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CHEMICAL EFFECTS

Unveiling the photodegradation of tralkoxydim herbicide and its formulation in natural waters: Structural elucidation of transformation products and toxicity assessment

2025-05-29

Pesticide degradation products (DPs), as emerging contaminants, are being detected in aquatic environments due to the widespread use of their active substances and pose potential risks to aquatic ecology and human health. However, their identification is challenging due to the many environmental conditions that influence their degradation processes. The photodegradation of the herbicide tralkoxydim and its formulation has been studied in ultrapure, spring and river waters and has shown rapid degradation. The photodegradation of tralkoxydim was slower in natural water and in the presence of humic acids (HA) than in ultrapure water, with half-lives of 5.1 h for river water and 1.1 h for ultrapure water. For the first time, three degradation products were identified in aquatic media using HPLC-TOF-MS/MS. These include photoisomerization, photolysis of the N-O bond of the oxime resulting in the tralkoxydim imine (major DP), and cyclization leading to tralkoxydim oxazole. Quantitative structure-activity relationship (QSAR) models were employed to approximate the potential ecotoxicological and environmental impacts of tralkoxydim and its DPs. Additionally, the toxicity of the isolated DPs was evaluated using a standard microtest bioassay with Vibrio fischeri bacteria. The results show that tralkoxydim imine and tralkoxydim oxazole exhibit high toxicity.

Authors: María José Patiño-Ropero, Juan Carlos Nieto-Carmona, María Cobos-Escudero, Al Mokhtar Lamsabhi, Manuel Alcamí, José Luis Alonso-Prados, Pilar Sandín-España

Full Source: Ecotoxicology and environmental safety 2025 May 29:299:118409. doi: 10.1016/j.ecoenv.2025.118409.

Association between endocrine disrupting chemicals exposure and the risk of all-cause mortality in individuals with diabetes mellitus or its complications: A prospective cohort study

2025-05-26

Objective: To investigate the association between exposure to endocrine disrupting chemicals (EDCs) and all-cause mortality in individuals with diabetes mellitus (DM) in U.S., including those with diabetic complications.

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Methods: This prospective cohort study included participants with DM in the 1999-2018 National Health and Nutritional Examination Survey. Data on mortality was obtained from national death records up to December 31, 2019. Cox regression, WQS regression and LASSO regression were constructed to examine the associations between EDCs and all-cause mortality in individuals with DM or its complications, adjusted for potential confounders. Restricted cubic spline analysis was used to investigate the linear relationship. Subgroup analyses were also tested in prespecified subgroups of interest.
Results: The study included 3,453 participants. Mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP), and mono-2-ethyl-5-carboxypentyl phthalate (MECPP) showed positive associations with all-cause mortality (MEHHP: 1.14 (CI1.00-1.29); MEOHP: 1.14 (CI 1.00-1.30); MECPP: 1.17 (CI 1.00-1.37)). These also exhibited positive associations with all-cause mortality in the participants with diabetic kidney disease (MEHHP: 1.24 (CI 1.08-1.42); MEOHP: 1.27 (CI 1.10-1.47); MECPP: 1.43 (CI 1.19-1.71)). Bisphenol A 1.45 (1.08, 1.96) and MCPP 1.59 (CI 1.24-2.05) showed positive associations with all-cause mortality in the diabetic retinopathy (DR) participants. MEHHP exposure interacted with hypertension in DM and hypercholesterolemia, as well as with age in DR populations. MCPP exposure interacted with age in DR, significantly amplifying mortality risks (P interaction < 0.05).
Conclusions: This study provided epidemiological evidence that higher concentrations of certain EDCs are associated with an increased risk of all-cause mortality in participants with DM or its complications.

Authors: Yueheng Zhang, Zilong Zhang, Feiyang Zhou, Guangchao Xu, Weichao Huang, Maoyang Wang, Yuanqi Lan, Wei Zhang, Zhiyuan Liu, Shusen Chang, Shi Qiu, Fang Qi, Zairong Wei

Full Source: Environment international 2025 May 26:200:109556. doi: 10.1016/j.envint.2025.109556.

