

Bulletin Board

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CHEMICAL EFFECTS

Combined toxicities of cadmium and five agrochemicals to the larval zebrafish (*Danio rerio*)

2022-09-26

Different pollutants usually co-exist in the natural environment, and the ecological and health risk assessment of agrochemicals needs to be carried out based on the combined toxicological effects of pollutants. To examine the combined toxicity to aquatic organisms, the effects of cadmium (Cd) and five pesticides (acetamiprid, carbendazim, azoxystrobin, chlorpyrifos, and bifenthrin) mixture on zebrafish (*Danio rerio*) larvae were assessed. The data from the 96-h toxicity test indicated that bifenthrin possessed the highest toxicity to *D. rerio* with the LC50 value of 0.15 mg L⁻¹, followed by chlorpyrifos (0.36 mg L⁻¹) and azoxystrobin (0.63 mg L⁻¹). Cd (6.84 mg L⁻¹) and carbendazim (8.53 mg L⁻¹) induced the intermediate toxic responses, while acetamiprid (58.39 mg L⁻¹) presented the lowest toxicity to the organisms. Pesticide mixtures containing chlorpyrifos and bifenthrin or acetamiprid and carbendazim showed synergistic impacts on the zebrafish. Besides, two binary combinations of Cd-acetamiprid and Cd-chlorpyrifos also displayed a synergistic effect on *D. rerio*. Our results offered a better idea of the mixed ecological risk assessment of Cd and different agricultural chemicals to aquatic organisms. Our findings better interpreted how the interaction between Cd and various agrochemicals changed their toxicity to aquatic vertebrates and provided valuable insights into critical impacts on the ecological hazard of their combinations.

Authors: Guixian Hu, Hao Wang, Yujie Wan, Liangliang Zhou, Qiang Wang, Minghua Wang

Full Source: Scientific reports 2022 Sep 26;12(1):16045. doi: 10.1038/s41598-022-20364-8.

Literature review and evaluation of biomarkers, matrices and analytical methods for chemicals selected in the research program Human Biomonitoring for the European Union (HBM4EU)

2022-08-06

Humans are potentially exposed to a large amount of chemicals present in the environment and in the workplace. In the European Human Biomonitoring initiative (Human Biomonitoring for the European Union = HBM4EU), acrylamide, mycotoxins (aflatoxin B1, deoxynivalenol,

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fumonisin B1), diisocyanates (4,4'-methylenediphenyl diisocyanate, 2,4- and 2,6-toluene diisocyanate), and pyrethroids were included among the prioritized chemicals of concern for human health. For the present literature review, the analytical methods used in worldwide biomonitoring studies for these compounds were collected and presented in comprehensive tables, including the following parameter: determined biomarker, matrix, sample amount, work-up procedure, available laboratory quality assurance and quality assessment information, analytical techniques, and limit of detection. Based on the data presented in these tables, the most suitable methods were recommended. According to the paradigm of biomonitoring, the information about two different biomarkers of exposure was evaluated: a) internal dose = parent compounds and metabolites in urine and blood; and b) the biologically effective = dose measured as blood protein adducts. Urine was the preferred matrix used for deoxynivalenol, fumonisin B1, and pyrethroids (biomarkers of internal dose). Markers of the biological effective dose were determined as hemoglobin adducts for diisocyanates and acrylamide, and as serum-albumin-adducts of aflatoxin B1 and diisocyanates. The analyses and quantitation of the protein adducts in blood or the metabolites in urine were mostly performed with LC-MS/MS or GC-MS in the presence of isotope-labeled internal standards. This review also addresses the critical aspects of the application, use and selection of biomarkers. For future biomonitoring studies, a more comprehensive approach is discussed to broaden the selection of compounds.

Authors: Gabriele Sabbioni, Argelia Castaño, Marta Esteban López, Thomas Göen, Hans Mol, Margaux Riou, Romuald Tagne-Fotso

Full Source: Environment international 2022 Aug 6;169:107458. doi: 10.1016/j.envint.2022.107458.

