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CHEMICAL EFFECTS

Toxicity Reference Values for Force Health Protection: Provisional Occupational Exposure Guidelines

2024-08-14

Force Health Protection programs in the U.S. Air Force endeavor to sustain the operational readiness of the warfighters. We have previously identified hundreds of chemical substances of interest and toxicity reference value (TRV) knowledge gaps that constrain risk based-decision-making for potential exposures. Multiple approaches to occupational TRV estimation were used to generate possible guideline values for 84 compounds (18% of the substances of interest). These candidate TRVs included values from international databases, chemical similarity (nearest neighbor) approaches, empirical adjustments to account for duration differences, quantitative activity relationships, and thresholds of toxicological concern. This present work describes derivation of provisional TRVs from these candidate values. Rodent bioassay-derived long-term worker Derived No-Effect Levels (DNELs) were deemed presumptively the most reliable, but only 19 such DNELs were available for the 84 substances with TRV gaps. In the absence of DNELs, the quality of the approaches and consistency among candidate values were key elements of the weight of evidence used to select the most suitable guideline values. The use of novel nearest-neighbor approaches, empirical adjustment of short term TRVs, and occupational exposure bands were found to be options that would allow occupational TRV estimation with reasonable confidence for nearly all substances evaluated.

Authors: Lisa M Sweeney, Teresa R Sterner

Full Source: Regulatory toxicology and pharmacology : RTP 2024 Aug 14:105686. doi: 10.1016/j.yrtph.2024.105686.

Force Health Protection programs in the U.S.

Emerging threat of marine microplastics: Cigarette butt contamination on Yellow Sea beaches and the potential toxicity risks to rotifer growth and reproduction

2024-08-14

Cigarette butts have become one of the most common and persistent forms of debris in marine coastal areas, where they pose significant toxicity risks. This study investigated cigarette butt pollution along beaches of the Yellow Sea and used laboratory experiments to assess the toxicity of their leachate and fibers on the euryhaline rotifer Brachionus plicatilis. A pollution index confirmed pollution by this debris across all eight beaches surveyed, where the density of cigarette butts averaged 0.23 butts/m2. In controlled laboratory experiments, both the fibers and leachates from cigarette butts exhibited negative impacts on the development, reproduction, and population growth of rotifers. Unique abnormalities observed under different exposure treatments indicated toxicity specific to certain chemicals and particles. Continuous exposure to cigarette butts initially reduced rotifer fecundity, but this effect diminished over successive generations. However, the exposure induced transgenerational reproductive toxicity in the rotifers. Adaptive responses in rotifers after repeated exposure led to relative reduction in reproductive inhibition in the F3 and F4 generations. Furthermore, rotifers were capable of ingesting and accumulating cigarette butts, and maternal transfer emerged as an alternative pathway for uptake of this material in the offspring. These results increase our understanding of the ecological risks posed by cigarette butts in aquatic environments.

Authors: Hairong Lian, Lingyun Zhu, Meng Li, Sen Feng, Fan Gao, Xin Zhang, Fan Zhang, Yilong Xi, Xianling Xiang

Full Source: Journal of hazardous materials 2024 Aug 14:478:135534. doi: 10.1016/j.jhazmat.2024.135534.

Hydrogen-bond organic-framework-based electrochemical sensor for highly sensitive determination of trace cadmium ions in environmental and e-cigarette samples

2024-09-08

Background: The heavy metal ion Cd2+ is acutely toxic, and excessive concentrations can have adverse effects on human production and life, and even lead to significant public health risks and environmental impacts. There are several mature non-electrochemical methods for heavy metal detection, but these methods are characterized by high cost, which makes it difficult to be applied to the field for timely detection. Therefore, it is necessary to prepare a new electrochemical sensor that is environmentally friendly and capable of detecting Cd2+ in the environment quickly, easily and sensitively.

