

Bulletin Board

Contents

OCT. 17, 2025

(click on page numbers for links)

CHEMICAL EFFECTS

- Characterization of engineered stone dust-induced reactive oxygen species generation and cytotoxicity in vitro3
- Bibliometric analysis of research trends and hotspots on organic solvent induced hearing loss4
- Research progress on population load and hepatotoxicity of glyphosate..5

ENVIRONMENTAL RESEARCH

- The hidden hazard in kitchen environment: A preliminary study of health risks associated with inhaling acrylamide during French fries frying5
- From waterways to the brain: Unraveling the environmental triggers of depression through PPCPs-gene network convergence6

PHARMACEUTICAL/TOXICOLOGY

- Environmental co-exposure to roxarsone and heavy metals drives bacterial antibiotic multidrug resistance via genetic and phenotypic adaptations7
- Environmental exposure to toxic and essential metals and glucose homeostasis in adolescents: A cross-sectional analysis of the Hong Kong School Children Cohort.....8
- Organophosphorus Pesticide Degradation by Microorganisms: A Review .9

OCCUPATIONAL

- The impact of climate change on the flux and fate of metals in freshwater systems: Implications for metal exposure across different scales10
- Exposure to consecutive extreme ozone-heatwave events and neurological disorders: a retrospective cohort study in Nanjing, China11

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Bulletin Board

Technical

OCT. 17, 2025

CHEMICAL EFFECTS

Characterization of engineered stone dust-induced reactive oxygen species generation and cytotoxicity in vitro

2025-10-10

Engineered stone (ES) fabrication generates respirable dust containing crystalline silica (CS), linked to accelerated silicosis outbreaks. Mechanisms underlying this toxicity, particularly the role of particle aging, remain unclear. In the occupational setting, workers are exposed to engineered stone dust (ESD) upon generation by cutting and grinding ES; however, ESD-initiated toxicity is frequently studied in labs using aged particles. This study aimed to compare radical generation and in vitro cytotoxicity of fresh versus aged ESD. Three different respirable ES types (ES A: 60% CS; B: 20%; C: 0%), granite (30%), and Min-u-Sil 5 (MS5, 99.5%) were generated using an automated cutting system and analyzed either freshly stored under N₂ at -80°C or after aging in air at room temperature for 2 weeks. RAW 264.7 macrophages were exposed to particles (10 µg/well, 100 µg/ml, 31.25 µg/cm², 24 hr), and viability, apoptosis, necrosis, and intracellular reactive oxygen species (ROS) were measured. Fresh ESD/granite exhibited significantly higher electron paramagnetic resonance (EPR) radical signals than aged counterparts and MS5. Fresh ES/granite reduced macrophage viability, while aged materials/MS5 did not. Apoptosis increased with all particles where fresh/aged difference occurred only in ES B. Necrosis rose markedly with fresh ES A. Intracellular ROS was elevated by some materials, but N-acetylcysteine (NAC) antioxidant failed to prevent cytotoxicity induced by fresh particles. In conclusion, freshly generated ESD displayed greater radical-generating capacity and distinct cytotoxic effects compared to aged ESD, influenced by factors beyond CS content. ROS-independent mechanisms appear crucial for acute cytotoxicity. These findings indicate particle aging as a critical factor in ESD toxicological assessment.

Authors: W Kyle Mandler, Alycia K Knepp, Stephen S Leonard, Walter McKinney, Sarah Keeley, Yong Qian

Full Source: Journal of toxicology and environmental health. Part A 2025 Oct 10:1-11. doi: 10.1080/15287394.2025.2562482.

Bulletin Board

Technical

OCT. 17, 2025

Bibliometric analysis of research trends and hotspots on organic solvent induced hearing loss

2025-09-20

Objective: To explore the research hotspots and trends in the literature related to hearing loss caused by organic solvents, and to provide an effective theoretical basis for further research on the impact of ototoxic organic solvents on the auditory system.

Methods: In January 2024, literatures that met the inclusion/exclusion criteria from 1974 to 2023 in the PubMed database were selected. The authors, countries, journal fields and publishing institutions of the literatures were analyzed through Bicom version 2.01. The author co-occurrence knowledge network graph and the literature publication institution graph were plotted using CiteSpace 6.3R1 Advance, and the co-occurrence clustering map of keywords was drawn using VOS viewer 1.6.19 software.

