CHEMWATCH

# Bulletin Board

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## CHEMICAL EFFECTS

### Simultaneous determination and dietary intake risk assessment of 60 herbicide residues in aquatic products

2023-04-20

A sensitive and rugged analytical method was first established to simultaneously determine 60 herbicides in aquatic products with gas chromatography-tandem mass spectroscopy (GC-MS/MS). After extraction with acetonitrile (MeCN), NaCl and anhydrous Na2SO4 were added, concentrated supernatants were directly passed through the Carb/NH2 solid phase extraction column. Then, the cartridge was rinsed with elution solution (MeCN/toluene, 3:1, v/v), followed by GC-MS/MS analysis with multiple reaction monitoring. An excellent linearity (1.0-100.0 μg/L) with R2 value of ≥0.9991 was obtained, and the limits of quantification were 0.018-3.852 μg/kg. Satisfactory recoveries (70.8 %-117.6 %) with RSDs below 11.0 % of herbicide residues were obtained at spiked levels of 0.010-0.050 mg/kg. Furthermore, herbicide residues in actual aquatic products were analyzed, and the acute/chronic risk assessment of dietary exposure was carried out. The wide use of herbicides for controlling weed and removing moss and harmful algae may obviously increase the risk of contamination of the aquaculture environment and fishery products. Therefore, considerable attention and more research are necessary to monitor residue levels for herbicides in aquatic products and ensure the quality of marine products and consumer safety.

Authors: Xinru Yu, Feng Xu, Rongrong Zhang, Hua Liu, Aili Sun, Liuquan Zhang, Zeming Zhang, Xizhi Shi

Full Source: The Science of the total environment 2023 Apr 20;163633. doi: 10.1016/j.scitotenv.2023.163633.

A sensitive and rugged analytical method was first established to simultaneously determine 60 herbicides in aquatic products with gas chromatography-tandem mass spectroscopy (GC-MS/MS).

### The association between multi-heavy metals exposure and lung function in a typical rural population of Northwest China

2023-04-22

Background: Heavy metal exposure is acknowledged to be associated with decrease of lung function, but the relationship between metals co-exposure and lung function in rural areas of Northwest China remains unclear, particularly in an area famous for heavy metal pollution and solid fuel use. Therefore, the purpose of this study is to explore the effects of heavy metal exposure on lung function and the potential impacts of living habit in a rural cohort of Northwest China.



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Methods: The study area included five villages of two regions in Northwestern China-Gansu province. All participants were recruited from the Dongdagou-Xinglong (DDG-XL) rural cohort in the study area. Urine levels of 10 common and representative heavy metals were detected by ICP-MS, including Cobalt (Co), Nickel (Ni), Molybdenum (Mo), Cadmium (Cd), Stibium (Sb), Copper (Cu), Zinc (Zn), Mercury (Hg), Lead (Pb), and Manganese (Mn). The lung function was detected by measuring percentages of predicted forced vital capacity (FVC%) and predicted forced expiratory volume in one second (FEV1%) as well as the ratio of FEV1/FVC. We also analyzed the association between heavy metals and pulmonary ventilation dysfunction (PVD). Restricted cubic spline, logistic regression, linear regression, and bayesian kernel machine regression (BKMR) model were used to analyze the relationship between heavy metal exposure and lung function.

Results: Finally, a total of 382 participants were included in this study with an average age of 56.69 ± 7.32 years, and 82.46% of them used solid fuels for heating and cooking. Single metal exposure analysis showed that the higher concentration of Hg, Mn, Sb, and lower Mo may be risk factors for PVD. We also found that FEV1% and FVC% were negatively correlated with Sb, Hg, and Mn, but positively correlated with Mo. The effect of mixed heavy metals exposure could be observed through BKMR model, through which we found the lung function decreased with the increase of heavy metal concentration. Furthermore, the males, BMI ≥ 24 kg/m2 and who used solid fuels showed a higher risk of PVD when exposed to Co, Zn, and Hg.

Conclusions: Our results suggested that heavy metal exposure was associated with decrease of lung function regardless of single exposure or mixed exposure, particularly for Sb, Hg, Mn and those who use solid fuels.

