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CHEMICAL EFFECTS

An extra-chelator-free fenton process assisted by electrocatalytic-induced in-situ pollutant carboxylation for target refractory organic efficient treatment in chemical-industrial wastewater

2023-06-01

For traditional Fenton processes, the quenching behavior of radical contenders (e.g., most aliphatic hydrocarbons) on hydroxyl radicals (·OH) usually hinders the removal of target refractory pollutants (aromatic/heterocyclic hydrocarbons) in chemical industrial wastewater, leading to excess energy consumption. Herein, we proposed an electrocatalytic-assisted chelation-Fenton (EACF) process, with no extra-chelator addition, to significantly enhance target refractory pollutant (pyrazole as a representative) removal under high ·OH contender (glyoxal) levels. Experiments and theoretical calculations proved that superoxide radical (·O2-) and anodic direct electron transfer (DET) effectively converted the strong ·OH-quenching substance (glyoxal) to a weak radical competitor (oxalate) during the electrocatalytic oxidation process, promoting Fe2+ chelation and therefore increasing radical utilization for pyrazole degradation (reached maximum of 43-fold value upon traditional Fenton), which appeared more obviously in neutral/alkaline Fenton conditions. For actual pharmaceutical tailwater treatment, the EACF achieved 2-folds higher oriented-oxidation capability and 78% lower operation cost per pyrazole removal than the traditional Fenton process, demonstrating promising potential for future practical applications.

Authors: Wei Li, Kajia Wei, Xu Yin, Hongwei Zhu, Quanqi Zhu, Xiaoyuan Zhang, Siqi Liu, Weiqing Han

Full Source: Environmental research 2023 Jun 1;116243. doi: 10.1016/j.envres.2023.116243.

The influence of size and surface chemistry on the bioavailability, tissue distribution and toxicity of gold nanoparticles in zebrafish (Danio rerio)

2023-05-31

Gold nanoparticles (AuNPs) are widely used in biomedicine and their specific properties including, size, geometrics, and surface coating, will affect their fate and behaviour in biological systems. These properties are well studied for their intended biological targets, but there is a lack

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of understanding on the mechanisms by which AuNPs interact in non-target organisms when they enter the environment. We investigated the effects of size and surface chemistry of AuNPs on their bioavailability, tissue distribution and potential toxicity using zebrafish (Danio rerio) as an experimental model. Larval zebrafish were exposed to fluorescently tagged AuNPs of different sizes (10-100 nm) and surface modifications (TNFα, NHS/PAMAM and PEG), and uptake, tissue distribution and depuration rates were measured using selective-plane illumination microscopy (SPIM). The gut and pronephric tubules were found to contain detectable levels of AuNPs, and the concentration-dependent accumulation was related to the particle size. Surface addition of PEG and TNFα appeared to enhance particle accumulation in the pronephric tubules compared to uncoated particles. Depuration studies showed a gradual removal of particles from the gut and pronephric tubules, although fluorescence indicating the presence of the AuNPs remained in the pronephros 96 h after exposure. Toxicity assessment using two transgenic zebrafish reporter lines, however, revealed no AuNP-related renal injury or cellular oxidative stress. Collectively, our data show that AuNPs used in medical applications across the size range 40-80 nm, are bioavailable to larval zebrafish and some may persist in renal tissue, although their presence did not result in measurable toxicity with respect to pronephric organ function or cellular oxidative stress for short term exposures.

Authors: Dylan L Windell, Sulayman Mourabit, Julian Moger, Stewart F Owen, Matthew J Winter, Charles R Tyler

Full Source: Ecotoxicology and environmental safety 2023 May 31;260:115019. doi: 10.1016/j.ecoenv.2023.115019.

