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CHEMICAL EFFECTS

Olive oil wastewater: a comprehensive review on examination of toxicity, valorization strategies, composition, and modern management approaches

2025-03-01

Olive mill wastewater (OMWW), a by-product of olive oil production, poses severe environmental challenges due to its toxicity, primarily caused by its high organic load and phenolic compounds, along with organic acids, lipids, and heavy metals. These components contribute to its elevated chemical and biological oxygen demand, making OMWW a persistent pollutant that necessitates urgent and effective treatment strategies. The ecological risks, including water contamination, soil degradation, and biodiversity loss, underscore the need for sustainable management approaches. This review explores the composition and toxicity of OMWW, examining advanced treatment technologies, e.g., bioremediation, membrane filtration, advanced oxidation processes, and integrated systems that enhance efficiency while minimizing environmental impact. In addition, this study investigates the potential for OMWW valorization as a rich source of polyphenols with antioxidant, antimicrobial, and anti-inflammatory properties. These bioactive compounds have significant economic value in industries such as pharmaceuticals, cosmetics, and functional foods. By evaluating sustainable extraction techniques and integrating advanced treatments with economic valorization, OMWW can be transformed from an environmental pollutant into a valuable resource. Such integrated approaches support a circular economy within the olive oil industry, reducing its ecological footprint and fostering sustainable development.

Authors: Asmaâ Dich, Waffa Abdelmoumene, Larbi Belyagoubi, Elham Assadpour, Nabila Belyagoubi Benhammou, Fuyuan Zhang, Seid Mahdi Jafari

Full Source: Environmental science and pollution research international 2025 Mar 1. doi: 10.1007/s11356-025-36127-7.

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ENVIRONMENTAL RESEARCH

Development of Methods for the Early Detection of Chemical Hazard and the Prevention of Pre-disease, Focusing on Environment, Food, and Health

2025

Based on the perspectives of the environment, food, and health, this review reflects on previous research examining stem cells for the early detection of chemical hazards and the development of preventive health tools. The risks posed by endocrine-disrupting chemicals in the environment are investigated, including studies on 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), phthalate esters, and bisphenol A. Building on the findings of these studies, this review identifies emerging challenges in the field of endocrine-disrupting chemical research. Moreover, this paper explores innovative testing methods aimed at accurately evaluating the impact of chemicals on human health. The key topics covered include the implementation of developmental neurotoxicity testing methods, the species-specific effects of methylmercury, nanomaterials and the application of human pluripotent cells to assess the effects of low-dose radiation. Additionally, this review highlights transformative approaches in chemical health impact assessment that integrate cell science and artificial intelligence, and addresses challenges related to the application of multi-omics technologies in environmental health and toxicology.

Authors: Hideko Sone

Full Source: Yakugaku zasshi: Journal of the Pharmaceutical Society of Japan 2025;145(3):201-221. doi: 10.1248/yakushi.24-00168.

Appraisal of potential toxic elements pollution, sources apportionment, and health risks in groundwater from a coastal area of SE China

2025-02-27

Groundwater is a vital natural resource, but the presence of potentially toxic elements (PTEs) poses significant risks to both groundwater safety and human health. This study collected 120 groundwater samples from a coastal area in southeastern China during wet and dry seasons to assess PTE levels, identify their sources, and evaluate pollution and health risks. Results showed that Mn, Zn, and Al had the highest average concentrations in both seasons, with Mn, Cd, and Zn frequently exceeding safe limits. PTE levels were higher during the wet season.

Natural background levels (NBLs) were determined, revealing that most elements met quality standards except for Mn and Cd. Four PTE sources were identified using principal component analysis and the APCS-MLR model: industrial emissions (25.5% dry, 23.8% wet), geological background (21.2% dry, 19% wet), natural sources (27.2% dry, 16.2% wet), and mining activities (20.8% dry, 23.4% wet). Heavy metal pollution was significant (moderate to heavy: 72.73% dry, 45.76% wet), but ecological risks were low (low risk: 92.73% dry, 66.10% wet). Health risk assessments and Monte Carlo simulations indicated low carcinogenic and non-carcinogenic risks, slightly higher in children than adults. Risks were more severe in the southwestern part of the study area. These findings support local groundwater management efforts.

Authors: Denghui Wei, Shiming Yang, Lin Zou, Juan Antonio Torres-Martínez, Yanhong Zheng, Qili Hu, Yunhui Zhang

Full Source: Journal of environmental management 2025 Feb 27:377:124691. doi: 10.1016/j.jenvman.2025.124691.