Results: In this study, hydrogen-bonded organic frameworks (HOFs) were synthesized by a simple hydrothermal reaction. The prepared materials consisted of only C, N and O and had a thin lamellar structure. The HOFs were integrated into a novel electrochemical sensor to achieve accurate detection of Cd2+ ions in real aqueous environments by square wave anodic dissolution voltammetry. The sensor has a wide linear range and a detection limit as low as 0.13 μg/L. Several real water samples, such as tap water, lake water, and e-cigarette digest, were analyzed to simulate

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the working environment of the sensor, and the results showed that the recoveries of Cd2+ ranged from 95.75 % to 101.2 %.
Significance: We pioneered the detection of heavy metal ions Cd2+ in e-cigarette digestate samples with the innovative use of HOFs as the sensor material, which demonstrated the potential application in electrochemical sensing with extremely low background current value and high sensitivity, providing new ideas for environmental monitoring and public health control.
Authors: Zesen Zuo, Kai Liu, Chunqiong Wang, Shengbao He, Fei Yang, Fengqin Chang, Wen-Tong Chen, Guangzhi Hu
Full Source: Analytica chimica acta 2024 Sep 8:1321:343038. doi: 10.1016/j.aca.2024.343038.

ENVIRONMENTAL RESEARCH

Machine learning based-model to predict catalytic performance on removal of hazardous nitrophenols and azo dyes pollutants from wastewater

2024-08-14
To maintain human health and purity of drinking water, it is crucial to eliminate harmful chemicals such as nitrophenols and azo dyes, considering their natural presence in the surroundings. In this particular research study, the application of machine learning techniques was employed in order to make an estimation of the performance of reduction catalysis in the context of ecologically detrimental nitrophenols and azo dyes contaminants. The catalyst utilized in the experiment was Ag@CMC, which proved to be highly effective in eliminating various contaminants found in water, like 4-nitrophenol (4-NP). The experiments were carefully conducted at various time intervals, and the machine learning procedures used in this study were all employed to forecast catalytic performance. The evaluation of the performance of such algorithms were done by means of Mean Absolute Error. The noteworthy findings of this research indicated that the ADAM and LSTM algorithm exhibited the most favourable performance in the case of toxic compounds i.e. 4-NP. Moreover, the Ag@CMC catalyst demonstrated an impressive reduction efficiency of 98 % against nitrophenol in just 8 min. Thus, based on these compelling results,

To maintain human health and purity of drinking water, it is crucial to eliminate harmful chemicals such as nitrophenols and azo dyes, considering their natural presence in the surroundings.

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it can be concluded that Ag@CMC works as a highly effective catalyst for practical applications in real-world scenarios.
Authors: Mohammad Sherjeel Javed Khan, Lariyah Mohd Sidek, Pavitra Kumar, Sadiq Abdullah Abdo Alkhadher, Hidayah Basri, Mohd Hafiz Zawawi, Ahmed El-Shafie, Ali Najah Ahmed
Full Source: International journal of biological macromolecules 2024 Aug 14:134701. doi: 10.1016/j.ijbiomac.2024.134701.

Analysis of proper ink management impact on overall environmental equipment efficiency for sustainability

2024-08-17
Printing as a process itself generates many environmental concerns. The paper addresses ink management in terms of environmental issues in the label printing industry, focusing on its environmental implications. The goal is to demonstrate how a proper ink management system impacts overall printing process efficiency and environmental sustainability for printing companies. The paper introduces an empirical approach to managing components for label and packaging production, utilizing automatic ink dispensing systems. The results demonstrate that the proper management of ink dispensing to minimize waste in packaging printing is crucial for optimizing operating print costs, potentially reducing the amount of ink needed to prepare colors by 52% and achieving energy savings of 37%. This approach fulfills the goal of sustainability by addressing environmental, economic, and social concerns. By optimizing ink usage and energy consumption, companies can significantly reduce operating costs and enhance economic performance. Simultaneously, these practices improve product quality, meet consumer demands for sustainable packaging, and create better working conditions for employees. Future directions and practical implications for supporting operational excellence in production are also discussed.
Authors: Krzysztof Krystosiak, Aldona Kluczek, Wojciech Werpachowski
Full Source: Scientific reports 2024 Aug 17;14(1):19104. doi: 10.1038/s41598-024-70118-x.