Impact of Marine Chlorine Emissions on Secondary Organic Aerosols in North China Plain

2025-05-29

Chlorine radicals (Cl), as important oxidant in the atmosphere, significantly influence the formation of secondary organic aerosols (SOA), which is harmful to air quality and human health. Additionally, marine is an important source of reactive chlorine-containing species that are released into the atmosphere via sea spray aerosols (SSA). To date, the contribution of marine chlorine-containing species on SOA has not been well quantified. Here, we explored and quantified the impact of chlorine-

containing species released by SSA on atmospheric oxidants (Cl, OH, HO2, O3), SOA and its main components in the North China Plain (NCP) in 2016 based on a high-resolution chemical transport model (WRF-CMAQ). Model results showed that marine chlorine-containing species emissions have the greatest effect on atmospheric oxidants in summer, and can increase Cl up to 4.53×10-5 ppt, reduce OH, HO2, and O3 up to 0.01 ppb, 0.41 ppb, and 5.30 ppb, respectively. Notably, marine chlorine-containing species emissions decreased O3 generation in each season (up to 1.02 ppb, 3.22 ppb, 5.30 ppb, and 1.58 ppb in winter, spring, summer and autumn, respectively), while promoted SOA formation in winter (0.01 μg/m3) and inhibited in summer (0.01 μg/m3). We also revealed that under high pollution events in winter, marine chlorine-containing species emissions can increase the SOA formation by up to 0.11 μg/m3 due to ClNO2 chemistry (heterogeneous reactions). Our study provides new perspective on the SSA contributions of SOA formation in NCP region.

Authors: Zhaoqi Gao, Lin Li, Zhou Liu, Jiangshan Mu, Zhuyi Wang, Bin Luo, Jingzhu Zhang, Shuting Tang, Hongliang Zhang, Jianlin Hu, Xuan Wang, Xuehua Zhou, Yuqiang Zhang

Full Source: Environmental pollution (Barking, Essex : 1987) 2025 May 29:126524. doi: 10.1016/j.envpol.2025.126524.

ENVIRONMENTAL RESEARCH

Heavy metal pollution in northwestern Himalayan groundwater: comprehensive assessment using multiple pollution indices and Monte Carlo simulation for health risk

2025-06

The ecosystem and human health are seriously at risk from contamination of heavy metals in water. A variety of pollution indices are used in this study to analyze the presence of heavy metal contamination in groundwater and used Monte Carlo simulation to quantify the health hazards associated with it. In two seasons the pre-monsoon and post-monsoon groundwater samples were taken in triplicate from 25 sites in South Kashmir, which is situated in the southern portion of the northwest Himalayas. The research area had higher than average quantities of heavy metals, according to the results. The cold climate probably had no seasonal influence on groundwater quality, but concentrations were generally greater in pre-monsoon than in the post-monsoon. To evaluate contamination, the study employed the following pollution indices: NPI (80%), HEI (76%), MI (80%), CoD (76%), and HPI (0%). There were found

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to be strong correlations between these indices, with R2 values of 0.96, 0.94, 0.96, and 0.95 between HEI and HPI, HEI and MI, HEI and Cd, and HEI and NPI, among other high correlations. The results of the Monte Carlo simulation for many exposure pathways showed that youngsters had a greater 95th percentile of carcinogenic risk than adults. The heavy metals were graded according to their non-carcinogenic risk using the Hazard Index (HI) as follows: Pb > Ni > Mn > Cd > Cu > Fe > Zn. For adults, the non-carcinogenic risk was shown to be 4.92E-01, while for children, it was 1.41E+01. Human health risk evaluations also showed that youngsters had a greater overall cancer risk (OCR) (1.61E-01) than adults (4.74E-03). PRACTITIONER POINTS: Groundwater Quality Monitoring: The study highlights the critical need for regular groundwater quality monitoring, particularly in areas prone to heavy metal contamination, like South Kashmir. This is essential for the early detection of hazardous metal levels and the mitigation of public health risks. Use of Pollution Indices: Pollution indices such as NPI, HEI, MI, and CoD can be effective tools for assessing and quantifying heavy metal contamination in water sources, providing a comprehensive understanding of the contamination levels. Health Risk Assessment: Monte Carlo simulations for human health risk assessments underscore the importance of prioritizing children's health, as they are at greater risk of carcinogenic and non-carcinogenic effects from heavy metal exposure. Seasonal Impact on Contamination: While seasonal variations in groundwater quality were not significant due to the cold climate, higher contamination levels were detected during the pre-monsoon period. This indicates the need for heightened monitoring before monsoon seasons in similar climatic regions.