Results: A total of 380 relevant literatures were retrieved, and 256 were finally included. The top three countries in terms of the number of published literature were the United States (accounting for 30.08%, 77/256), the United Kingdom (accounting for 17.97%, 46/256), and the Netherlands (accounting for 10.16%, 26/256). The published authors were represented by Pierre Campo, involving a total of 165 institutions, mainly occupational health research institutions and hearing institutions. It mainly involved related fields such as audiology, occupational medicine, environmental hygiene, toxicology, and otolaryngology. The key groups were painters, aviation industry personnel, gas station workers and agricultural workers. The key solvents included organic solvent mixtures, benzene and its derivatives, trichloroethylene, ethanol, carbon disulfide, etc.

Conclusion: Research on hearing loss caused by organic solvents mainly focuses on countries such as the United States, the United Kingdom, and the Netherlands, with a particular emphasis on occupational groups such as painters, aviation industry personnel, gas station workers, and agricultural personnel, as well as the ototoxic effects of organic solvent mixtures, benzene and its derivatives, etc. This provides a basis for subsequent mechanism exploration, protection strategy formulation, and hearing health management of the target population.

Authors: X Y Ni, Q Jia, H Y Sha, F Zhang

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 2025 Sep 20;43(9):687-692. doi: 10.3760/cma.j.cn121094-20240604-00250.

Bulletin Board

Technical

OCT. 17, 2025

Research progress on population load and hepatotoxicity of glyphosate

2025-09-20

Glyphosate is an organophosphorus herbicide with a large global production volume and wide application. It is commonly present in the environment and has a relatively long residual period. Its long-term toxicity, carcinogenic potential and other health effects deserve attention and further research. Glyphosate exposure has toxic effects on a variety of organs, including but not limited to hepatotoxicity, reproductive toxicity, neurotoxicity, etc., and is associated with the occurrence and development of different types of cancer. This article summarizes the physicochemical properties of glyphosate, its usage and pollution status in China, sorts out and summarizes its population load situation, and focuses on discussing the hepatotoxic effects of glyphosate under various exposure scenarios, including the acute poisoning situation and the progress of long-term low-dose exposure in the general population, and long-term high dose exposure condition in the occupational population. The hepatotoxic effects of glyphosate on mammals, fish, and organs and cells in vitro experiments were deeply analyzed. The possible toxicological mechanism of glyphosate hepatotoxicity was analyzed from oxidative stress, mitochondrial dysfunction, inflammation and other aspects, aiming to explore the effects of glyphosate exposure on liver health and provide a reference for scientific guidance on the rational use of glyphosate.

Authors: J Lu, B S Wang, B L Zhu

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 2025 Sep 20;43(9):713-720. doi: 10.3760/cma.j.cn121094-20240422-00174.

ENVIRONMENTAL RESEARCH

The hidden hazard in kitchen environment: A preliminary study of health risks associated with inhaling acrylamide during French fries frying

2025-10-11

High temperatures during the deep-frying of French fries can lead to the formation of acrylamide (AA), a potential carcinogen. Our previous research indicated that AA may volatilize into the air, posing a respiratory exposure risk to kitchen staff. This study aimed to assess AA exposure among individuals deep-frying French fries and evaluate the protective

Bulletin Board

Technical

OCT. 17, 2025

effect of mask usage. This study employed an integrated approach using personal sampling, human biomonitoring using urinary biomarkers, and exposure questionnaires to assess the potential respiratory health risks of AA exposure among kitchen workers. Personal air sampling revealed an average airborne AA concentration of $1.32 \pm 0.79 \mu\text{g}/\text{m}^3$. After 8 h of frying French fries, urinary concentrations of N-acetyl-S-(3-amino-3-oxopropyl) cysteine (AAMA) were 38.48, 29.74, and 28.58 $\mu\text{g}/\text{g}$ creatinine in G1 (no mask), G2 (worn the same mask for 8 h), and G3 (changed masks every 15 min), respectively. G1 had significantly higher AAMA levels than G2 ($p = 0.030$) and G3 ($p = 0.024$), suggesting a protective effect from wearing a mask. A strong linear correlation ($R^2=0.883$) between airborne AA and urinary AAMA in G1 suggests that inhalation was a primary exposure route. The results of health risk assessment showed that the estimated cancer risk exceeded the NIOSH Risk Management Limit for Carcinogens (1.0×10^{-4}), indicating that AA exposure during deep-frying is a potential occupational hazard. These findings underscore the need for enhanced protective measures to mitigate health risks in kitchen environments.