ENVIRONMENTAL RESEARCH

Aging, characterization and sorption behavior evaluation of tire wear particles for tetracycline in aquatic environment

2023-06-01

Accounting for more than half of the total primary microplastic (MP) emissions, and one-sixth of the total marine MP pollution in China in 2015, tire wear particles (TWP) are inevitable to age and interact with co-existing species, thus pose a potential risk to the surroundings. The impacts of simulated ultraviolet radiation weathering and liquid-phase potassium persulfate oxidation of TWP on the surface physicochemical properties were comparatively explored. The characterization results demonstrated that the content of carbon black, particle size and specific surface area of

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the aged TWP all decreased, while the changes of the hydrophobicity and polarity were inconsistent. The interfacial interactions with tetracycline (TC) in aqueous were investigated, the well fitted pseudo-second-order kinetics, Dual-mode Langmuir and Scatchard isotherm models indicated the attachment of TC dominated by surface adsorption at lower concentration, and there's a positive synergistic effect among the main sorption domains. Moreover, the results of the influences of co-existing salts and natural organic matter revealed that the potential risks of TWP elevated by the adjacent media in natural compartment. This work provides new insights into the way that TWP interact with contaminants in the real environment.

Authors: Jiongjun Huang, Zhiqiang Li, Zhuo Wang, Hongzhu Ma, Jiayi Wang, Baoshan Xing

Full Source: Chemosphere 2023 Jun 1;335:139116. doi: 10.1016/j.chemosphere.2023.139116.

PHARMACEUTICAL/TOXICOLOGY

A rapid systematic scoping review of research on the impacts of water contaminated by chemicals on very young children

2023-06-02

Low-income countries are struggling with the health impacts of both surface and groundwater chemical contamination. Although the impact of biological contaminants on children's health is acknowledged, the long-term effects of these and emerging contaminants on young children may be underestimated. To map the existing evidence on health impacts of water contaminated with chemicals on young children (<5 years), we conducted a scoping review to select and organize relevant literature. Of the 98 studies in the review, 24 revealed that the hazard ratio of arsenic, nitrates, cadmium, and fluoride (all of which are on the World Health Organisation's list of 10 chemicals of public health concern) was higher in very young children than in older age groups. Anthropogenic activities (textile manufacturing, waste disposal, and intensified agriculture) are leading contributors to the release of chemicals to groundwater used for drinking. Three major pathways for chemical contamination exposure in young children were confirmed: maternal transmission during pregnancy and breastfeeding, and early school years. Children exhibited acute and chronic disruptions to their neurological, skeletal, reproductive, and endocrine systems, as well as cumulative carcinogenic risks, amongst other life-altering consequences. The lack of research on emerging contaminants' effects on young children in low-income countries is worrisome, as their increased use may compound the issues caused by the existing problem of "legacy chemicals." Precautionary principle should regulate the operation of industries producing these chemicals in a robust manner. Evidence from major producers and exporters in high-income countries is sufficient to warrant action, even without waiting for direct harm to be observed in low-income countries. Literature recommends prioritising prevention of contamination over demand side treatment or finding alternative water sources, especially in water-scarce areas affected by climate change. Local and transnational efforts are required to enforce safer industry practices and prevent further water quality deterioration in low-income countries.

Authors: Eniola Shittu, Monica Lakhanpaul, Carol Vigurs, Kaushik Sarkar, Marta Koch, Priti Parikh, Luiza C Campos

Full Source: The Science of the total environment 2023 Jun 2;164604. doi: 10.1016/j.scitotenv.2023.164604.

Low-income countries are struggling with the health impacts of both surface and groundwater chemical contamination.

Progression-free survival and safety at 3.5years of follow-up: results from the randomised phase 3 PRIMA/ENGOT-OV26/GOG-3012 trial of niraparib maintenance treatment in patients with newly diagnosed ovarian cancer

2023-05-03

To report updated long-term efficacy and safety from the double-blind, placebo-controlled, phase 3 PRIMA/ENGOT-OV26/GOG-3012 study (NCT02655016). Methods: Patients with newly diagnosed advanced ovarian cancer with complete or partial response (CR or PR) to first-line platinum-based chemotherapy received niraparib or placebo once daily (2:1 ratio). Stratification factors were best response to first-line chemotherapy regimen (CR/PR), receipt of neoadjuvant chemotherapy (yes/no), and homologous recombination deficiency (HRD) status (deficient [HRd]/proficient [HRp] or not determined). Updated (ad hoc) progression-free survival (PFS) data (as of November 17, 2021) by investigator assessment (INV) are reported. Results: In 733 randomised patients (niraparib, 487; placebo, 246), median PFS follow-up was 3.5years. Median INV-PFS was 24.5 versus 11.2months (hazard ratio, 0.52; 95% confidence interval [CI], 0.40-0.68) in the HRd population and 13.8 versus 8.2months (hazard ratio, 0.66; 95% CI, 0.56-0.79) in the overall population for niraparib and placebo, respectively. In the HRp population, median INV-PFS was 8.4 versus 5.4months (hazard ratio, 0.65; 95% CI, 0.49-0.87), respectively. Results were concordant with the primary analysis.