Authors: Uzma Imtiyaz, Mushtaq Ahmad Rather

Full Source: Water environment research: a research publication of the Water Environment Federation 2025 Jun;97(6):e70078. doi: 10.1002/wer.70078

Ambient air pollution in critical windows of exposure and spontaneous miscarriage in a preconception cohort

2025-05-28

Air pollution may increase spontaneous miscarriage risk, potentially through inflammation. Prior studies are heterogeneous, and none have used a mixtures approach. We used data from participants who conceived in a prospective time-to-pregnancy study (N=446) in North Carolina to examine spontaneous miscarriage, defined as a positive home pregnancy test and a self-reported pregnancy loss before gestational week 20 (N=101). We characterized average and peak exposure to PM10, PM2.5,

CO, NO, NO2, SO2, and O3 through linked residential addresses with fusion and chemical transport models. We used single pollutant and exposure mixtures models (quantile-based g-computation) to estimate associations in six exposure windows including spermatogenesis, early follicle development, and the follicular and luteal phases of the conception cycle. Sensitivity analyses stratified by vitamin D level (an anti-inflammatory). Multivariable Cox proportional hazards models estimated adjusted hazard ratios (HR) and 95% confidence intervals (CI) per interquartile range increase in pollutant concentration. In exposure mixtures models, while the confidence intervals were wide, the magnitude and direction of several estimates were consistent with increased spontaneous miscarriage risk with increasing air pollutant exposure: spermatogenesis (HR[CI]: 1.2 [0.80, 1.8]), early follicle development (1.2 [0.80, 1.8]), and luteal phase (1.2 [0.80, 1.9]). Associations were stronger among those with low vitamin D, for example, increasing ozone was associated with increased spontaneous miscarriage only among those with low vitamin D (follicular phase HR[CI]: 3.1 [1.3, 7.4] vs. 0.84 [0.46,1.5] for high vitamin D, pinteraction=0.002). Air pollutants may be associated with small increases in miscarriage risk, but larger mixtures studies are needed. Further study of low vitamin D and air pollution risk is important for understanding the public health implications of vitamin D supplementation.

Authors: Anne Marie Z Jukic, Kathryn S Konrad, Ian D Buller, Johanna R Jahnke, Ana Rosen Vollmar, D Robert McConnaughey, Alexander P Keil, Anne Z Steiner

Full Source: Environmental research 2025 May 28:121965. doi: 10.1016/j.envres.2025.121965.

Cytogenetic evaluation of vaginal and buccal epithelium of pregnant women living in conditions of radioactive, chemical and combined environmental contamination

2025-05-31

Introduction: Many pollutants constantly worsen the ecological situation, thereby causing irreparable harm to the health of the population. Technogenic impact on the biosphere has become one of the significant factors dictating our conditions of existence on Earth.

Purpose of the study: to conduct a comparative analysis of the frequency of cytogenetic abnormalities, indicators of proliferation disorders and nuclear destruction of vaginal and buccal epithelium of pregnant women 26-33 years old living in conditions of radioactive, chemical and combined environmental contamination of the Bryansk region.

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Methods: micronucleus test, staining method by Kvik, fluorescence method, immunocytochemistry method, Shapiro-Wilk test, Mann-Whitney U test.

Results: the frequency of cytogenetic abnormalities, indicators of proliferation disorders and nuclear destruction in the vaginal epithelium of pregnant women living in areas of radioactive, chemical and combined environmental contamination is 1.3-4.9 times higher, and in the buccal epithelium 1.6-7.8 times higher compared to ecologically safe (control) areas ($p < 0.01$-0.001). The combined effect of radioactive contamination and chemical pollution resulted in a significantly higher (increase from 12.8% to 81.4% in vaginal epithelium and from 22.6% to 2.3 times in buccal epithelium) frequency of cells with micronuclei, cells with protrusions, binuclear cells, cells with double nuclei, as well as cells with karyopyknosis and karyolysis in pregnant women compared to areas with only one pollution factor.

