CHEMWATCH

# Bulletin Board

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### CONTACT US


subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

## CHEMICAL EFFECTS

### Association between volatile organic compounds exposure and periodontitis: A representative cross-sectional study

2024-07-14

Aim: Periodontitis is one of the most common oral diseases and a major cause of tooth loss in adults. Environmental pollution is closely associated with the prevalence of periodontitis. However, few studies have focused on the association between volatile organic compounds (VOCs) and periodontitis. This cross-sectional study aims to examine whether exposure to VOCs is associated with periodontitis, based on data from the National Health and Nutrition Examination Survey (NHANES, 2011-2014).
Materials and methods: We analysed data on blood VOC levels, periodontitis and related covariates from 2772 participants of the NHANES. The association between the blood VOCs and periodontitis was analysed using weighted logistic regression analysis, the restricted cubic spline (RCS) model and the weighted quantile sum (WQS) regression model. Interaction tests and mediation analysis were also conducted.
Results: After adjusting for covariates, for each natural constant-fold increase in 1,4-dichlorobenzene, the odds of having periodontitis increased by 16% (odds ratio = 1.16; 95% confidence interval: 1.08-1.24, $p < .001$). WQS regression model indicated that 1,4-dichlorobenzene contributed the most to the association between VOC co-exposure and periodontitis. Mediation analysis further revealed that total bilirubin levels mediated the association between 1,4-dichlorobenzene and the prevalence of periodontitis, accounting for 4.32%. In addition, the positive association between o-xylene and periodontitis was more pronounced in the <65-year-old group.
Conclusions: This study has provided relatively little evidence to demonstrate a specific link between VOCs and periodontitis. Nonetheless, exposure to VOCs remains a non-negligible public health concern, and further research is required to investigate the association and potential mechanisms of action between VOCs and periodontitis.

Authors: Haitao Dong, Xueting Wang, Ning Xiao, Xin Yang, Xin Zhang, Piye Niu, Tian Chen

Full Source: Journal of clinical periodontology 2024 Jul 14. doi: 10.1111/jcpe.14041.

Aim: Periodontitis is one of the most common oral diseases and a major cause of tooth loss in adults.



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### Amino-modified nanoplastics at predicted environmental concentrations cause transgenerational toxicity through activating germline EGF signal in Caenorhabditis elegans

2024-07-12

In the real environment, some chemical functional groups are unavoidably combined on the nanoplastic surface. Reportedly, amino-modified polystyrene nanoparticles (PS-A NPs) exposure in parents can induce severe transgenerational toxicity, but the underlying molecular mechanisms remain largely unclear. Using Caenorhabditis elegans as the animal model, this study was performed to investigate the role of germline epidermal growth factor (EGF) signal on modulating PS-A NPs' transgenerational toxicity. As a result, 1-10 μg/L PS-A NPs exposure transgenerationally enhanced germline EGF ligand/LIN-3 and NSH-1 levels. Germline RNAi of lin-3 and nsh-1 was resistant against PS-A NPs' transgenerational toxicity, implying the involvement of EGF ligand activation in inducing PS-A NPs' transgenerational toxicity. Furthermore, LIN-3 overexpression transgenerationally enhanced EGF receptor/LET-23 expression in the progeny, and let-23 RNAi in F1-generation notably suppressed PS-A NPs' transgenerational toxicity in the exposed worms overexpressing germline LIN-3 at P0 generation. Finally, LET-23 functioned in neurons and intestine for regulating PS-A NPs' transgenerational toxicity. LET-23 acted at the upstream DAF-16/FOXO within the intestine in response to PS-A NPs' transgenerational toxicity. In neurons, LET-23 functioned at the upstream of DAF-7/DBL-1, ligands of TGF-β signals, to mediate PS-A NPs' transgenerational toxicity. Briefly, this work revealed the exposure risk of PS-A NPs' transgenerational toxicity, which was regulated through activating germline EGF signal in organisms.