ENVIRONMENTAL RESEARCH

Effect of heat stress on DNA damage: a systematic literature review

2022-09-30

Thermal stress has a direct effect on various types of DNA damage, which depends on the stage of the cell cycle when the cell is exposed to different climate conditions. A literature review was conducted to systematically investigate and assess the overall effect of heat stress and DNA damage following heat exposure. In this study, electronic databases including PubMed, Scopus, and Web of Science were searched to find relevant literature on DNA damage in different ambient temperatures.

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Outcomes included (1) measurement of DNA damage in heat exposure, (2) three different quantification methods (comet assay, 8-hydroxy-2-deoxyguanosine (8-OHdG), and γ -H2AX), and (3) protocols used for moderate (31) and high temperatures (42). The evidence shows that long exposure and very high temperature can induce an increase in DNA damage through aggregate in natural proteins, ROS generation, cell death, and reproductive damage in hot-humid and hot-dry climate conditions. A substantial increase in DNA damage occurs following acute heat stress exposure, especially in tropical and subtropical climate conditions. The results of this systematic literature review showed a positive association between thermal stress exposure and inhibition of repair of DNA damage.

Authors: Peymaneh Habibi, Seyed Naser Ostad, Ahad Heydari, Shima Aliebrahimi, Vahideh Montazeri, Abbas Rahimi Foroushani, Mohammad Reza Monazzam, Mahmoud Ghazi-Khansari, Farideh Golbabaeei
Full Source: International journal of biometeorology 2022 Sep 30. doi: 10.1007/s00484-022-02351-w.

Risk from unintentional environmental mixtures in EU surface waters is dominated by a limited number of substances

2022-09-28

Unintentional environmental mixtures happen when multiple chemicals co-occur in the environment. A generic mixture assessment factor (MAF), has been proposed to account for this. The MAF is a number by which safe exposure levels for single chemicals are divided to ensure protection against combined exposures to multiple chemicals. Two key elements to judge the appropriateness of a generic MAF are (1) defining the scope of mixtures that need to be addressed by a MAF (i.e.: simple mixtures vs complex mixtures), and (2) the existence of common risk drivers across large spatial scales. Simple mixtures with one to three risk drivers can easily be addressed by chemical-by-chemical regulatory action. Our work provides evidence on the prevalence and complexity of cumulative risk in EU freshwaters based on chemical monitoring data from one of the largest databases in the EU. With 334 chemicals being monitored, low complexity mixtures (one to 3 three risk drivers) dominated. Only 15 out of 307 chemicals (5 %) were most frequent chemical risk drivers. When these 15 chemicals were excluded from the analysis, 95 % of all monitoring site - year combinations did not pose a concern for cumulative risk. Most of these 15 chemicals are already banned or listed in various priority lists, showing that current regulatory frameworks were effective in identifying drivers of single chemical and cumulative risk. Although the monitoring

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data do not represent the entirety of environmental mixtures in the EU, the observed patterns of (1) limited prevalence of truly complex mixtures, and (2) limited number of overall risk drivers, argue against the need for implementing a generic MAF as a regulatory tool to address risk from unintentional mixtures in EU freshwaters.

Authors: Ismael Rodea-Palomares, Zhenglei Gao, Arnd Weyers, Markus Ebeling

Full Source: The Science of the total environment 2022 Sep 28;159090. doi: 10.1016/j.scitotenv.2022.159090.

PHARMACEUTICAL/TOXICOLOGY

Status of cosmetic safety in Malaysia market: Mercury contamination in selected skin whitening products

2022-10-01

Background: Concern on cosmetic safety has been a subject of interest in recent years, and is commonly associated with the exposure of the consumers to chemicals and impurities such as mercury contamination. Moreover, cancellations of notified cosmetic products were recurrently being reported by the Malaysia authority, namely the National Pharmaceutical Regulatory Authority (NPRA). Among the cosmetic categories was skin whitening product, which is still in high demand whilst reported to cause health risks. Besides, low number of studies on cosmetic safety and mercury contamination were recorded in Malaysia. The lack of scientific evidence on the safety and risks of the ingredients used in cosmetic formulation is a major concern to many consumers.