Conclusion: The results demonstrate the synergistic effects of radiation contamination and chemical pollution on the cytogenetic status of pregnant women.

Authors: Anton V Korsakov, Alexandra S Domakhina, Vladislav P Troshin, Olga Yu Milushkina

Full Source: International archives of occupational and environmental health 2025 May 31. doi: 10.1007/s00420-025-02144-9.

PHARMACEUTICAL/TOXICOLOGY

The Single and Combined Effects of Decabromodiphenyl Ethane and Mixed Microplastics on Male Mice Reproductive Toxicity

2025-05-31

The expansive surface area of microplastics (MPs) allow them to retain pollutants, however, the combined toxicity of mixed MPs and organic contaminants remains poorly studied. The semen quality of men worldwide was observed to exhibit downward trends. This study investigates the reproductive toxicity and underlying mechanisms of male mice exposed to MPs and novel brominated flame retardants decabromodiphenyl ethane (DBDPE), individually or combined. Male mice were treated by oral gavage with corn oil, 5 or 50 mg/kg DBDPE, 10 mg/kg MPs (a mixture of PE (Polyethylene) and PVC (Polyvinyl chloride)), and DBDPE+MPs (50 mg/kg DBDPE mixed with 10 mg/kg MPs) for 7 weeks. Our results suggested DBDPE alone decreased the sex hormones levels and

sperm count, whereas MPs alone had no significant effect. DBDPE and/or MPs impaired testicular morphology, sperm malformation rate, oxidative stress levels, and apoptosis. Our results of transcriptomics from GC-2 cells indicated that DBDPE and MPs lead to changes in oxidative stress, apoptosis, inflammation, proliferation and differentiation. Furthermore, DBDPE and/or MPs exposure inhibited the Kelch-like ECH-associated protein 1- NF-E2-related factor 2 (Keap1-Nrf2) signaling pathway. Moreover, the combined treatment of MPs and DBDPE exerted an antagonistic effect on the reproductive system of mice. This study provides valuable insights into the mechanisms of joint action in reproductive toxicity in mammals due to the combined exposure to MPs and DBDPE.
Authors: Zhipeng Qi, Wei Li, Linwei Pan, Weiyi Song, Yu Deng, Jing Li, Lichun Xu, Jikuan Yan, Cheng Zou, Haibo Yang, Xinxin Yang
Full Source: Biology of reproduction 2025 May 31:ioaf121. doi: 10.1093/biolre/ioaf121.

Evaluating the environmental occurrence of per- and polyfluoroalkyl substances (PFAS) and potential exposure risk for recreational shellfish harvesters in the Great Bay Estuary, New Hampshire

2025-05-30
Background: Shellfish may be an important contributor to PFAS exposure from seafood consumption. Yet, shellfish consumption patterns are distinct from other seafood varieties and PFAS exposure via shellfish consumption has not been well studied, especially among recreational harvesters who may be exposed to PFAS through direct consumption of shellfish, incidental ingestion of sediment, and dermal absorption.
Methods: Collocated surface water, sediment, and bivalve shellfish samples were collected in the Great Bay Estuary, a prominent estuary in New Hampshire, USA with multiple known PFAS sources. All media were analyzed for 27 PFAS compounds via UPLC-MS/MS. Human health risk of PFAS exposure from recreational shellfish harvesting was estimated for typical and high seafood consumers across multiple exposure routes using available health guidance values.
Results: PFAS were detected in all Great Bay water, sediment, and shellfish samples. PFAS concentrations varied spatially, and profiles varied by media type, with shorter chain compounds found in water and longer chain compounds found in sediment and shellfish. For adults, PFAS exposure risk from recreational shellfish harvesting was greatest from direct consumption of shellfish (>99 % of estimated daily PFAS dose), followed by dermal absorption and incidental sediment ingestion. For