Authors: Huanliang Liu, Xiaochao Tan, Xiaona Li, Yu Wu, Shuhan Lei, Zhenyu Wang

Full Source: The Science of the total environment 2024 Jul 12:174766. doi: 10.1016/j.scitotenv.2024.174766.

In the real environment, some chemical functional groups are unavoidably combined on the nanoplastic surface.

### The impact of endocrine-disrupting chemicals on stem cells: Mechanisms and implications for human health

2025-01

Endocrine-disrupting chemicals (EDCs) are compounds, either natural or man-made, that interfere with the normal functioning of the endocrine system. There is increasing evidence that exposure to EDCs can have profound adverse effects on reproduction, metabolic disorders, neurological alterations, and increased risk of hormone-dependent cancer.

Stem cells (SCs) are integral to these pathological processes, and it is therefore crucial to understand how EDCs may influence SC functionality. This review examines the literature on different types of EDCs and their effects on various types of SCs, including embryonic, adult, and cancer SCs. Possible molecular mechanisms through which EDCs may influence the phenotype of SCs are also evaluated. Finally, the possible implications of these effects on human health are discussed. The available literature demonstrates that EDCs can influence the biology of SCs in a variety of ways, including by altering hormonal pathways, DNA damage, epigenetic changes, reactive oxygen species production and alterations in the gene expression patterns. These disruptions may lead to a variety of cell fates and diseases later in adulthood including increased risk of endocrine disorders, obesity, infertility, reproductive abnormalities, and cancer. Therefore, the review emphasizes the importance of raising broader awareness regarding the intricate impact of EDCs on human health.

Authors: Juan P Muñoz

Full Source: Journal of environmental sciences (China) 2025 Jan:147:294-309. doi: 10.1016/j.jes.2023.11.015.

## ENVIRONMENTAL RESEARCH

### Microplastic pollution and nutrient enrichment shift the diet of freshwater macroinvertebrates

2024-07-12

Microplastic pollution poses a global threat to freshwater ecosystems, with laboratory experiments indicating potential toxic impacts through chemical toxicity, physical abrasion, and false satiation. Bioplastics have emerged as a potential greener alternative to traditional oil-based plastics. Yet, their environmental effects remain unclear, particularly at scales relevant to the natural environment. Additionally, the interactive impacts of microplastics with other environmental stressors, such as nutrient enrichment, are poorly understood and rarely studied. Under natural conditions organisms might be able to mitigate the toxic effects of microplastics by shifting their diet, but this ability may be compromised by other stressors. This study combines an outdoor mesocosm experiment and stable isotope analysis to determine changes in the trophic niches of three freshwater invertebrate species exposed to conventional (HDPE) and bio-based biodegradable (PLA) microplastics at two concentrations, both independently and combined with nutrient enrichment. Exposure to microplastics altered the isotopic niches of two of the invertebrate species, with nutrient enrichment mediating this effect. Moreover, the effects of

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microplastics were consistent regardless of their type or concentration. Under enriched conditions, two of the species exposed to microplastics shifted to a specialised diet compared with controls, whereas little difference was observed between the isotopic niches of those exposed to microplastic and controls under ambient nutrient conditions. Additionally, PLA was estimated to support 24 % of the diet of one species, highlighting the potential assimilation of bioplastics by biota and possible implications. Overall, these findings suggest that the toxic effects of microplastics suggested from laboratory studies might not manifest under real-world conditions. However, this study does demonstrate that subtle sublethal effects occur even at environmentally realistic microplastic concentrations. The crucial role of nutrient enrichment in mediating microplastic effects underscores the importance of considering microplastic pollution in the context of other environmental stressors.

Authors: Ana Martínez Rodríguez, Pavel Kratina, J Iwan Jones

Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Jul 12:124540. doi: 10.1016/j.envpol.2024.124540.