Authors: Li-Hsin Cheng, Ming-Jen Chen, Tzu-Ping Tseng, Li-Jen Huang, Ching-Ho Lin, Chin-Hsing Lai, Shu-Hsing Yeh, Peter Brimblecombe, Hui-Tsung Hsu

Full Source: Ecotoxicology and environmental safety 2025 Oct 11:305:119200. doi: 10.1016/j.ecoenv.2025.119200.

From waterways to the brain: Unraveling the environmental triggers of depression through PPCPs-gene network convergence

2025-10-09

Pharmaceutical and personal care products (PPCPs), as ubiquitous emerging contaminants, present undercharacterized neuropsychiatric hazards through environmental exposure. This investigation employs convergent multi-omics strategies - integrating toxicogenomic discovery, disease-associated genomic mapping, and transcriptomic profiling - to elucidate mechanistic linkages between PPCPs bioactivity and depressive pathogenesis. Through systematic analysis of Nanjing's aquatic chemical burden (prioritizing dimenhydrinate, ibuprofen, padimate-O, caffeine, and roxithromycin), we identified 3073 conserved molecular targets bridging PPCPs toxicity and depression etiology via Comparative Toxicogenomics Database and GeneCards interrogation. Functional ontology revealed dysregulated pathways encompassing lipidomic remodeling, IL-17-mediated neuroinflammation, and synaptic transmission deficits. Ensembled machine learning algorithms (Lasso regression, XGBoost,

Bulletin Board

Technical

OCT. 17, 2025

random forest) converged on seven high-fidelity candidate biomarkers (HSPA8, CBX1, CD59, CHAF1A, CUX1, ID2, RPL3) demonstrating stress-adaptive, chromatin regulatory, and immunomodulatory functions. Molecular docking predicted strong binding affinities between PPCPs and depression-related proteins, notably dimenhydrinate with CHAF1A (-6.1 kcal/mol) and HSPA8 (-6.1 kcal/mol), suggesting multi-target modulation. This work proposes a computational framework to map molecular interactions between specific PPCPs and depression-associated pathways. Candidate targets highlight testable hypotheses for future experimental validation. These findings suggest selected PPCPs with neuroactive properties may warrant further investigation as environmental modifiers of depression risk.

Authors: Cong Wang, Ke Che, Guanglei Zhang, Hao Yu

Full Source: Ecotoxicology and environmental safety 2025 Oct 9:305:119181. doi: 10.1016/j.ecoenv.2025.119181.

PHARMACEUTICAL/TOXICOLOGY

Environmental co-exposure to roxarsone and heavy metals drives bacterial antibiotic multidrug resistance via genetic and phenotypic adaptations

2025-09-29

Agricultural wastewater, a significant component of the anthropogenic water cycle, often contains complex mixtures of contaminants, including non-antibiotic feed additives, posing largely uncharacterized risks for antimicrobial resistance (AMR) evolution. This study addresses the critical knowledge gap regarding the combined impact of commonly co-occurring roxarsone (ROX) and heavy metals (Zn, Cu) at environmentally relevant concentrations on the de novo evolution and persistence of multidrug resistance in aquatic environments. Using a 90-day laboratory evolution experiment with *Escherichia coli*, we demonstrate that while ROX alone induced moderate resistance (e.g., 6.2-fold increase in minimum inhibitory concentration (MIC) for chloramphenicol), co-exposure with Zn and Cu synergistically drove multidrug tolerance to nine antibiotics and selected for stable, heritable resistance to chloramphenicol, tetracycline, and kanamycin (up to 8.2-fold MIC increase). This robust resistance persisted even after pollutant removal, highlighting a significant long-term threat to water quality and public health via the dissemination of resilient AMR bacteria from agricultural sources. Co-exposure intensified oxidative stress-induced mutagenesis

Bulletin Board

Technical

OCT. 17, 2025

and selected for key adaptive strategies enhancing bacterial survival and AMR persistence in contaminated water. These include upregulated efflux pumps, increased secretion of extracellular polymeric substances (1.1-3.2-fold), enhanced motility (1.1-1.5-fold), and cell filamentation (lengths 2.4-8.2-fold greater). These findings illuminate a potent, previously underestimated environmental pathway where mixtures of common agricultural pollutants in wastewater synergistically select for persistent multidrug resistance. This research underscores the urgent need to revise water quality criteria and wastewater treatment paradigms to address the co-selection pressures exerted by non-antibiotic chemical mixtures in aquatic ecosystems.