To report updated long-term efficacy and safety from the double-blind, placebo-controlled, phase 3 PRIMA/ENGOT-OV26/GOG-3012 study (NCT02655016).

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Niraparib-treated patients were more likely to be free of progression or death at 4years than placebo-treated patients (HRd, 38% versus 17%; overall, 24% versus 14%). The most common grade ≥ 3 treatment-emergent adverse events in niraparib patients were thrombocytopenia (39.7%), anaemia (31.6%), and neutropenia (21.3%). Myelodysplastic syndromes/acute myeloid leukaemia incidence rate (1.2%) was the same for niraparib- and placebo-treated patients. Overall survival remained immature. Conclusions: Niraparib maintained clinically significant improvements in PFS with 3.5years of follow-up in patients with newly diagnosed advanced ovarian cancer at high risk of progression irrespective of HRD status. No new safety signals were identified.

Authors: Antonio González-Martín, Bhavana Pothuri, Ignace Vergote, Whitney Graybill, Domenica Lorusso, Colleen C McCormick, Gilles Freyer, Floor Backes, Florian Heitz, Andrés Redondo, Richard G Moore, Christof Vulsteke, Roisin E O'Cearbhaill, Izabela A Malinowska, Luda Shtessel, Natalie Compton, Mansoor R Mirza, Bradley J Monk

Full Source: European journal of cancer (Oxford, England: 1990) 2023 May 3;S0959-8049(23)00225-3. doi: 10.1016/j.ejca.2023.04.024.

Research progress and trend of effects of organophosphorus pesticides on aquatic organisms in the past decade

2023-05-31

Organophosphorus pesticides (OPPs) are widely used in agricultural production due to their chemical stability, high efficiency and low cost. It should be emphasized that OPPs can seriously harm aquatic organisms after entering the water environment through leaching and other ways. To this end, this review combines a new method to quantitatively visualize and summarize information on developments in this field to review the latest progress in OPPs toxicity, propose scientific trends and research hotspots. Among all countries, China and the United States have published a large number of articles and played a leading role. Based on the detection of co-occurrence keywords, it is emphasized that "OPPs cause oxidative stress in organisms", which reflects that the main factor of OPPs toxicity is the occurrence of oxidative stress. Researchers also focused on studies involving AchE activity, acute toxicity and mixed toxicity. This reveals that OPPs mainly affect the nervous system, and higher organisms are more resistant to the toxic effects of OPPs than lower organisms due to their strong metabolic capacity. As for the mixed toxicity of OPPs, most OPPs have synergistic toxic effects. Moreover, the analysis of keyword bursts revealed that the study of OPPs on the immune response

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of aquatic organisms and the effect of temperature on toxicity will become new research trends. In conclusion, this scientometric analysis can provide a scientific basis for improving the aquatic ecological environment and rationally using OPPs.

Authors: Hongyan Li, Yaqi Jiao, Li Li, Xiaoguang Jiao

Full Source: Comparative biochemistry and physiology. Toxicology & pharmacology : CBP 2023 May 31;109673. doi: 10.1016/j.cbpc.2023.109673.