Unraveling fate of sulfonamide antibiotics in sandy loam soil and water of India and environmental risk assessment

2025-02-28

Antibiotic resistance is an alarming issue nowadays due to the increased use of antibiotics in humans, veterinary, fisheries, etc. Sulfonamides are one group of highly used antibiotics frequently detected in the environmental matrices. So, in the present study, we evaluated the sorption and dissipation of two commonly detected sulfonamide antibiotics in water (sulfamethazine (SMZ) and sulfamethoxazole (SMXZ)) in sandy loam soil and irrigation waters in the tropical region. Soil samples were processed using modified QuEChERS and the residues were quantified using LC-MS/MS. Optimized sample processing methods gave recoveries in the range of 88-91% from soil and water. The sulfonamides persisted in soil and irrigation waters with an average half-life of 12-22 days for SMZ and 20-33 days for SMXZ in different moisture regimes in soil and 13 days (SMZ) and 9 days (SMXZ) in irrigation water. The sorption data fitted well to Freundlich isotherm and indicated hydrophobic partitioning as the major mechanism behind sorption. The antibiotics exhibited unfavorable sorption in sandy loam soil which led to their stronger potential to leach to groundwater as indicated by the Groundwater Ubiquity Scores (GUS) (2.19 for SMZ and 3.09 for SMXZ). The sorption was favored at acidic pH and the incorporation of compost in soil also favored the sorption process leading to high retention of these antibiotics onto the soil surface. The environmental risk assessment also indicates their

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tendency to develop antimicrobial resistance. So, these antibiotics should be used with proper measures to avoid adverse impacts on humans and the environment.

Authors: Neethu Narayanan, Suman Gupta, Priya Saini, Neera Singh

Full Source: Environmental monitoring and assessment 2025 Feb 28;197(3):341. doi: 10.1007/s10661-025-13782-4.

PHARMACEUTICAL/TOXICOLOGY

Hematological Parameters and Mercury Exposure in Children Living Along Gold-Mining-Impacted Rivers in the Mojana Region, Colombia

2025-03-01

Mercury (Hg) exposure is a key determinant of human health, arising from environmental, occupational, and domestic sources, as well as the consumption of contaminated food, particularly fish. Due to their developmental stage and heightened susceptibility, children are especially vulnerable. This study evaluated Hg contamination in a high-risk pediatric population affected by local economic activities such as small-scale gold mining, agriculture, and fishing. The objective was to determine whether exposure to this toxic metal was associated with alterations in hematological biomarkers, analyzing potential correlations with total Hg (T-Hg) levels in the hair and blood of 282 children aged 6 to 12 years in the Mojana Bolivarense (Colombia). The mean T-Hg concentration in hair was 0.88 µg/g in Magangue, 1.55 µg/g in Achi, and 0.26 µg/g in Arjona. A total of 35.0% and 44.4% of the examined minors from Magangue and Achi, respectively, exceeded the international threshold for hair Hg (1 µg/g). Likewise, blood T-Hg concentrations surpassed the recommended safety level (5 µg/L) in 39.4% of children from Achi and 0.8% from Magangue, while in Arjona, all values remained below this threshold. The geometric mean (GM) values of the hair-to-blood Hg ratio varied across locations. Spearman correlations revealed a very strong positive association between blood and hair T-Hg levels in Achi ($\rho = 0.801$; $p < 0.01$), a moderate correlation in Magangue ($\rho = 0.325$; $p < 0.01$), and some significant links with hematological parameters. Multiple linear regression analysis indicated a positive association between blood T-Hg concentration and white blood cell count ($\beta = 0.053$; $p = 0.021$) and granulocytes ($\beta = 0.086$; $p = 0.011$), as well as an inverse correlation with lymphocyte percentage ($\beta = - 0.353$; $p = 0.036$). These findings suggest that Hg exposure may influence

inflammatory and immunosuppressive processes, posing a potential health risk to vulnerable populations, particularly young individuals.
Authors: Jenny Palomares-Bolaños, Karina Caballero-Gallardo, Jesus Olivero-Verbel
Full Source: Biological trace element research 2025 Mar 1. doi: 10.1007/s12011-025-04557-6.

Perfluorooctanoic acid increases serum cholesterol in a PPARα-dependent manner in female mice