Authors: Ling Zheng, Yunhui Yu, Xiaoyu Tian, Li He, Xiaobing Shan, Jingping Niu, Jun Yan, Bin Luo

Full Source: Environmental science and pollution research international 2023 Apr 22. doi: 10.1007/s11356-023-26881-x.

Background: Medical therapies can cause cardiotoxicity.

### Cardiotoxicity of chloroquine and hydroxychloroquine through mitochondrial pathway

2023-04-21

Background: Medical therapies can cause cardiotoxicity. Chloroquine (QC) and hydroxychloroquine (HQC) are drugs used in the treatment of malaria and skin and rheumatic disorders. These drugs were considered to help treatment of coronavirus disease (COVID-19) in 2019. Despite the low cost and availability of QC and HQC, reports indicate that this class of drugs can

cause cardiotoxicity. The mechanism of this event is not well known, but evidence shows that QC and HQC can cause cardiotoxicity by affecting mitochondria and lysosomes.
Methods: Therefore, our study was designed to investigate the effects of QC and HQC on heart mitochondria. In order to achieve this aim, mitochondrial function, reactive oxygen species (ROS) level, mitochondrial membrane disruption, and cytochrome c release in heart mitochondria were evaluated. Statistical significance was determined using the one-way and two-way analysis of variance (ANOVA) followed by post hoc Tukey to evaluate mitochondrial succinate dehydrogenase (SDH) activity and cytochrome c release, and Bonferroni test to evaluate the ROS level, mitochondrial membrane potential (MMP) collapse, and mitochondrial swelling.
Results: Based on ANOVA analysis (one-way), the results of mitochondrial SDH activity showed that the IC50 concentration for CQ is 20 μM and for HCQ is 50 μM. Based on two-way ANOVA analysis, the highest effect of CQ and HCQ on the generation of ROS, collapse in the MMP, and mitochondrial swelling were observed at 40 μM and 100 μM concentrations, respectively ($p < 0.05$). Also, the highest effect of these two drugs has been observed in 60 min ($p < 0.05$). The statistical results showed that compared to CQ, HCQ is able to cause the release of cytochrome c from mitochondria in all applied concentrations ($p < 0.05$).
Conclusions: The results suggest that QC and HQC can cause cardiotoxicity which can lead to heart disorders through oxidative stress and disfunction of heart mitochondria.
Authors: Enayatollah Seydi, Mojgan Karbalay, Saghi Naderpour, Abdollah Arjmand, Jalal Pourahmad
Full Source: BMC pharmacology & toxicology 2023 Apr 21;24(1):26. doi: 10.1186/s40360-023-00666-x.

## ENVIRONMENTAL RESEARCH

### Intermediate and long-term exposure to air pollution and temperature and the extracellular microRNA profile of participants in the normative aging study (NAS)

2023-04-19
Background: The molecular effects of intermediate and long-term exposure to air pollution and temperature, such as those on extracellular microRNA (ex-miRNA) are not well understood but may have clinical consequences.

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Objectives: To assess the association between exposure to ambient air pollution and temperature and ex-miRNA profiles.
Methods: Our study population consisted of 734 participants in the Normative Aging Study (NAS) between 1999 and 2015. We used high-resolution models to estimate four-week, eight-week, twelve-week, six-month, and one-year moving averages of PM2.5, O3, NO2, and ambient temperature based on geo-coded residential addresses. The outcome of interest was the extracellular microRNA (ex-miRNA) profile of each participant over time. We used a longitudinal quantile regression approach to estimate the association between the exposures and each ex-miRNA. Results were corrected for multiple comparisons and ex-miRNAs that were still significantly associated with the exposures were further analyzed using KEGG pathway analysis and Ingenuity Pathway Analysis.
Results: We found 151 significant associations between levels of PM2.5, O3, NO2, and ambient temperature and 82 unique ex-miRNAs across multiple quantiles. Most of the significant results were associations with intermediate-term exposure to O3, long-term exposure to PM2.5, and both intermediate and long-term exposure to ambient temperature. The exposures were most often associated with the 75th and 90th percentile of the outcomes. Pathway analyses of significant ex-miRNAs revealed their involvement in biological pathways involving cell function and communication as well as clinical diseases such as cardiovascular disease, respiratory disease, and neurological disease.
Conclusion: Our results show that intermediate and long-term exposure to all our exposures of interest were associated with changes in the ex-miRNA profile of study participants. Further studies on environmental risk factors and ex-miRNAs are warranted.
Authors: Mahdieh Danesh Yazdi, Feiby L Nassan, Anna Kosheleva, Cuicui Wang, Zongli Xu, Qian Di, Weeberb J Requia, Nicole T Comfort, Haotian Wu, Louise C Laurent, Peter DeHoff, Pantel Vokonas, Andrea A Baccarelli, Joel D Schwartz
Full Source: Environmental research 2023 Apr 19;115949. doi: 10.1016/j.envres.2023.115949.