Objective: The aim of this study was to identify the presence of mercury in skin whitening products, and to identify products containing mercury with the concentration exceeding the limitation of 1 ppm.

Methodology: A total of 104 whitening products were selected from the market via random sampling technique. The mercury concentration was determined by accredited laboratory, and the results were later compared with the cosmetic guideline of Malaysia and the list of banned products issued by NPRA.

Results: A total of 51.9% (n=54) whitening products were found registered under the NPRA Quest system, and remaining 48.1% (n=50) were non-registered products. None of the whitening products listed mercury as an ingredient, but laboratory analysis showed 15.4% (n=16) of the products contained mercury with the concentration exceeding the maximum limit of 1 ppm. A total of 87.5% of the whitening products (14 out of 16) containing high mercury concentration were non-registered

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products which were not registered in NPRA Quest system. The exceeded concentration recorded ranged between 1.81 ppm to 838,123 ppm. Besides that, 50% (8 out of 16) of the products were found in the list of banned products issued by the NPRA of Malaysia.

Conclusions: This study presents the status of cosmetic products, particularly the skin whitening products available in Malaysia market. Concern arises when some of the products were found to have presence of harmful substances such as mercury. Even though the presence of mercury in a cosmetic product can either be non-intentional or intentionally used by the manufacturer in the cosmetic formulation, the impact of the ingredient can cause health risk to the users.

Authors: Che Wan Jasimah Wan Mohamed Radzi, Fatin Nur Majdina Nordin
Full Source: Journal of cosmetic dermatology 2022 Oct 1. doi: 10.1111/jocd.15429.

Ancestral BPA exposure caused defects in the liver of medaka for four generations

2022-09-26

In addition to lifestyle-induced liver defects, environmental chemicals can induce liver defects in experimental animals due to their direct and acute exposure. It is not clear whether environmental chemical exposures result in the transgenerational passage of liver defects in subsequent generations living in an uncontaminated environment. Bisphenol A (BPA), a plasticizer chemical, has been ubiquitous in the environment in the recent decade. Every organism is exposed to this chemical at some point during its lifetime. Literature suggests that direct BPA exposure can result in several metabolic diseases, including non-alcoholic fatty liver disease (NAFLD). Despite the phasing out of BPA from several consumer goods, it is unclear whether ancestral BPA exposure causes liver health problems in the unexposed future generations. Here, we demonstrate an advanced stage of NAFLD in the grandchildren (F2 generation) of medaka fish (*Oryzias latipes*) due to embryonic BPA exposure in the grandparental generation (F0), which persists for five generations (F4) even in the absence of BPA. The severity of transgenerational NAFLD phenotype included steatosis together with perisinusoidal fibrosis and apoptosis of hepatocytes. Adult females developed more severe histopathological conditions in the liver than males. Genes encoding enzymes involved in lipolytic pathways were significantly decreased. The present results suggest that ancestral BPA exposure can result in transgenerational metabolic diseases that can persist for five generations and that the NAFLD trait is sexually dimorphic. Given that ancestral BPA exposure can

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lead to altered metabolic health outcomes in the subsequent unexposed generations, the development of the methods and strategies to mitigate the transgenerational onset of metabolic diseases seem imperative to protect future generations.

Authors: Sourav Chakraborty, Manthi Dissanayake, Julia Godwin, Xuegeng Wang, Ramji K Bhandari

Epidemiology Evidence for Health Effects of 150 per- and Polyfluoroalkyl Substances: A Systematic Evidence Map

2022-09

Background: Per- and polyfluoroalkyl substances (PFAS) comprise a large class of chemicals with widespread use and persistence in the environment and in humans; however, most of the epidemiology research has focused on a small subset.