2025-03-01
Per- and polyfluoroalkyl substances (PFAS) are a large group of persistent chemicals that are pervasive in the environment leading to widespread exposure for humans. Perfluorooctanoic acid (PFOA), one of the most commonly measured PFAS in people, disrupts liver and serum lipid homeostasis as shown in animal toxicity and human epidemiological studies. We tested the hypothesis that the effects of PFOA exposure in mice expressing mouse PPARα (mPPARα) are driven largely through PPARα-dependent mechanisms while non-PPARα dependent mechanisms will be more apparent in mice expressing human PPARα (hPPARα). Female and male mPPARα, hPPARα, and PPARα null mice were exposed to PFOA (0.5, 1.4 or 6.2 mg PFOA/L) via drinking water for 14 weeks. Concurrently, mice consumed an American diet containing human diet-relevant amounts of fat and cholesterol. Here, we focused on the effects in female mice, given the dearth of data reported on PFAS-induced effects in females. Increasing the duration of PFOA exposure reduced weight gain in all genotypes of female mice while end-of-study body fat was lower in PFOA exposed hPPARα and PPARα null mice. Serum cholesterol, but not triacylglyceride, concentrations were increased by PFOA exposure in a PPARα-dependent manner. Hepatic triacylglycerides were higher in vehicle-exposed mPPARα and PPARα null mice than hPPARα mice, and PFOA significantly reduced concentrations in mPPARα and PPARα null mice only. In contrast, PFOA increased hepatic cholesterol content in a PPARα-dependent manner. Changes in liver and serum cholesterol may be explained by a strong, PPARα-dependent downregulation of Cyp7a1 expression. PFOA significantly increased PPARα target gene expression in mPPARα mice. Other nuclear receptors were examined: CAR target gene expression was only induced by PFOA in hPPARα and PPARα null mice. PXR target gene expression was induced by PFOA in all genotypes. Results were similar in male mice with two exceptions: (1) vehicle-exposed male mice of all genotypes were equally susceptible to diet-induced hepatic steatosis; (2) male mice drank less water, resulting in lower serum

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PFOA levels, which may explain the less significant changes in lipid endpoints. Overall, our results show that PFOA modifies triacylglyceride and cholesterol homeostasis independently and that PPARα plays an important role in PFOA-induced increases in liver and serum cholesterol.
Authors: G Nielsen, D D Gondim, M C Cave, W J Heiger-Bernays, T F Webster, J J Schlezinger
Full Source: Archives of toxicology 2025 Mar 1. doi: 10.1007/s00204-025-03984-7.

Per- and polyfluoroalkyl substances in environment and potential health impacts: Sources, remediation treatment and management, policy guidelines, destructive technologies, and techno-economic analysis

2025-02-27
Per- and polyfluoroalkyl Substances (PFAS), also known as forever chemicals and ubiquitous persistence, pose significant public health challenges due to their potential toxicity, particularly in drinking water and soil contamination. However, PFAS occurrence and their concentrations in different environmental matrices vary globally, but factors influencing trends, transport, fate, toxicity, and interactions with co-contaminants remain largely unexplored. Therefore, this review critically examines the state-of-the-art worldwide PFAS sources, distribution, and pathways, and evaluates how PFASs are processed in wastewater treatment, generally, which causes severe problems with the quality and safety of drinking water. Importantly, the review also underscores health issues due to PFAS consumption and recent research trends on developing effective treatment strategies to manage PFAS contamination. Potential effects of PFAS were linked to urban land use and the proportion of wastewater effluent in streamflow. Besides, major emphasis was provided on challenges for conventional treatment, destructive technologies, environmental accumulation, precursor transformation, and cost-investment related to PFAS removal technologies. To combat PFAS contamination, this review proposes a framework that promotes the comprehensive identification of prevalent compounds, with a focus on their eradication through knowledge-based and targeted analysis. Additionally, it explores the ongoing debate surrounding PFAS laws and legal frameworks, offering ideas for enhancing contamination management. Lastly, this review provides a strategic plan for improving

response and preparedness, serving as a foundation for addressing future environmental challenges and informing health risk assessments.
Authors: Priyanka Chambial, Neelam Thakur, Jyoti Kushawaha, Rakesh Kumar
Full Source: The Science of the total environment 2025 Feb 27:969:178803. doi: 10.1016/j.scitotenv.2025.178803.

OCCUPATIONAL

Higher PFOS Exposure Associated with Higher SHBG in Third Trimester. The Odense Child Cohort

2025-02-28
Background: Perfluoroalkyl substances (PFAS) are chemicals with endocrine disrupting properties. Experimental studies indicate that PFAS have estrogenic effects by inducing aromatase activity. Sex hormone-binding globulin (SHBG) is a marker of the balance between estrogen and testosterone, as estrogen stimulates and testosterone inhibits SHBG production.
Objective: To investigate associations between maternal PFAS concentrations and levels of SHBG and testosterone in pregnancy.
Methods: In Odense Child Cohort (OCC), concentrations of PFAS: perfluorohexane sulfonic acid (PFHxS), perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), and perfluorodecanoic acid (PFDA) were measured in 1,611 eligible women at median gestational week (GW) 12 (25th, 75th percentile: 10, 15). Among these, levels of sex hormone-binding globulin (SHBG), calculated free testosterone (Free-T), free androgen index (FAI), and total testosterone (TT) were assessed in 1,048 at median GW 29 (25th, 75th percentile: 28, 30). Associations between PFAS concentrations and levels of SHBG and testosterone were estimated using multiple linear regression models. The effect of combined exposure to PFAS was also assessed via Quantile G-Computation.
Results: A doubling in PFOS concentration was associated with an increment in SHBG concentration by 2.29% (95%CI: 0.04%, 4.59%) in adjusted analyses. PFOS exposure in the third tertile, as compared to the first tertile, significantly increased SHBG concentrations by 4.60% (95%CI: 0.82%, 8.53%). No significant association was demonstrated between PFAS and TT, however, a non-significant inverse association was found between PFAS and Free-T and FAI. Combined PFAS exposure was non-significantly associated with an increase in SHBG, and decrease in Free-T, FAI, and TT.