### Application of FTIR two-dimensional correlation spectroscopy (2D-COS) analysis in characterizing environmental behaviors of microplastics: A systematic review

2025-01

Microplastics (MPs) are ubiquitous in the environment, continuously undergo aging processes and release toxic chemical substances. Understanding the environmental behaviors of MPs is critical to accurately evaluate their long-term ecological risk. Generalized two-dimensional correlation spectroscopy (2D-COS) is a powerful tool for MPs studies, which can dig more comprehensive information hiding in the conventional one-dimensional spectra, such as infrared (IR) and Raman spectra. The recent applications of 2D-COS in analyzing the behaviors and fates of MPs in the environment, including their aging processes, and interactions with natural organic matter (NOM) or other chemical substances, were summarized systematically. The main requirements and limitations of current approaches for exploring these processes are discussed, and the corresponding strategies to address these limitations and drawbacks are proposed as well. Finally, new trends of 2D-COS are

Microplastics (MPs) are ubiquitous in the environment, continuously undergo aging processes and release toxic chemical substances.

prospected for analyzing the properties and behaviors of MPs in both natural and artificial environmental processes.
Authors: Shuang Peng, Feipeng Wang, Dongbin Wei, Cuiping Wang, Haijun Ma, Yuguo Du
Full Source: Journal of environmental sciences (China) 2025 Jan:147:200-216. doi: 10.1016/j.jes.2023.10.004.

## Radioactivity estimation of radioactive hotspots using a Compton camera and derivation of dose rates in the surrounding environment

2024-07-01
At the Fukushima Daiichi Nuclear Power Station, radiation sources released in the accident were deposited on various equipment and building structures. During decommissioning, it is crucial to understand the distribution of radiation sources and ambient dose equivalent rates to reduce worker exposure and implement detailed work planning. In this study, the author introduces a method for visualizing radiation sources, estimates their radioactivity using a Compton camera, and derives the dose rate around the radiation sources. In the demonstration test, the Compton camera was used to visualize radioactive hotspots caused by 137Cs radiation sources deposited in the outdoor environment and estimated the radioactivity. Furthermore, the dose rate around the hotspots was calculated from the estimated radioactivity, which confirmed that the calculated dose rate correlated with the dose rate measured using a survey meter. This approach is novel, where a series of analyses were conducted using the Compton camera to visualize radioactive hotspots, estimate the radioactivity, and derive the dose rate in the surrounding environment.
Authors: Yuki Sato
Full Source: Applied radiation and isotopes: including data, instrumentation and methods for use in agriculture, industry and medicine 2024 Jul 1:212:111421. doi: 10.1016/j.apradiso.2024.111421.

At the Fukushima Daiichi Nuclear Power Station, radiation sources released in the accident were deposited on various equipment and building structures.

# PHARMACEUTICAL/TOXICOLOGY

## Assessment of the Impact of Trace Essential Metals on Cancer Development

2024-06-21
This study examines the impact of zinc, copper, cobalt, iron, and manganese on cancer development, considering their dual roles as potential promoters or inhibitors within tumorigenesis. A comprehensive analysis of existing literature and experimental data is conducted to elucidate the intricate relationship between these trace elements and cancer progression. The findings highlight the multifaceted effects of zinc, copper, cobalt, iron, and manganese on various aspects of cancer development, including cell proliferation, angiogenesis, and metastasis. Understanding the nuanced interactions between these trace elements and cancer could offer crucial insights into tumorigenesis mechanisms and facilitate the identification of novel biomarkers and therapeutic targets for cancer prevention and treatment strategies. This research underscores the importance of considering the roles of essential trace elements in cancer biology and may ultimately contribute to advancements in precision medicine approaches for combating cancer.
Authors: Aleksandra Górska, Agnieszka Markiewicz-Gospodarek, Mateusz Trubalski, Marta Żerebiec, Julia Poleszak, Renata Markiewicz
Full Source: International journal of molecular sciences 2024 Jun 21;25(13):6842. doi: 10.3390/ijms25136842.