### An algorithm for quantitatively estimating occupational endotoxin exposure in the Biomarkers of Exposure and Effect in Agriculture (BEEA) study: I. Development of task-specific exposure levels from published data

2023-04-23
Background/objective: Farmers conduct numerous tasks with potential for endotoxin exposure. As a first step to characterize endotoxin exposure

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for farmers in the Biomarkers of Exposure and Effect in Agriculture (BEEA) Study, we used published data to estimate task-specific endotoxin concentrations.
Methods: We extracted published data on task-specific, personal, inhalable endotoxin concentrations for agricultural tasks queried in the study questionnaire. The data, usually abstracted as summary measures, were evaluated using meta-regression models that weighted each geometric mean (GM, natural-log transformed) by the inverse of its within-study variance to obtain task-specific predicted GMs.
Results: We extracted 90 endotoxin summary statistics from 26 studies for 9 animal-related tasks, 30 summary statistics from 6 studies for 3 crop-related tasks, and 10 summary statistics from 5 studies for 4 stored grain-related tasks. Work in poultry and swine confinement facilities, grinding feed, veterinarian services, and cleaning grain bins had predicted GMs > 1000 EU/m3. In contrast, harvesting or hauling grain and other crop-related tasks had predicted GMs below 100 EU/m3.
Significance: These task-specific endotoxin GMs demonstrated exposure variability across common agricultural tasks. These estimates will be used in conjunction with questionnaire responses on task duration to quantitatively estimate endotoxin exposure for study participants, described in a companion paper.
Authors: Melissa C Friesen, Shuai Xie, Jean-François Sauvé, Susan Marie Viet, Pabitra R Josse, Sarah J Locke, Felicia Hung, Gabriella Andreotti, Peter S Thorne, Jonathan N Hofmann, Laura E Beane Freeman
Full Source: American journal of industrial medicine 2023 Apr 23. doi: 10.1002/ajim.23486.

Environmental air pollution and resulting acid rain have the effect of increasing aluminum levels in water bodies.

## PHARMACEUTICAL/TOXICOLOGY

### Aluminum induces a stress response in zebrafish gills by influencing metabolic parameters, morphology, and redox homeostasis

2023-04-19
Environmental air pollution and resulting acid rain have the effect of increasing aluminum levels in water bodies. We studied the effects of aluminum on fish gills, the tissue most exposed to aluminum, using zebrafish as an experimental model. Adult zebrafish were exposed to an aluminum concentration found in polluted environments (11 mg/L) for 10, 15 and 20 days and the effects on gill morphology, redox homeostasis (ROS content, NADPH oxidase, NOX, activity, oxidative



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damage, antioxidant enzymes, total antioxidant capacity, in vitro susceptibility to oxidants) and on behavioural and metabolic parameters (routine respiratory oxygen consumption rMO2, tail-beating frequency, cytochrome oxidase activity and muscle lactate content) were evaluated. Exposure to aluminum affects branchial histology, inducing alterations in primary and secondary lamellae and redox homeostasis, modifying ROS levels, NOX activity, lipid and protein oxidative damage, antioxidant enzymes, and total antioxidant capacities, and increases rMO2. The effects exhibited a time-dependent behaviour, suggesting the activation of an adaptive response. These changes are associated with a transition of muscle metabolism from aerobic to anaerobic, as suggested by the increase in muscle lactate content, which is probably functional to preserve locomotor performance. Overall, the results here reported provide new insights into the toxicity mechanisms of Al exposure on gill tissue and the subsequent adaptive response of aquatic species.
Authors: Gaetana Napolitano, Teresa Capriello, Paola Venditti, Gianluca Fasciolo, Alessandra La Pietra, Marco Trifuoggi, Antonella Giarra, Claudio Agnisola, Ida Ferrandino
Full Source: Comparative biochemistry and physiology. Toxicology & pharmacology : CBP 2023 Apr 19;109633. doi: 10.1016/j.cbpc.2023.109633.

