CHEMWATCH

Bulletin Board

Contents

MAR. 10, 2023

(click on page numbers for links)

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

Human 2,3,7,8-tetrachlorodibenzo-p-dioxin exposure and thyroid cancer risk

2023-03-02
Thyroid cancer incidence has been steadily rising since the 1970s and exposure to environmental pollutants, including persistent organic pollutants such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other dioxins, has emerged as a potential explanation for this increase. This study aimed to summarize available human studies on the association between TCDD exposure and thyroid cancer. A systematic review of the literature was performed searching the National Library of Medicine and National Institutes of Health PubMed, Embase, and Scopus databases, through January 2022, using the following keywords: "thyroid", "2,3,7,8-tetrachlorodibenzo-p-dioxin", "TCDD", "dioxin", and "Agent Orange". Six studies were included in this review. Three studies evaluated the acute exposure to the chemical factory accident in Seveso, Italy, and found a non-significant increase in the risk of thyroid cancer. Two studies investigating Agent Orange exposure among United States Vietnam War veterans found a significant risk of thyroid cancer following exposure. No association was found in one study evaluating TCDD exposure through herbicides. The current study highlights the limited information on the potential association between TCDD exposure and thyroid cancer and thus the need for future human studies, especially considering the persistent human exposure to dioxins in the environment.
Authors: Maaike van Gerwen, Vikram Vasan, Eric Genden, Shira R Saul
Full Source: Toxicology 2023 Mar 2;488:153474. doi: 10.1016/j.tox.2023.153474.

Thyroid cancer incidence has been steadily rising since the 1970s and exposure to environmental pollutants, including persistent organic pollutants such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other dioxins, has emerged as a potential explanation for this increase.

Effect of Arsenic Exposure and Cigarette Smoking on Total and Cause-Specific Mortality: An Occupational Cohort With 27 Follow-up Years

2023-03-01
Background: The relationship between arsenic exposure and all-cause mortality and the joint effects of arsenic exposure and smoking have been poorly described in previous studies.
Methods: After 27 years of follow-up, a total of 1738 miners were included in the analysis. Different statistical methods were used to explore the relationship between arsenic exposure and smoking and the risk of all-cause mortality and various causes of death.

CHEMWATCH
Bulletin Board
Technical
MAR. 10, 2023

Results: A total of 694 deaths occurred during the 36,199.79 person-years of follow-up. Cancer was the leading cause of death, and arsenic-exposed workers had significantly higher mortality rates for all-cause, cancer, and cerebrovascular disease. All-cause, cancer, cerebrovascular disease, and respiratory disease increased with cumulative arsenic exposure. Conclusions: We demonstrated the negative effects of smoking and arsenic exposure on all-cause mortality. More effective actions should be taken to reduce arsenic exposure in miners.
Authors: Xin-Hua Jia, Yu-Fei Li, Ya-Guang Fan, Qing-Hua Zhou, Fang-Hui Zhao, You-Lin Qiao, Marja Lalley
Full Source: Journal of occupational and environmental medicine 2023 Mar 1;65(3):217-223. doi: 10.1097/JOM.0000000000002764.

Joint effect of ambient PM2.5 exposure and vitamin B12 during pregnancy on the risk of gestational diabetes mellitus