Printing as a process itself generates many environmental concerns.

Cyclic methylsiloxanes in wastewater treatment plants: Occurrence, emissions, environmental distributions, and occupational exposure

2024-08-16
Cyclic methylsiloxanes (CMSs), widely found in wastewater treatment plants (WWTPs), are potentially hazardous to the environment and human

health. In this study, the environmental behavior and human exposure risks of three CMSs (D4-D6) were evaluated in WWTPs located in Beijing and Kunming, Yunnan province. D5 had the highest concentrations in air, water, and sludge, with seasonal variation that consisted of a high concentration in summer and low concentration in winter. The CMS concentrations in air were 3-4-fold higher in the A2/O (Anaerobic-Anoxic-Oxic) treatment units than in the other units. CMS emissions to air, soil, and water from the Beijing WWTP were in the ranges of 3.4 × 104-5.0 × 104 kg·a-1, 4.5 × 102-7.5 × 102 kg·a-1, and 2.5 × 102-2.9 × 102 kg·a-1, constituting 98 %, 1.3 %, and 0.7 % of the total emissions, respectively. Total daily inhalation exposure doses of CMSs (ADDinh,CMSs) associated with four different jobs in WWTPs showed that wastewater treatment technicians had the highest ADDinh,CMSs (51 μg/kg/day), indicating that these people had the highest occupational exposure risk in WWTPs. Therefore, this study identified that atmospheric emission was the main environmental fate of CMSs in WWTPs, and provide a basis for the improvement of WWTP process and risk management decisions. ENVIRONMENTAL IMPLICATION: Assessing the environmental fate and occupational exposure risk of cyclic methylsiloxanes (CMSs) found in wastewater treatment plants (WWTPs) is crucial. This is the first study to identify that atmospheric emission was the main environmental fate of CMSs in WWTPs, especially D5; the inhalation exposure doses of CMSs were all significantly higher in the occupational population working in WWTPs. The results described in our study will help enhance the understanding of current knowledge base of environmental fate and exposure risk of CMSs in WWTPs, and provide a basis for the improvement of WWTP process and risk management decisions.

Authors: Kaixin Dong, Ying Zhou, Junyu Guo, Yao Jiang, Boya Zhang, Yifei Wang, Yuan Chen

Full Source: The Science of the total environment 2024 Aug 16:175524. doi: 10.1016/j.scitotenv.2024.175524.

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PHARMACEUTICAL/TOXICOLOGY

Associations of prenatal exposure to individual and mixed organophosphate esters with ADHD symptom trajectories in preschool children: The modifying effects of maternal Vitamin D

2024-08-15

Background: Organophosphate esters (OPEs) are a class of environmental chemicals with endocrine-disrupting properties. Epidemiologic studies have demonstrated that prenatal OPEs exposure is associated with neurodevelopmental disorders in offspring. However, studies assessing the effects of prenatal OPEs exposure on the dynamic changes in attention deficit hyperactivity disorder (ADHD) symptoms in preschoolers are scarce. Since vitamin D has been demonstrated to have a "neuroprotective" effect, the modifying effects of maternal vitamin D were estimated.

Methods: The present study included 2410 pregnant women from the Ma'anshan Birth Cohort. The levels of OPEs in the mothers' urine were examined in the three trimesters. The Chinese version of the Conners Abbreviated Symptom Questionnaire was used to examine preschoolers' ADHD symptoms at 3, 5, and 6 years of age. ADHD symptom trajectories were fitted via group-based trajectory modeling. We used multinomial logistic regression, Bayesian kernel machine regression, quantile-based g-computation, and generalized linear models to assess individual and mixed relationships between OPEs during pregnancy and preschoolers' ADHD symptoms and trajectories.