OCCUPATIONAL

Dose additive maternal and offspring effects of oral maternal exposure to a mixture of three PFAS (HFPO-DA, NBP2, PFOS) during pregnancy in the Sprague-Dawley rat

2023-06-02

Simultaneous exposure to multiple per- and polyfluoroalkyl substances (PFAS) is common in humans across the globe. Individual PFAS are associated with adverse health effects, yet the nature of mixture effects after exposure to two or more PFAS remains unclear. Previously we reported that oral administration of hexafluoropropylene oxide-dimer acid (HFPO-DA, or GenX), Nafion byproduct 2 (NBP2), or perfluorooctane sulfonate (PFOS) individually during pregnancy produced maternal and F1 effects. Here, we hypothesized that responses to the combined exposure to these three PFAS would be dose additive. Pregnant Sprague-Dawley rats were exposed to a fixed-ratio equipotent mixture where the top dose contained each PFAS at their ED50 for neonatal mortality (100 % dose = PFOS 3 mg/kg; NBP2 10 mg/kg; HFPO-DA 110 mg/kg), followed by a dilution series (33.3, 10, 3.3, and 1 %) and vehicle controls (0 % dose). Consistent with the single chemical studies, dams were exposed from gestation day (GD)14-18 or from GD8-postnatal day (PND2). Fetal and maternal livers on GD18 displayed multiple significantly upregulated genes associated with lipid and carbohydrate metabolism at all dose levels, while dams displayed significantly increased liver weight (≥3.3 % dose) and reduced serum thyroid hormones (≥33.3 % dose). Maternal exposure from GD8-PND2 significantly reduced pup bodyweights at birth (≥33.3 % dose) and PND2 (all doses), increased neonatal liver weights (≥3.3 % dose), increased pup mortality (≥3.3 % dose), and reduced maternal bodyweights and weight gain at the top dose. Echocardiography of adult F1 males and females identified significantly increased left ventricular anterior wall thickness (~10 % increase), whereas other cardiac

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morphological, functional, and transcriptomic measures were unaffected. Mixture effects in maternal and neonatal animals conformed to dose addition using a relative potency factor (RPF) analysis. Results support dose addition-based cumulative assessment approaches for estimating combined effects of PFAS co-exposure.
Authors: Justin M Conley, Christy S Lambright, Nicola Evans, Aimen K Farraj, Jacob Smoot, Rachel D Grindstaff, Donna Hill, James McCord, Elizabeth Medlock-Kakaley, Aaron Dixon, Erin Hines, L Earl Gray Jr
Full Source: The Science of the total environment 2023 Jun 2;164609. doi: 10.1016/j.scitotenv.2023.164609.

Health symptoms, inflammation, and bioaerosol exposure in workers at biowaste pretreatment plants

2023-06-01
Biowaste pretreatment plants have been built within the last years in Denmark in order to recycle pre-sorted biowaste from houses, restaurants, and industry. We investigated the association between exposure and health at six biowaste pretreatment plants (visited twice) across Denmark. We measured the personal bioaerosol exposure, took blood samples, and administered a questionnaire. Thirty-one persons participated, 17 of them twice, resulting in 45 bioaerosol samples, 40 blood samples, and questionnaire answers from 21 persons. We measured exposure to bacteria, fungi, dust, and endotoxin, the total inflammatory potential of the exposures, and serum levels of the inflammatory markers serum amyloid A (SAA), high sensitivity C-reactive protein (hsCRP), and human club cell protein (CC16). Higher exposures to fungi and endotoxin were found for workers with tasks inside the production area compared to workers with main tasks in the office area. A positive association was found between the concentration of anaerobic bacteria and hsCRP and SAA, whereas bacteria and endotoxin were inversely associated with hsCRP and SAA. A positive association between hsCRP and the fungal species Penicillium digitatum and P. camemberti were found, whereas an inverse association between hsCRP and Aspergillus niger and P. italicum were found. Staff with tasks inside the production area reported more symptoms of the nose than those working in the office area. To conclude, our results indicate that workers with tasks inside the production area are

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exposed to elevated levels of bioaerosols, and that this may affect workers' health negatively.
Authors: Pil Uthaug Rasmussen, Margit W Frederiksen, Tanja K Carøe, Anne Mette Madsen
Full Source: Waste management (New York, N.Y.) 2023 Jun 1;167:173-182. doi: 10.1016/j.wasman.2023.05.042.