Objectives: The aim of this systematic evidence map (SEM) is to summarize the epidemiology evidence on approximately 150 lesser studied PFAS prioritized by the EPA for tiered toxicity testing, facilitating interpretation of those results as well as identification of priorities for risk assessment and data gaps for future research.

Methods: The Populations, Exposure, Comparators, and Outcomes (PECO) criteria were intentionally broad to identify studies of any health effects in humans with information on associations with exposure to the identified PFAS. Systematic review methods were used to search for literature that was screened using machine-learning software and manual review. Studies meeting the PECO criteria underwent quantitative data extraction and evaluation for risk of bias and sensitivity using the Integrated Risk Information System approach.

Results: 193 epidemiology studies were identified, which included information on 15 of the PFAS of interest. The most commonly studied health effect categories were metabolic (n=37), endocrine (n=30), cardiovascular (30), female reproductive (n=27), developmental (n=26), immune (n=22), nervous (n=21), male reproductive (n=14), cancer (n=12), and urinary (n=11) effects. In study evaluation, 120 (62%) studies were considered High/Medium confidence for at least one outcome.

Discussion: Most of the PFAS in this SEM have little to no epidemiology data available to inform evaluation of potential health effects. Although exposure to the 15 PFAS that had data was fairly low in most studies, these less-studied PFAS may be used as replacements for "legacy" PFAS, leading to potentially greater exposure. It is impractical to generate epidemiology evidence to fill the existing gaps for all potentially relevant PFAS. This

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SEM highlights some of the important research gaps that currently exist. <https://doi.org/10.1289/EHP11185>.

Authors: Elizabeth G Radke, J Michael Wright, Krista Christensen, Cynthia J Lin, Alexandra E Goldstone, Courtney Lemeris, Kristina A Thayer

Full Source: Environmental health perspectives 2022 Sep;130(9):96003. doi: 10.1289/EHP11185.

Dietary selenium intake and thyroid cancer risk in postmenopausal women

2022-09-05

Objective: It has been suggested that higher selenium intake and consumption of supplements protect against several cancers. To our knowledge, epidemiologic evidence is rare and inconsistent on the association of selenium level and the risk for thyroid cancer. Therefore, the aim of this study was to examine the association between selenium intake and thyroid cancer risk in postmenopausal women using the Women's Health Initiative (WHI) database.

Methods: The WHI recruited 161 808 postmenopausal women 50 to 79 y of age between September 1, 1993 and December 31, 1998. The present study included 147 348 women 63.15 y of age (SD = 7.21) at baseline. The main exposure was baseline total selenium intake including dietary selenium measured by food frequency questionnaire (FFQ) and supplemental selenium. The outcome was thyroid cancer, which was adjudicated by trained physicians. Cox proportional hazard models were used to analyze the association.

Results: During a mean follow-up of 16.4 y until September 30, 2020, 442 thyroid cancer cases were identified. There was no significant association between total selenium intake and thyroid cancer risk after adjusting for multiple covariates (highest versus lowest quartile: hazard ratio [HR], 0.88; 95% confidence interval [CI], 0.60-1.29). Association between total selenium intake and the risk for papillary thyroid cancer was also not significant (highest versus lowest quartile: HR, 1.02; 95% CI, 0.66-1.52). Conclusions: The present data did not support that either total or dietary selenium intake was associated with the risk for thyroid cancer or the papillary subtype in postmenopausal women ages 50 to 79 y in the United States.

Authors: Xiaojingyuan Xu, Michael Hendryx, Xiaoyun Liang, Ka Kahe, Yueyao Li, Juhua Luo

Full Source: Nutrition (Burbank, Los Angeles County, Calif.) 2022 Sep 5;103-104:111840. doi: 10.1016/j.nut.2022.111840

Objective: It has been suggested that higher selenium intake and consumption of supplements protect against several cancers.

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The impact of wildfire smoke and temperature on traumatic worker injury claims, Oregon 2009-2018

2022-09-15

Background and aims: As average temperatures rise and wildfire events increase in the United States, outdoor workers may be at an increased risk of injury. Recent research suggests that heat exposure increases outdoor workers' risk of traumatic injuries, but co-exposures of heat and wildfire smoke have not been evaluated.