Results: Preschoolers' ADHD symptom scores were fitted to 3 trajectories, including the low-score, moderate-score, and high-score groups. First-trimester dibutyl phosphate (DBP), second-trimester bis(2-butoxyethyl) phosphate (BBOEP), and third-trimester diphenyl phosphate (DPHP) were associated with an increased risk in the high-score group ($p < 0.05$). BBOEP in the third trimester was associated with decreased risk in the moderate-score group (OR = 0.89, 95% CI: 0.79, 1.00). For mothers with 25(OH)D deficiency, a positive relationship was observed between OPEs during pregnancy and symptom trajectories. Our results did not reveal any mixed effects of OPEs on ADHD symptom trajectories.

Conclusion: Prenatal exposure to OPEs had heterogeneous associations with ADHD symptom trajectories in preschoolers. Additionally, the effect

Background: Organophosphate esters (OPEs) are a class of environmental chemicals with endocrine-disrupting properties.

of individual OPEs on symptom trajectories was intensified by vitamin D deficiency.
Authors: Han Li, Juan Tong, Xing Wang, Mengjuan Lu, Fengyu Yang, Hui Gao, Hong Gan, Shuangqin Yan, Guopeng Gao, Kun Huang, Yunxia Cao, Fangbiao Tao
Full Source: Journal of hazardous materials 2024 Aug 15:478:135541. doi: 10.1016/j.jhazmat.2024.135541.

'Humans think outside the pixels' - Radiologists' perceptions of using artificial intelligence for breast cancer detection in mammography screening in a clinical setting

2024-07
Objective: This study aimed to explore radiologists' views on using an artificial intelligence (AI) tool named ScreenTrustCAD with Philips equipment) as a diagnostic decision support tool in mammography screening during a clinical trial at Capio Sankt Göran Hospital, Sweden.
Methods: We conducted semi-structured interviews with seven breast imaging radiologists, evaluated using inductive thematic content analysis.
Results: We identified three main thematic categories: AI in society, reflecting views on AI's contribution to the healthcare system; AI-human interactions, addressing the radiologists' self-perceptions when using the AI and its potential challenges to their profession; and AI as a tool among others. The radiologists were generally positive towards AI, and they felt comfortable handling its sometimes-ambiguous outputs and erroneous evaluations. While they did not feel that it would undermine their profession, they preferred using it as a complementary reader rather than an independent one.
Conclusion: The results suggested that breast radiology could become a launch pad for AI in healthcare. We recommend that this exploratory work on subjective perceptions be complemented by quantitative assessments to generalize the findings.
Authors: Jennifer Viberg Johansson, Emma Engström
Full Source: Health informatics journal 2024 Jul-Sep;30(3):14604582241275020. doi: 10.1177/14604582241275020

Objective: This study aimed to explore radiologists' views on using an artificial intelligence (AI) tool named ScreenTrustCAD with Philips equipment) as a diagnostic decision support tool in mammography screening during a clinical trial at Capio Sankt Göran Hospital, Sweden.
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OCCUPATIONAL

Meta-analysis Identifies Key Genes and Pathways Implicated in Benzo[a]pyrene Exposure Response

