposed to these active ingredients. Here we review the current knowledge that exists about exposure to fungicides that bees experience in the field, and link quantitative data on exposure to acute and chronic risk of lethal endpoints for honey bees (Apis mellifera). From the 702 publications we screened, 76 studies contained quantitative data on residue detections in honey bee matrices, and a further 47 provided qualitative information about exposure for a range of bee taxa through various routes. We compiled data for 90 fungicides and metabolites that have been detected in honey, beebread, pollen, beeswax, and the bodies of honey bees. The risks posed to honey bees by fungicide residues was estimated through the EPA Risk Quotient (RQ) approach. Based on residue concentrations detected in honey and pollen/beebread, none of the reported fungicides exceeded the levels of concern (LOC) set by regulatory agencies for acute risk, while 3 and 12 fungicides exceeded the European Food Safety Authority (EFSA) chronic LOC for honey bees and wild bees, respectively. When considering exposure to all bees, fungicides of most concern include many broad-spectrum systemic fungicides, as well as the widely used broad-spectrum contact fungicide chlorothalonil. In addition to providing a detailed overview of the frequency and extent of fungicide residue detections in the bee environment, we identified important research gaps and suggest future directions to move towards a more comprehensive understanding and mitigation of the risks of exposure to fungicides for bees, including synergistic risks of co-exposure to fungicides and other pesticides or pathogens.
Authors: Sabrina Rondeau, Nigel E Raine
Full Source: Environment international 2022 Jul;165:107311. doi: 10.1016/j.envint.2022.107311.

Fungicides account for more than 35% of the global pesticide market and their use is predicted to increase in the future.

Using biomonitoring as a complementary approach in BTEX exposure assessment in the general population and occupational settings: a systematic review and meta-analysis

2022-06-27

Hazardous organic compounds such as benzene, toluene, ethylbenzene, o-xylene, m-xylene, and p-xylene (known as BTEX) found at work and at home can cause adverse health effects of human beings throughout their lives. Biological monitoring, an exposure assessment method, considers all exposed organic and non-organic compounds. Our goal was to perform a systematic review and a statistical analysis (meta-analysis) of peer-reviewed publications to assess urinary concentrations of BTEX biomarkers in both occupationally-exposed population and the general population. Several major electronic databases, including Scopus, Embase, Medline, Web of Science, and Google scholar (grey literature), were searched for biomonitoring studies of BTEX. Overall, 33 studies met the eligible criteria for the systematic review and six met the full inclusion criteria for meta-analysis. For meta-analysis, we included studies in which unmetabolized BTEX compounds were measured in urine samples. Due to insufficient data, studies that measured BTEX metabolites in urine samples and unmetabolized BTEX compounds in blood samples were excluded from the meta-analysis but were analyzed in the qualitative synthesis. Most studies showed increased urinary concentrations of BTEX in exposed individuals (mainly workers) compared to unexposed individuals. The results showed that the highest total BTEX concentrations were recorded in painters and policemen. This study showed that the undoubted associations between lifestyle and environmental factors and urinary levels of BTEX or its metabolites have not yet been confirmed in current biomonitoring studies. This is attributed to the few studies reported in this research area, the lack of homogeneous information, and the disagreement in the published results of the studies.

Authors: Mohammad Hoseini, Mohammad Reza Samaei, Armita Shahesmaeili, Susana Silva Martínez, Hoda Amiri

Full Source: Reviews on environmental health 2022 Jun 27. doi: 10.1515/reveh-2022-0042.

Hazardous organic compounds such as benzene, toluene, ethylbenzene, o-xylene, m-xylene, and p-xylene (known as BTEX) found at work and at home can cause adverse health effects of human beings throughout their lives.

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Probabilistic health risk assessment of occupational exposure to crystalline silica in an iron foundry in Urmia, Iran

2022-06-24

This study aimed to quantify the exposure of foundry workers to crystalline silica and associated cancer and non-cancer health risks using a probabilistic approach. Breathing zone air samples were collected according to the NIOSH 7602 method and analyzed using Fourier transform infrared spectroscopy. The health risks posed by crystalline silica were then assessed using the EPA-developed inhalation risk assessment model and Monte Carlo simulation. The sensitivity analysis was also conducted to determine the contribution of input parameters to the health risks. The mean concentration of crystalline silica in six foundry stations ranged from 0.029 to 0.064 mg m-3, exceeding the occupational exposure limits. The average values of cancer risks were greater than the USEPA level, i.e., 1E - 6 in all workstations of the foundry. Workers in sand preparation and molding stations suffered the greatest cancer risks, with the mean value of 2.35E - 5 and 2.10E - 5, respectively. Non-cancer hazard quotient exceeded 1 in all foundry stations ranging from 1.56 (in melting and pouring) to 3.37 (in sand preparation). The 95% upper-bound values of the health risks decreased by 77.52% and 56.77%, assuming the use of engineering controls and wearing respirators by workers, respectively. Sensitivity analyses indicate that concentration was the most sensitive factor contributing to the carcinogenic (46.13%) and non-carcinogenic (67.08%) risks. These findings can aid managers in gaining a better understanding of the silica risks faced by foundry workers and the role of engineering controls and respirators in protecting workers' health.

Authors: Zahra Moutab Sahihazar, Abolfazl Ghahramani, Sadjad Galvani, Mohammad Hajaghazadeh

Full Source: Environmental science and pollution research international 2022 Jun 24. doi: 10.1007/s11356-022-21487-1.

This study aimed to quantify the exposure of foundry workers to crystalline silica and associated cancer and non-cancer health risks using a proba-bilistic approach.