Water consumption patterns impact hydration markers in males working in accordance with the National Institute for Occupational Safety and Health recommendations

2023-06-02
The impact of water consumption bolus volume and frequency on hydration biomarkers during work in the heat is unknown. In a randomized, crossover fashion, eight males consumed either 500 mL of water every 40 min or 237 mL of water every 20 min during 2 h of continuous walking at 6.4 kph, 1.0% grade in a 34 °C/30% relative humidity environment, followed by 2 h of rest. Hydration biomarkers and variables were assessed pre-work, post-work, and after the 2 h recovery. There were no differences in body mass between trials at any time point (all $p > 0.05$). Percent change in plasma volume during work was not different when 237 mL of water was repeatedly consumed (-1.6 ± 8.2%) compared to 500 mL of water (-1.3 ± 3.0%, $p = 0.92$). Plasma osmolality was maintained over time ($p = 0.55$) with no difference between treatments ($p = 0.21$). When consuming 500 mL of water repeatedly, urine osmolality was lower at recovery (205 ± 108 mOsmo/L) compared to pre-work (589 ± 95 mOsmo/L, $p < 0.01$), different from repeatedly consuming 237 mL of water which maintained urine osmolality from pre-work (548 ± 144 mOsmo/L) through recovery (364 ± 261 mOsmo/L, $p = 0.14$). Free water clearance at recovery was greater with repeated consumption of 500 mL of water (1.2 ± 1.0 mL/min) compared to 237 mL of water (0.4 ± 0.8 mL/min, $p = 0.02$). Urine volume was not different between treatments post-work ($p = 0.62$), but greater after 2 h of recovery when repeatedly consuming 500 mL of water compared to 237 mL ($p = 0.01$), leading to greater hydration efficiency upon recovery with repeated consumption of 237 mL of water (68 ± 12%) compared to 500 mL (63 ± 14%, $p = 0.01$). Thirst and total gastrointestinal symptom scores were not different between treatments at any time point (all $p > 0.05$). Body temperatures and heart rate were not different between treatments at any time point (all $p > 0.05$). Drinking larger, less frequent water boluses or drinking smaller, more frequent water boluses are both reasonable strategies to promote adequate hydration and limit

The impact of water consumption bolus volume and frequency on hydration biomarkers during work in the heat is unknown.

changes in body mass in males completing heavy intensity work in the heat.
Authors: Riana R Pryor, Jonathan R Larson, Lesley W Vandermark, Blair D Johnson, Zachary J Schlader
Full Source: Journal of occupational and environmental hygiene 2023 Jun 2;1-12. doi: 10.1080/15459624.2023.2221713.

PIG-A gene mutation as a mutagenicity biomarker among coke oven workers

2023-06-02
PIG-A gene mutations can be detected in humans, and PIG-A assays can potentially predict the risk of exposure to carcinogens. However, extensive, population-based studies to validate this are lacking. We studied a cohort of occupational coke oven workers with chronic high exposure to carcinogenic polycyclic aromatic hydrocarbons, which are well-studied genotoxins classified by the IARC as carcinogenic to humans. Peripheral blood erythrocytes of workers were assessed for gene mutations using a PIG-A assay, and chromosome damage using the cytokinesis-block micronucleus test with lymphocytes. Two sample populations from a non-industrialized city and new employees in industrial plants were selected as controls. We observed a significantly elevated PIG-A mutation frequency (MF) and increased frequencies of micronuclei (MN) and nuclear buds (NBUDs) in coke oven workers, compared with levels in the control groups. We found that the coke oven workers with different lengths of service had a relatively high mutation frequency. Overall, the study findings showed that occupational exposure of coke oven workers increases the genetic damage and the PIG-A MF could be a potential biomarker for risk assessment of carcinogen exposure.

PIG-A gene mutations can be detected in humans, and PIG-A assays can potentially predict the risk of exposure to carcinogens.

Authors: Jing Xi, Yiyi Cao, Yanhua Wang, Xinyue You, Weiying Liu, Ting Wang, Jingjing Yin, Junxiang Ma, Zhenjie Wang, Nan Wu, Xinyu Zhang, Huawei Duan, Yang Luan
Full Source: Food and chemical toxicology: an international journal published for the British Industrial Biological Research Association 2023 Jun 2;113872. doi: 10.1016/j.fct.2023.113872.