## Exposure to pesticides, persistent and non - persistent pollutants in French 3.5-year-old children: Findings from comprehensive hair analysis in the ELFE national birth cohort

2024-07-07
Introduction: Exposure to endocrine disruptors during early childhood poses significant health risks. This study examines the exposure levels of French 3.5-year-old children to various persistent and non-persistent pollutants and pesticides using hair analysis as part of the ELFE national birth cohort. Differences in sex and geographical location among the children were investigated as possible determinants of exposure.
Methods: Exposure biomarkers from 32 chemical families were analyzed using LC-MS/MS and GC-MS/MS in 222 hair samples from children in the ELFE cohort. Of these, 46 mother-child pairs from the same cohort provided unique insight into prenatal and postnatal exposure. Regressions, correlations and discriminate analysis were used to assess relationships between exposure and possible confounding factors.
Results and discussion: Among the biomarkers tested in children's hair samples, 69 had a detection frequency of ≥ 50 %, with 20 showing a 100 % detection rate. The most detected biomarkers belonged to the bisphenol, organochlorine and organophosphate families. Sex-specific differences were observed for 26 biomarkers, indicating the role of the child's sex in exposure levels. Additionally, regional differences were noted,

Introduction: Exposure to endocrine disruptors during early childhood poses significant health risks.

with Hexachlorobenzene varying significantly across the different French regions. Nicotine presented both the highest concentration (16303 pg/mg) and highest median concentration (81 pg/mg) measured in the children's hair. Statistically significant correlations between the levels of biomarkers found in the hair samples of the mothers and their respective children were observed for fipronil (correlation coefficient = 0.32, p = 0.03), fipronil sulfone (correlation coefficient = 0.34, p = 0.02) and azoxystrobin (correlation coefficient = 0.29, p = 0.05).
Conclusions: The study highlights the elevated exposure levels of young children to various pollutants, highlighting the influence of sex and geography. Hair analysis emerges as a crucial tool for monitoring endocrine disruptors, offering insights into exposure risks and reinforcing the need for protective measures against these harmful substances.
Authors: Linda R Macheka, Paul Palazzi, Alba Iglesias-González, Cécile Zaros, Brice M R Appenzeller, Florence A Zeman
Full Source: Environment international 2024 Jul 7:190:108881. doi: 10.1016/j.envint.2024.108881.

## OCCUPATIONAL

### Arsenic exposure and oxidative damage to lipid, DNA, and protein among general Chinese adults: A repeated-measures cross-sectional and longitudinal study

2025-01
Arsenic-related oxidative stress and resultant diseases have attracted global concern, while longitudinal studies are scarce. To assess the relationship between arsenic exposure and systemic oxidative damage, we performed two repeated measures among 5236 observations (4067 participants) in the Wuhan-Zhuhai cohort at the baseline and follow-up after 3 years. Urinary total arsenic, biomarkers of DNA oxidative damage (8-hydroxy-2'-deoxyguanosine (8-OHdG)), lipid peroxidation (8-isoprostaglandin F2alpha (8-isoPGF2α)), and protein oxidative damage (protein carbonyls (PCO)) were detected for all observations. Here we used linear mixed models to estimate the cross-sectional and longitudinal associations between arsenic exposure and oxidative damage. Exposure-response curves were constructed by utilizing the generalized additive mixed models with thin plate regressions. After adjusting for potential confounders, arsenic level was significantly and positively related to the levels of global oxidative damage and their annual increased rates in dose-response manners. In cross-sectional analyses, each 1% increase in arsenic