2023-03-01
Background: Evidence has indicated that the risk of gestational diabetes mellitus (GDM) was linked to PM2.5 exposure during pregnancy, but findings on susceptible exposure windows are inconsistent. Further, previous studies have not paid attention to B12 intake in the relationship between PM2.5 exposure and GDM. The study is aimed to identify the strength and exposure periods for associations of PM2.5 exposure with GDM, followed by exploring the potential interplay of gestational B12 levels and PM2.5 exposure on the risk of GDM.
Methods: The participants were recruited in a birth cohort between 2017 and 2018, and 1396 eligible pregnant women who completed a 75-g oral glucose tolerance test (OGTT) were included. Prenatal PM2.5 concentrations were estimated using an established spatiotemporal model. Logistic and linear regression analyses were used to test associations of gestational PM2.5 exposure with GDM and OGTT-glucose levels, respectively. The joint associations of gestational PM2.5 exposure and B12 level on GDM were examined under crossed exposure combinations of PM2.5 (high versus low) and B12 (insufficient versus sufficient).
Results: In the 1396 pregnant women, the median levels of PM2.5 exposure during the 12 weeks before pregnancy, the 1st trimester, and the 2nd trimesters were 59.33 μg/m3, 63.44 μg/m3, and 64.39 μg/m3, respectively. The risk of GDM was significantly associated with a 10 μg/m3 increase of PM2.5 during the 2nd trimester (RR = 1.44, 95 % CI: 1.01, 2.04). The percentage change in fasting glucose was also associated with PM2.5

Background: Evidence has indicated that the risk of gestational diabetes mellitus (GDM) was linked to PM2.5 exposure during pregnancy, but findings on susceptible exposure windows are inconsistent.

exposure during the 2nd trimester. A higher risk of GDM was observed among women with high PM2.5 exposure and insufficient B12 levels than those with low PM2.5 and sufficient B12.
Conclusion: The study supported higher PM2.5 exposure during the 2nd trimester is significantly associated with GDM risk. It first highlighted insufficient B12 status might enhance adverse effects of air pollution on GDM.
Authors: Xueli Yang, Qiang Zhang, Yao Sun, Chen Li, Hongyu Zhou, Chang Jiang, Jing Li, Liwen Zhang, Xi Chen, Naijun Tang
Full Source: The Science of the total environment 2023 Mar 1;162514. doi: 10.1016/j.scitotenv.2023.162514.

ENVIRONMENTAL RESEARCH

Health risk assessment of heavy metals in the seafood at Kalpakkam coast, Southeast Bay of Bengal

2023-03-02
The distribution of heavy metals in the seafood intake by various age group representatives around the Kalpakkam coastal region was part of the baseline study. Totally 40 different types of fish species were estimated on heavy metals (Cu, Cr, Co, Cd, Pb, Ni, Zn, and Mn) in the coastal zone; the average concentration of heavy metals were 0.71, 0.06, 0, 0, 0.07, 0.02, 1.06 and 0.36 ppm, respectively. Individual mean bioaccumulation index (IMBI) and Metal pollution index (MPI) with heavy metals distributed around the coastal zone were compared with fish tissue and were found to be higher for Zn and Cu. The human health risk was calculated using uncertainty modeling of risk assessment of Estimated daily intake (EDI), Maximum allowable consumption rate (CRlim), Target hazard quotient (THQ), and Hazard index (HI) were estimated for different age groups. Our present values were suggestively high (>1) for both kids and adults. The cumulative cancer risk assessment based on heavy metals and the Hospital-Based Cancer Registry (HBCR) compared to the region did not exceed the recommended threshold risk limit around the Kalpakkam coastal zone. Statistical analyses such as correlation, Principal component, and Cluster investigation ensure that heavy metal concentrations do not pose a major risk to occupants.
Authors: Kumar Pandion, Kantha Deivi Arunachalam, Rajinikanth Rajagopal, Daoud Ali, Saud Alarifi, Soon Woong Chang, Balasubramani Ravindran
Full Source: Marine pollution bulletin 2023 Mar 2;189:114766. doi: 10.1016/j.marpolbul.2023.114766.

The distribution of heavy metals in the seafood intake by various age group representatives around the Kalpakkam coastal region was part of the baseline study.