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children, dermal absorption and incidental ingestion were also important, contributing to 10 % of estimated daily exposure. PFAS exposure risk from consuming razor clams exceeded the reference hazard quotient of 1 for multiple compounds among the general population that consumes typical or greater amounts of seafood, and among persons of childbearing age and young children who consume high amounts of seafood.
Conclusions: High frequency recreational shellfish harvesting and consumption may increase exposure to certain PFAS.
Authors: Christine L Gardiner, Jonathan M Petali, Celia Y Chen, Nathan G Giffard, Sujan Fernando, Thomas M Holsen, Juby R Varghese, Megan E Romano, Kathryn A Crawford
Full Source: The Science of the total environment 2025 May 30:986:179747. doi: 10.1016/j.scitotenv.2025.179747.

OCCUPATIONAL

Analyzing the Impact of Occupational Exposures on Male Fertility Indicators: A Machine Learning Approach

2025-05-29
Occupational exposures are critical factors affecting workers' reproductive health. This study investigates the impact of magnetic fields, electric fields, whole-body vibration, noise levels, and heat stress on male reproductive indicators using advanced machine learning models. The aim is to identify key risk factors and provide predictive insights into workers' reproductive health over the next decade. Data were collected from 80 male workers in an automobile part manufacturing plant, capturing demographic characteristics, occupational exposures, biochemical markers, hormone levels, and sperm parameters. Five machine learning models logistic regression, bagging classifier, extreme gradient boosting, random forest, and support vector machine were trained and evaluated using 5-fold cross-validation to determine effective predictors of reproductive health outcomes. Exposure to whole-body vibration, magnetic fields, electric fields, and heat stress closely affected free testosterone levels, with SHAP importance indicating: Magnetic Field Exposure (0.339) and Wet Bulb Globe Temperature (0.138). Worker Age (0.244) was the most influential demographic factor negatively impacting Free Testosterone. The XGBoost and random forest achieved the highest AUC (0.99), outperforming other models in predictive accuracy. The Random Forest model Importance (% Increase in MSE) predicted that Electric Field Exposure (5%) and Magnetic Field Exposure (4.7%) would have the most substantial negative impact on Free Testosterone, followed by Worker Age (4.1%). This study underscores

the need for targeted interventions, such as improved workplace safety protocols and regular health monitoring, to protect workers' reproductive health.

Authors: Hamzeh Mohammadi, Shayan Khoddam, Farideh Golbabaei, Somayeh Farhang Dehghan

Full Source: Reproductive toxicology (Elmsford, N.Y.) 2025 May 29:108959. doi: 10.1016/j.reprotox.2025.108959.

A Systematic review on the occupational health impacts of ionising radiation exposure among healthcare professionals

2025-05-30

Exposure to low-doses of ionising radiation can induce biological effects in healthcare professionals, such as DNA damage, genotoxic effects, lens opacities, and risk of cancer.
Objective: This systematic review aims to assess the current status and identify the health impacts of occupational exposure to ionising radiation.
Methods: The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Articles were included only if they specifically addressed the adverse biological effects of ionising radiation on healthcare professionals, particularly in medical applications. Studies published between January 2019 and December 2023 were considered, with sources obtained from the Scopus, PubMed, and Web of Science databases.
Results: A total of 345 articles were identified through an extensive literature search, and after the complete text screening, 32 articles were deemed suitable for inclusion in the review. Eleven studies reported significantly higher micronuclei (MN) frequencies in workers exposed to ionising radiation compared to unexposed. The MN studies reviewed found a significant correlation between dose or exposure time and MN frequencies. All studies revealed significantly higher chromosomal aberrations (CA) values when exposed to ionising radiation.
The occurrence of lens opacities among interventional physicians varied significantly, with rates ranging from 16% to 47%.
Conclusion: This review emphasizes the high occurrence of cataracts, increased cancer risk, and the relevant frequency of MN and CA in workers chronically exposed to low doses.

Authors: Rogério Lopes, Pedro Teles, Joana Santos

Full Source: Journal of radiological protection: official journal of the Society for Radiological Protection 2025 May 30. doi: 10.1088/1361-6498/added2.