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Conclusion: PFOS exposure was associated with an increase in the proportion of estrogen effects to androgen effects, assessed by higher SHBG concentrations, in pregnant women. Estrogenic effects during pregnancy may have implications on offspring neural, metabolic, and endocrine development, hence supporting the necessity of a follow-up of offspring.
Authors: Richard Christian Jensen, Dorte Glintborg, Erich Batzella, Flemming Nielsen, Henriette Boye, Anne Vibeke Schmedes, Tina Kold Jensen, Marianne S Andersen
Full Source: Environmental research 2025 Feb 28:121265. doi: 10.1016/j.envres.2025.121265.

Metabolomic machine learning predictor for arsenic-associated hypertension risk in male workers

2025-02-19
Arsenic (As)-induced hypertension is a significant public health concern, highlighting the need for early risk prediction. This study aimed to develop a predictive model for occupational As exposure and hypertension using metabolomics and machine learning. A total of 365 male smelting workers from southern regions were selected. Forty workers from high and low urinary arsenic (U-As) exposure groups were chosen for non-targeted metabolomics analysis. Univariate analysis revealed that U-As is a risk factor for blood pressure and hypertension ($P < 0.05$). Restricted cubic spline (RCS) analysis showed that both systolic and diastolic blood pressure, as well as hypertension risks, increased with U-As, with a threshold at 32 μg/L. Of 1145 metabolites, 383 differentially expressed metabolites (382 upregulated, 1 downregulated) were identified. Least absolute shrinkage and selection operator (LASSO) regression was used to construct a predictive model for occupational hypertension, with N-hexosyl leucine, myristic acid, gamma-glutamylvaline, and pregnanediol disulfate as predictors. The area under the curve (AUC) of the receiver operating characteristic (ROC) for the predictive model was 0.917, indicating strong predictability and accuracy. This model, based on metabolomics and machine learning, provides an effective tool for early identification and intervention for occupational populations at high risk of hypertension due to As exposure.
Authors: Youyi Wu, Guoliang Li, Ming Dong, Yaotang Deng, Zhiqiang Zhao, Jiazhen Zhou, Simin Xian, Le Yang, Mushi Yi, Jieyi Yang, Yue Hu, Xinhua Li, Ping Chen, Lili Liu
Full Source: Journal of pharmaceutical and biomedical analysis 2025 Feb 19:259:116761. doi: 10.1016/j.jpba.2025.116761.

Effect of 1-nitropyrene exposure on the biological behavior of trophoblast cells

2025-02-28

1-nitropyrene (1-NP) is a toxic component of PM2.5 that adversely affects human health, especially pregnant women; however, the mechanisms are still unclear. This study aims to explore the mechanisms by which 1-NP influences trophoblast cell behaviors. HTR8/Svneo cells were treated by different concentrations of 1-NP (0, 5, 10, 20μM) to assess clonogenic, invasive, and migratory abilities. Western blot analysis was used to assess the expression of EMT and Wnt/β-catenin pathway proteins. 1-NP significantly inhibited HTR8/Svneo cell clonogenic ability, especially at 10μM and 20μM ($P<0.01$). Invasiveness decreased by 68.44% at 5μM ($P<0.05$), and migration was significantly inhibited at 10μM and 20μM ($P<0.05$). Western blot revealed increased E-cadherin and decreased Vimentin ($P<0.01$), elevated β-catenin ($P<0.05$), and reduced APC ($P<0.01$). In summary, 1-NP impacts trophoblast cell clonogenicity, invasion, and migration by modulating EMT and Wnt/β-catenin pathways, providing novel insights into its biological effects on trophoblast cells.

Authors: Chuting Wang, Long Zhang, Daidi Gui, Wenjing Zou, Menglei Zhu, Yu Liu, Lei Hua, Changlian Li, Rui Ding

Full Source: Reproductive toxicology (Elmsford, N.Y.) 2025 Feb 28:108865. doi: 10.1016/j.reprotox.2025.108865.