Ultraviolet C (UVC) light has long been used as a sterilizing agent, primarily through devices that emit at 254 nm.

### Different biological effects of exposure to far-UVC (222 nm) and near-UVC (254 nm) irradiation

2023-04-11
Ultraviolet C (UVC) light has long been used as a sterilizing agent, primarily through devices that emit at 254 nm. Depending on the dose and duration of exposure, UV 254 nm can cause erythema and photokeratitis and potentially cause skin cancer since it directly modifies nitrogenated nucleic acid bases. Filtered KrCl excimer lamps (emitting mainly at 222 nm) have emerged as safer germicidal tools and have even been proposed as devices to sterilize surgical wounds. All the studies that showed the safety of 222 nm analyzed cell number and viability, erythema generation, epidermal thickening, the formation of genetic lesions such as cyclobutane pyrimidine dimers (CPDs) and pyrimidine-(6-4)-pyrimidone photoproducts (6-4PPs) and cancer-inducing potential. Although nucleic acids can absorb and be modified by both UV 254 nm and UV 222 nm equally, compared to UV 254 nm, UV 222 nm is more intensely absorbed by proteins (especially aromatic side chains), causing photooxidation and cross-linking. Here, in addition to analyzing DNA lesion formation, for the first time, we evaluated changes in the proteome and cellular pathways, reactive oxygen species formation, and metalloproteinase

(MMP) levels and activity in full-thickness in vitro reconstructed human skin (RHS) exposed to UV 222 nm. We also performed the longest (40 days) in vivo study of UV 222 nm exposure in the HRS/J mouse model at the occupational threshold limit value (TLV) for indirect exposure (25 mJ/cm2) and evaluated overall skin morphology, cellular pathological alterations, CPD and 6-4PP formation and MMP-9 activity. Our study showed that processes related to reactive oxygen species and inflammatory responses were more altered by UV 254 nm than by UV 222 nm. Our chronic in vivo exposure assay using the TLV confirmed that UV 222 nm causes minor damage to the skin. However, alterations in pathways related to skin regeneration raise concerns about direct exposure to UV 222 nm.

Authors: Renata Spagolla Napoleão Tavares, Douglas Adamoski, Alessandra Girasole, Ellen Nogueira Lima, Amauri da Silva Justo-Junior, Romênia Domingues, Ana Clara Caznok Silveira, Rafael Elias Marques, Murilo de Carvalho, Andre Luis Berteli Ambrosio, Adriana Franco Paes Leme, Sandra Martha Gomes Dias

Full Source: Journal of photochemistry and photobiology. B, Biology 2023 Apr 11;243:112713. doi: 10.1016/j.jphotobiol.2023.112713.

## OCCUPATIONAL

### Focusing on testosterone levels in male: A half-longitudinal study of polycyclic aromatic hydrocarbon exposure and diastolic blood pressure in coke oven workers

2023-04-20

Polycyclic aromatic hydrocarbons (PAHs) can interfere with testosterone levels, and low levels of testosterone are associated with increased cardiovascular events. To explore the role of testosterone in PAHs exposure and cardiovascular health, we used data from the 2011-2016 National Health and Nutrition Examination Survey (NHANES) and a longitudinal database of 332 male coke oven workers from China. The urine PAHs, tobacco metabolites and plasma testosterone levels of coke oven workers were measured. There were inverse associations between serum (plasma) testosterone concentrations and the risk of dysarteriotony and dyslipidemia among the NHANES participants and coke oven workers. The results of the cross-lagged panel analysis among workers showed that the decrease in testosterone preceded the increase in diastolic blood pressure (DBP), and the absolute value of the path coefficient from baseline testosterone to follow-up DBP (β2 = -8.162, P = 0.077) was significantly larger than the absolute value of the path coefficient from baseline DBP

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to follow-up testosterone (β1 = -0.001, P = 0.781). Results from the half-longitudinal mediation analysis showed that baseline hydroxyfluorene predicted significant decreases in plasma testosterone from baseline to follow-up (path a: 0.71, 95% CI: 1.26, -0.16), whereas plasma testosterone at baseline also predicted significant increments in DBP from baseline to follow-up (path b: 9.22, 95% CI: 17.24, -1.19). The indirect effect of PAHs on DBP via plasma testosterone level was marginally significant (test for indirect effects a*b (P = 0.08)). In conclusion, testosterone level is a longitudinal precursor to increased DBP and plays an essential role in the association between PAHs exposure and damage to the cardiovascular system. Coke oven workers with low plasma testosterone levels are more likely to experience adverse changes in blood pressure and lipid levels after exposure to PAHs.