Authors: Qian-He Liu, Li Yuan, Zheng-Hao Li, Kenneth Mei Yee Leung, Guo-Ping Sheng

Full Source: Water research 2025 Sep 29;288(Pt B):124682. doi: 10.1016/j.watres.2025.124682.

Environmental exposure to toxic and essential metals and glucose homeostasis in adolescents: A cross-sectional analysis of the Hong Kong School Children Cohort

2025-10-11

Environmental exposure to heavy metals is associated with increased risk of type 2 diabetes (T2D). Although T2D in adolescents and young adults is increasingly prevalent, the association between toxic and essential metals and glucose homeostasis in adolescents has not been reported. We examined the associations of individual and mixture of urinary concentrations of four toxic metals (arsenic [As], cadmium [Cd], mercury [Hg], and lead [Pb]), and seven essential metals (chromium [Cr], cobalt [Co], copper [Cu], manganese [Mn], nickel [Ni], selenium [Se], and zinc [Zn]) with glucose homeostasis traits in 1939 Chinese adolescents (mean age 15.6 ± 2.1 , 49.1 % boys) in Hong Kong. We used linear regression, advanced machine learning-based quantile-g-computation (qgcomp), Bayesian kernel machine regression (BKMR), and restricted cubic splines to examine the associations, dose-response relationships, and interactions between creatinine-adjusted urinary concentrations of 11 metals and fasting plasma glucose (FPG), insulin resistance (HOMA-IR), and beta-cell function (HOMA-beta). After adjusting for confounders, the urinary As-FPG, Cr-FPG, Zn-HOMA-IR, Cu-HOMA-beta, Cr-HOMA-beta associations were linear while that of Mn-HOMA-beta was non-linear. We observed an interaction between toxic (Cr) and essential (As) metals for HOMA-beta. We further observed sex-specific associations of toxic (As) and essential metals (Cr, Zn, Mn, and Cu) with glucose homeostasis traits as well as the

Bulletin Board

Technical

OCT. 17, 2025

associations of metal mixture of 11 metals with increased FPG and HOMA-IR. These complex associations between urinary metal concentrations and glucose homeostasis traits in adolescents call for prospective studies to evaluate their long-term significance on metabolic health.

Authors: Jiazhou Yu, Aimin Yang, Elaine Chow, Mai Shi, Yincong Xue, Claudia Ht Tam, Natural Hs Chu, Stephanie Hm Cheung, Eric Sh Lau, Hongjiang Wu, Juliana Nm Lui, Ronald Cw Ma, Alice Ps Kong, Andrea Oy Luk, Jones Cm Chan, Iris Hs Chan, Michael Hm Chan, Juliana Cn Chan
Full Source: Ecotoxicology and environmental safety 2025 Oct 11:305:119179. doi: 10.1016/j.ecoenv.2025.119179.

Organophosphorus Pesticide Degradation by Microorganisms: A Review

2025-08-26

Pesticides spread into the air, contaminate soil and water, and can affect various objects, contributing to secondary pollution regardless of the employed type or application method. Currently, organophosphorus pesticides (OPs) are widely utilized in agriculture, forestry, and livestock farming worldwide. These chemicals enter the body through multiple exposure routes and can harm the nervous system, endocrine system, and other organs. Owing to the environmental persistence and elevated toxicity exhibited by these pesticides, certain OPs are difficult to break down biologically, thus posing serious threats to human health and ecosystems. Disinfection or destruction of those pesticides remaining in the environment represents one of the important tasks scientists face. This review presents information on OPs, some of their properties, environmental impacts, and mechanisms for the effective decomposition of these pesticide residues by microorganisms. Bacteria and fungi isolated from samples contaminated with various OPs were analyzed. New metabolites formed during OP degradation by these microorganisms, as well as microbial enzymes involved in OP degradation and the molecular mechanisms of the process, are presented. The methods used in these studies and recommendations for future research are also detailed.