CHEMWATCH
Bulletin Board
Technical
MAR. 10, 2023

Microplastics in aquatic environments: A comprehensive review of toxicity, removal, and remediation strategies

2023-03-01
The occurrence of microplastics (MPs) in aquatic environments has been a global concern because they are toxic and persistent and may serve as a vector for many legacies and emerging pollutants. MPs are discharged to aquatic environments from different sources, especially from wastewater plants (WWPs), causing severe impacts on aquatic organisms. This study mainly aims to review the Toxicity of MPs along with plastic additives in aquatic organisms at various trophic compartments and available remediation methods/strategies for MPs in aquatic environments. Occurrences of oxidative stress, neurotoxicity, and alterations in enzyme activity, growth, and feeding performance were identical in fish due to MPs toxicity. On the other hand, growth inhibition and ROS formation were observed in most of the microalgae species. In zooplankton, potential impacts were acceleration of premature molting, growth retardation, mortality increase, feeding behaviour, lipid accumulation, and decreased reproduction activity. MPs and additives could also exert some toxicological impacts on polychaete, including neurotoxicity, destabilization of the cytoskeleton, reduced feeding rate, growth, survivability and burrowing ability, weight loss, and high rate of mRNA transcription. Among different chemical and biological treatments for MPs, high removal rates have been reported for coagulation and filtration (>86.5 %), electrocoagulation (>90 %), advanced oxidation process (AOPs) (30 % to 95 %), primary sedimentation/Grit chamber (16.5 % to 58.84 %), adsorption removal technique (>95 %), magnetic filtration (78 % to 93 %), oil film extraction (>95 %), and density separation (95 % to 100 %). However, desirable extraction methods are required for large-scale research in MPs removal from aquatic environments.
Authors: A S Shafiuddin Ahmed, Md Masum Billah, Mir Mohammad Ali, Md Khurshid Alam Bhuiyan, Laodong Guo, Mohammad Mohinuzzaman, M Belal Hossain, M Safiur Rahman, Md Saiful Islam, Meng Yan, Wenlong Cai
Full Source: The Science of the total environment 2023 Mar 1;162414. doi: 10.1016/j.scitotenv.2023.162414.

The occurrence of microplastics (MPs) in aquatic environments has been a global concern because they are toxic and persistent and may serve as a vector for many legacies and emerging pollutants.

Transformation and environmental risk of heavy metals in sewage sludge during the combined thermal hydrolysis, anaerobic digestion and heat drying treatment process

2023-03-06

The design of this study was to investigate the solid-aqueous migration and chemical speciation transformation of heavy metals (HMs) in the sewage sludge during the combined process of thermal hydrolysis, anaerobic digestion and heat-drying. The results showed that most of the HMs were still accumulated in the solid phase of various sludge samples after treatment. After thermal hydrolysis, the concentrations of Cr, Cu and Cd increased slightly. All the HMs measured after anaerobic digestion were concentrated obviously. While the concentrations of all HMs decreased slightly after heat-drying. The stability of HMs in the sludge samples was enhanced after treatment. The environmental risks of various HMs were also relieved in the final dried sludge samples.

Authors: Chunsheng Qiu, Jiakang Li, Chenchen Wang, Nannan Liu, Li Qi, Dong Wang, Shaopo Wang, Liping Sun

Full Source: Environmental science and pollution research international 2023 Mar 6. doi: 10.1007/s11356-023-26200-4.

PHARMACEUTICAL/TOXICOLOGY

Exposure, toxicological mechanism of endocrine disrupting compounds and future direction of identification using nano-architectonics

2023-03-03

Endocrine-disrupting compounds (EDC) are a group of exogenous chemicals that structurally mimic hormones and interfere with the hormonal signaling cascade. EDC interacts with hormone receptors, transcriptional activators, and co-activators, altering the signaling pathway at both genomic and non-genomic levels. Consequently, these compounds are responsible for adverse health ailments such as cancer, reproductive issues, obesity, and cardiovascular and neurological disorders. The persistent nature and increasing incidence of environmental contamination from anthropogenic and industrial effluents have become a global concern, resulting in a movement in both developed and developing countries to identify and estimate the degree of exposure to EDC. The U.S. Environment Protection Agency (EPA) has outlined a series of in vitro and in vivo assays to screen potential endocrine disruptors. However, the multidisciplinary nature and concerns over the widespread application demand alternative and practical techniques for identifying and estimating EDC. The review chronicles the state-of-art 20 years (1990-2023) of scientific literature regarding EDC's exposure and molecular mechanism, highlighting the toxicological effects on the biological system. Alteration in signaling mechanisms by representative endocrine disruptors such as bisphenol A (BPA), diethylstilbestrol (DES), and genistein has been emphasized. We further discuss the currently available assays and techniques for in vitro detection and propose the prominence of designing nano-architectonic-sensor substrates for on-site detection of EDC in the contaminated aqueous environment.