Authors: Quan Feng, Jiajun Wei, Yong Wang, Jinyu Wu, Hongyue Kong, Shugang Guo, Gaisheng Liu, Jun Dong, Liuquan Jiang, Qiang Li, Jisheng Nie, Jin Yang

Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Apr 20;121614. doi: 10.1016/j.envpol.2023.121614.

### Occupational exposures in the rubber tire industry and risk of cancer: a systematic review

2023-04-21

Objective: This study aimed at investigate the association between cancer and the rubber tire industry using indicators used to estimate exposure, such as duration or historical time period of exposure.

Methods: A systematic review using MEDLINE was carried out. The Preferred Reporting Items for Systematic Reviews (PRISMA) statement guided the systematic review. The Risk of Bias in Non-Randomized Studies of Exposures (ROBINS-E) was used to analyze biases in the selected studies.

Results: A total of 240 articles were initially selected. Of these, 17 were included in this systematic review of 15 different cohorts and one case-control study. Five cohorts were composed of rubber industry employees including some who worked in the rubber tire industry, whereas the other 10 cohorts were composed exclusively of rubber tire industry employees. An increased risk of lung/respiratory cancer is possible in the oldest time periods without duration of exposure showing any association according to the analysis. The work areas of mixing and milling as well as compounding seem to be more specifically associated with this risk, which could be expected because of the exposure to fumes containing carcinogenic agents.

Objective: This study aimed at investigate the association between cancer and the rubber tire industry using indicators used to estimate exposure, such as duration or historical time period of exposure.

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Conclusions: Having worked in the rubber tire industry in the past, especially in milling, mixing as well as compounding may be associated with an increased risk of lung/respiratory cancer.
Authors: Sylvain Chamot, Marion Delzard, Lea Leroy, Gwen Marhic, Olivier Ganry
Full Source: International archives of occupational and environmental health 2023 Apr 21. doi: 10.1007/s00420-023-01972-x.

## Human occupational exposure to microplastics: A cross-sectional study in a plastic products manufacturing plant

2023-04-20
Microplastics are ubiquitous in the natural environment, and their potential impact on health is a key issue of concern. Investigating exposure routes in humans and other living organisms is among the major challenges of microplastics. This study aims to examine the exposure level of plastic factory staff to microplastic particles before and after work shifts through body receptors (hand and facial skin, saliva and hair) in Sirjan, southeast of Iran. Moreover, the effect of face masks, gloves, cosmetics (e.g: face powder cream, lipstick and eye makeup products) and appearance on the exposure level is investigated. In total, 19 individuals are selected during six working days. Then, the collected samples are transferred to the laboratory for filtration, extraction, identification and counting of microplastic particles. Moreover, 4802 microplastic particles (100-5000 μm in size) in strand, polyhedral and spherical shapes and color spectra of white/transparent, black, blue/green, red and purple are observed. The nature of most of the observed samples is fiber with a size ≥1000 μm. Analyzing the selected samples using micro-Raman spectroscopy indicate polyester and nylon are the main identified fibers. Hair and saliva samples have the highest and lowest number of microplastics, respectively. Using gloves and sunscreen among all the participants, wearing a scarf and hair size among women and having a beard and mustache among men could have an effective role in the exposure level to microplastics. Results of this study could reveal the exposure route to microplastic particles in the human body and highlight the importance of providing higher protection to reduce exposure.
Authors: Maryam Shahsavaripour, Sajjad Abbasi, Moghadameh Mirzaei, Hoda Amiri
Full Source: The Science of the total environment 2023 Apr 20;163576. doi: 10.1016/j.scitotenv.2023.163576.

Microplastics are ubiquitous in the natural environment, and their potential impact on health is a key issue of concern.