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level was associated with a 0.406% (95% confidence interval (CI): 0.379% to 0.433%), 0.360% (0.301% to 0.420%), and 0.079% (0.055% to 0.103%) increase in 8-isoPGF2α, 8-OHdG, and PCO, respectively. More importantly, arsenic was further found to be associated with increased annual change rates of 8-isoPGF2α (β: 0.147; 95% CI: 0.130 to 0.164), 8-OHdG (0.155; 0.118 to 0.192), and PCO (0.050; 0.035 to 0.064) in the longitudinal analyses.
Our study suggested that arsenic exposure was not only positively related with global oxidative damage to lipid, DNA, and protein in cross-sectional analyses, but also associated with annual increased rates of these biomarkers in dose-dependent manners.
Authors: Yongfang Zhang, Min Zhou, Dongming Wang, Ruyi Liang, Wei Liu, Bin Wang, Weihong Chen
Full Source: Journal of environmental sciences (China) 2025 Jan:147:382-391. doi: 10.1016/j.jes.2023.12.002.

### Drinking water source and exposure to regulated water contaminants in the California Teachers Study cohort

2024-07-13
Background: Pollutants including metals/metalloids, nitrate, disinfection byproducts, and volatile organic compounds contaminate federally regulated community water systems (CWS) and unregulated domestic wells across the United States. Exposures and associated health effects, particularly at levels below regulatory limits, are understudied.
Objective: We described drinking water sources and exposures for the California Teachers Study (CTS), a prospective cohort of female California teachers and administrators.
Methods: Participants' geocoded addresses at enrollment (1995-1996) were linked to CWS service area boundaries and monitoring data (N = 115,206, 92%); we computed average (1990-2015) concentrations of arsenic, uranium, nitrate, gross alpha (GA), five haloacetic acids (HAA5), total trihalomethanes (TTHM), trichloroethylene (TCE), and tetrachloroethylene (PCE). We used generalized linear regression to estimate geometric mean ratios of CWS exposures across demographic subgroups and neighborhood characteristics. Self-reported drinking water source and consumption at follow-up (2017-2019) were also described.
Results: Medians (interquartile ranges) of average concentrations of all contaminants were below regulatory limits: arsenic: 1.03 (0.54,1.71) µg/L, uranium: 3.48 (1.01,6.18) µg/L, GA: 2.21 (1.32,3.67) pCi/L, nitrate: 0.54 (0.20,1.97) mg/L, HAA5: 8.67 (2.98,14.70) µg/L, and TTHM: 12.86 (4.58,21.95) µg/L. Among those who lived within a CWS boundary and self-reported drinking water information (2017-2019), approximately 74%

Background: Pollutants including metals/metalloids, nitrate, disinfection byproducts, and volatile organic compounds contaminate federally regulated community water systems (CWS) and unregulated domestic wells across the United States.

self-reported their water source as municipal, 15% bottled, 2% private well, 4% other, and 5% did not know/missing. Spatially linked water source was largely consistent with self-reported source at follow-up (2017-2019). Relative to non-Hispanic white participants, average arsenic, uranium, GA, and nitrate concentrations were higher for Black, Hispanic and Native American participants. Relative to participants living in census block groups in the lowest socioeconomic status (SES) quartile, participants in higher SES quartiles had lower arsenic/uranium/GA/nitrate, and higher HAA5/TTHM. Non-metropolitan participants had higher arsenic/uranium/nitrate, and metropolitan participants had higher HAA5/TTHM.
Impact: Though average water contaminant levels were mostly below regulatory limits in this large cohort of California women, we observed heterogeneity in exposures across sociodemographic subgroups and neighborhood characteristics. These data will be used to support future assessments of drinking water exposures and disease risk.

Authors: Maya Spaur, Danielle N Medgyesi, Komal Bangia, Jessica M Madrigal, Lauren M Hurwitz, Laura E Beane Freeman, Jared A Fisher, Emma S Spielfogel, James V Lacey Jr, Tiffany Sanchez, Rena R Jones, Mary H Ward
Full Source: Journal of exposure science & environmental epidemiology 2024 Jul 13. doi: 10.1038/s41370-024-00703-9.