Authors: Diyorbek Kosimov, Rustambek Ergashev, Aziza Mavjudova, Sherali Kuziev

Full Source: Frontiers in bioscience (Elite edition) 2025 Aug 26;17(3):38805. doi: 10.31083/FBE38805.

Bulletin Board

Technical

OCT. 17, 2025

OCCUPATIONAL

The impact of climate change on the flux and fate of metals in freshwater systems: Implications for metal exposure across different scales

2025-10-09

Climate change and chemical pollution are two of the gravest environmental concerns, and it is becoming increasingly recognised that climate change and climate variability will alter the environmental distribution and toxicity of chemical pollutants. Trace metals are an established pollutant group where decades of research have been able to determine causal links between environmental concentrations and water chemistry, and accumulation and toxic effects. In the present paper, we assert that to fully comprehend the impact of climate change on metal bioavailability and exposures in freshwaters, three distinct scales need to be understood: (i) the global scale of metal biogeochemical cycling which will alter metal inputs from soil into freshwater; (ii) the environmental scale of fluctuating water chemistry parameters that will change metal complexation dynamics; and (iii) the organismal scale at which climate-induced physiological modifications at the site of uptake may alter the bioaccumulation of metals and climate-induced impairments of cellular function that will change toxicity. At each scale much is already known about the processes and pathways that govern metal input, bioavailability and impacts on biota, but the key impact of climate variability is to alter the frequency, intensity, and rates at which these processes occur with the underlying commonality throughout scales being a shift to a more dynamic system. In an increasingly dynamic environment, it is the kinetics of both chemical and biological reactions that become more important compared to predictions of metal bioavailability from currently utilised thermodynamic equilibrium-based models. Extending such models to include climate variability is not easy, but to begin such a process would ultimately lead to more accurate and realistic applications to policy guidance.

Authors: Farhan R Khan, Nicolas R Bury, Christopher A Cooper, David Boyle, Elizabeth Middleton, Simon D Herzog

Full Source: Environmental research 2025 Oct 9:123057. doi: 10.1016/j.envres.2025.123057.

Bulletin Board

Technical

OCT. 17, 2025

Exposure to consecutive extreme ozone-heatwave events and neurological disorders: a retrospective cohort study in Nanjing, China

2025-10-10

Objectives: In the context of global warming and escalating urbanization, occurrences of extreme ozone (EO) and heatwave (HW) events are increasingly frequent. However, studies on the impact of consecutive extreme ozone and heatwave (EO-HW) events on hospitalizations for neurological disorders (ND) and related economic burdens remains limited. Our study aimed to explore the impacts of these events on ND hospitalizations, length of stay, and related costs, with a specific focus on quantifying the impacts of consecutive extreme events of varying durations.

Methods: Time-series analysis was performed to investigate the relationships between consecutive O₃ and HW events of varying durations and the number of hospitalizations, length of stay, and hospitalization costs for ND, employing a quasi-Poisson distributed-lag non-linear model (DLNM). In addition, we further identified potential high-risk groups by age and gender stratification.

Results: Exposure to EO-HW events were associated with an increased risk of hospitalization for ND, with this risk persisting from lag 1 day (1.097, 95% CI: 1.005, 1.198) to lag 4 days (1.071, 95% CI: 1.004, 1.139). Significant associations were particularly evident in male (highest RR value 1.092, 95% CI: 1.016, 1.173) and aged < 65 years (highest RR value 1.124, 95% CI: 1.008, 1.254). Furthermore, exposure to EO-HW events were found to result in longer length of stay and higher hospitalization costs compared to exposure to HW events alone.

Conclusions: Consecutive EO-HW events significantly increase the risk of hospitalization and the economic burden of ND. Local authorities should consider incorporating early warning information and public health interventions for consecutive extreme weather into existing early warning systems. Neglecting to do so will likely result in higher associated illness rates and economic burdens.

Authors: Haili Ren, Yizhang Xia, Tianchi Zhuang, Yang Li, Yu Chen, Wei Huang, Peijie Jiang, Xia Tang, Shuwen Han, Yan Cui, Jiemiao Shen, Minghui Ji

Full Source: Environmental health: a global access science source 2025 Oct 10;24(1):74. doi: 10.1186/s12940-025-01234-y.