Methods: Oregon workers' compensation data from 2009 to 2018 were linked to satellite data by the date of injury to determine if acute heat (maximum Heat Index) and wildfire smoke (presence/absence) were associated with a traumatic injury. North American Industry Classification System (NAICS) codes were utilized to identify accepted, disabling injury claims from construction (NAICS 23) and agriculture, forestry, fishing, and hunting (NAICS 11). Claims from April to October were analyzed using negative binomial models to calculate incident rate ratios (IRR) by heat and wildfire exposure for All workers and specifically for Agricultural (Ag)/Construction workers.

Results: During the study period, 91,895 accepted, traumatic injury claims were analyzed. All workers had an injury IRR of 1.04 (95% confidence interval [CI]: 1.02-1.06) while Ag/Construction workers had an IRR of 1.11 (95% CI: 1.06-1.16) when wildfire smoke was present. When the maximum Heat Index was 75°F or greater, the IRR significantly increased as temperatures increased. When the maximum Heat Index was above 80-84°F, All workers had an IRR of 1.04 (95% CI: 1.01-1.06) while Ag/Construction workers had an IRR of 1.14 (95% CI: 1.08-1.21) with risk increasing with increased temperatures. In joint models, heat remained associated with injury rates, but not wildfire smoke. No multiplicative interactions between exposures were observed.

Conclusion: Increasing temperature was associated with increased rates of traumatic injury claims in Oregon that were more pronounced in Ag/Construction workers. Future work should focus on further understanding these associations and effective injury prevention strategies.

Authors: Richard Evoy, Perry Hystad, Harold Bae, Laurel Kincl

Full Source: Health science reports 2022 Sep 15;5(5):e820. doi: 10.1002/hsr2.820.

Background and aims: As average temperatures rise and wildfire events increase in the United States, outdoor workers may be at an increased risk of injury.

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Health risk assessment of exposure to ambient formaldehyde in carpet manufacturing industries

2022-10-01

Formaldehyde is categorized as a definitive carcinogen by the International Agency for Research on Cancer. To the best of our knowledge, no study has assessed the health risks of occupational exposure of workers in carpet manufacturing plants to formaldehyde. Therefore, this study assesses the health risks of the occupational exposure to formaldehyde of 67 male workers in carpet manufacturing plants in Iran in 2022. Exposure to formaldehyde was quantitatively determined after collecting personal exposure samples from the workers' respiratory zone and spectrophotometric analysis based on method number 3500 of the National Institute of Occupational Safety and Health. In the next step, the carcinogenic and noncarcinogenic risks based on personal exposure to formaldehyde were evaluated. Sensitivity analyses were employed using the Monte Carlo simulation method. The mean inhalation exposure of workers to formaldehyde was 0.636 mg m⁻³. The inhalation cancer risk value based on the integrated risk information system for formaldehyde was $4.06 \times 10^{-4} \pm 3.17 \times 10^{-5}$ (mean \pm standard deviation), which exceeded the value reported by the US Environmental Protection Agency. An unacceptable carcinogenic risk level was found in 75.6% of workers. The highest mean inhalation cancer risk was 6.74×10^{-4} (i.e., 6.74 additional cases per 10,000 employees exposed) was found in sizing post employees. The hazard quotient of formaldehyde was 0.311 ± 0.024 . The formaldehyde concentration had a considerable effect on the health risk. The findings of this study provide valuable scientific information that supports the development of future policies to enhance the health status of employees in carpet manufacturing plants.

Authors: Amir Hossein Khoshakhlagh, Kai-Jen Chuang, Prashant Kumar
Full Source: Environmental science and pollution research international
2022 Oct 1. doi: 10.1007/s11356-022-23353-6.

Formaldehyde is categorized as a definitive carcinogen by the International Agency for Research on Cancer.