2024-08-16
Introduction: Benzo[a]pyrene (B[a]P) is a carcinogenic polycyclic aromatic hydrocarbon that poses significant risks to human health. B[a]P influences cellular processes via intricate interactions; however, a comprehensive understanding of B[a]P's effects on the transcriptome remains elusive. This study aimed to conduct a comprehensive analysis focused on identifying relevant genes and signaling pathways affected by B[a]P exposure and their impact on human gene expression.
Methods: We searched the Gene Expression Omnibus database and identified four studies involving B[a]P exposure in human cells (T lymphocytes, hepatocellular carcinoma cells, and C3A cells). We utilized two approaches for differential expression analysis: the LIMMA package and linear regression. A meta-analysis was utilized to combine log fold changes (FC) and p-values from the identified studies using a random effects model. We identified significant genes at a Bonferroni-adjusted significance level of 0.05 and determined overlapping genes across datasets. Pathway enrichment analysis elucidated key cellular processes modulated by B[a]P exposure.
Results: The meta-analysis revealed significant upregulation of CYP1B1 (log FC = 1.15, 95% CI: 0.51-1.79, $P < 0.05$, $I2 = 82\%$) and ASB2 (log FC = 0.44, 95% CI: 0.20-0.67, $P < 0.05$, $I2 = 40\%$) in response to B[a]P exposure. Pathway analyses identified 26 significantly regulated pathways, with the top including Aryl Hydrocarbon Receptor Signaling ($P = 0.00214$) and Xenobiotic Metabolism Signaling ($P = 0.00550$). Key genes CYP1A1, CYP1B1, and CDKN1A were implicated in multiple pathways, highlighting their roles in xenobiotic metabolism, oxidative stress response, and cell cycle regulation.
Conclusion: The results provided insights into the mechanisms of B[a]P toxicity, highlighting CYP1B1's key role in B[a]P bioactivation. The findings underscored the complexity of B[a]P's mechanisms of action and their potential implications for human health. The identified genes and pathways provided a foundation for further exploration and enhanced our understanding of the multifaceted biological activities associated with B[a]P exposure.
Authors: Mingze Zhu, Jooyeon Hwang, Chao Xu
Full Source: Chemosphere 2024 Aug 16:143121. doi: 10.1016/j.chemosphere.2024.143121.

Introduction: Benzo[a]pyrene (B[a]P) is a carcinogenic polycyclic aromatic hydrocarbon that poses significant risks to human health.

Occupational chronic psychological stress and transaminase, HSP70 gene family and its proteins association of the interaction with metabolic syndrome

2024-07

Objective: To explore the association of Occupational chronic psychological stress with transaminase, heat shock protein70(HSP70)gene family and their protein interaction with metabolic syndrome(MS).
Methods: A case-control study was used. According to the inclusion and exclusion criteria, from March 2015 to March 2016, 583 unrelated MS patients were selected as the case group and 585 unrelated healthy people as the control group among hospitalized and physical examination subjects aged 20-60 in Wuzhong People's Hospital and General Hospital of Ningxia Medical University. Questionnaire survey, physical examination, clinical and biochemical indicators, serum HSP70 level and five-locus polymorphism detection of HSP70 gene were carried out. GMDR 0.7 software was used to analyze the relationship between psychological stress, transaminase, HSP70 gene and its protein interaction and MS.
Results: After adjusting for age and sex, the rs1008438, rs1061581, rs539689 and rs222795 locus of HSP70 gene in the Co-dominant model and Dominant model and the rs222795 loci in the Over-dominant model carry wild homozygous genotype and heterozygous genotype were all related to the reduction of MS risk(OR<1, P<0.05). GMDR result: the 2-factor interaction model composed of psychological stress and serum HSP70, the 2-3 factor interaction model composed of transaminase activity, and the 2-6 factor interaction model composed of five locus of HSP70 gene, the 2-9 factor interaction model consisting of psychological stress and transaminase activity, HSP70 gene and its protein were all significantly associated with MS(P<0.01, P<0.05), all each factor interaction models were the best, and the 9-factor optimal interaction model had the highest risk of MS(OR=46.51, 95%CI 27.65-78.26), and the risk of MS in high-risk type was 45.23 times higher than that in low-risk type(95%CI 31.29-65.38, P<0.01).
Conclusion: HSP70 gene family carrying wild-type alleles is a protective factor for MS. The interaction among Occupational chronic psychological stress interacts with transaminases, HSP70 gene and its serum proteins may be associated with MS. With the increase of involvement interaction factors, the risk of MS increased significantly. The interaction of multiple factors can greatly increase its risk.

Authors: Nan Chen, Lin Song, Xinqiao Wang, Herong Liu, Shengnan Fan, Hui Song

Full Source: Wei sheng yan jiu = Journal of hygiene research 2024 Jul;53(4):561-568. doi: 10.19813/j.cnki.weishengyanjiu.2024.04.007.

Objective: To explore the association of Occupational chronic psychological stress with transaminase, heat shock protein70(HSP70) gene family and their protein interaction with metabolic syndrome(MS).
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