Authors: Eepsita Priyadarshini, Ajith Manayil Parambil, Paulraj Rajamani, Vinoth Kumar Ponnusamy, Yi-Hsun Chen

Full Source: Environmental research 2023 Mar 3;115577. doi: 10.1016/j.envres.2023.115577.

The design of this study was to investigate the solid-aqueous migration and chemical speciation transformation of heavy metals (HMs) in the sewage sludge during the combined process of thermal hydrolysis, anaerobic digestion and heat-drying.

The protective effect of natural or chemical compounds against arsenic-induced neurotoxicity: Cellular and molecular mechanisms

2023-03-03

Arsenic is a notorious metalloid that exists in the earth's crust and is considered toxic for humans and the environment. Both cancerous and non-cancerous complications are possible after arsenic exposure. Target organs include the liver, lungs, kidney, heart, and brain. Arsenic-induced neurotoxicity, the main focus of our study, can occur in central and peripheral nervous systems. Symptoms can develop in a few hours, weeks, or years depending on the quantity of arsenic and the duration of exposure. In this review, we aimed to gather all the compounds, natural and chemical, that have been studied as protective agents in cellular, animal, and human reports. Oxidative stress, apoptosis, and inflammation are frequently described as destructive mechanisms in heavy metal toxicity. Moreover, reduced activity of acetylcholinesterase, the altered release of monoamine neurotransmitters, down-regulation of N-methyl-D-aspartate receptors, and decreased brain-derived neurotrophic factor are important underlying mechanisms of arsenic-induced neurotoxicity. As for neuroprotection, though some compounds have yet limited data, there are others, such as curcumin, resveratrol, taurine, or melatonin which have been studied more deeply and might be closer to a reliable protective agent. We collected the available information on all protective

Arsenic is a notorious metalloid that exists in the earth's crust and is considered toxic for humans and the environment.

Copyright Chemwatch 2023 ©

agents and the mechanisms by which they fight against arsenic-induced neurotoxicity.
Authors: Mersedeh Shayan, Samira Barangi, Hossein Hosseinzadeh, Soghra Mehri
Full Source: Food and chemical toxicology : an international journal published for the British Industrial Biological Research Association 2023 Mar 3;113691. doi: 10.1016/j.fct.2023.113691.

OCCUPATIONAL

Interaction between aluminum exposure and ApoEε4 gene on cognitive function of in-service workers

2023-03-01
The occurrence and development of cognitive impairment, the early stage of AD, may be affected both by factors of environmental (aluminum exposure) and genetic (ApoEε4 gene). But whether there is an interaction between the two factors on cognitive function is still unknown. To explore the interaction between the two factors on cognitive function of in-service workers. A total of 1121 in-service workers in a large aluminum factory were investigated in Shanxi Province. Cognitive function was assessed by the Mini-mental State Examination (MMSE), the clock-drawing test (CDT), the Digit Span Test (DST, including DSFT and DSBT), the fuld object memory evaluation (FOM), and the verbal fluency task (VFT). The plasma-Al (p-Al) concentrations were measured by inductively coupled plasma-mass spectrometry (ICP-MS) as an internal exposure indicator, and the participants were divided into four Al exposure groups according to the quartile of p-Al concentrations, namely Q1, Q2, Q3, and Q4. ApoE genotype was determined by Ligase Detection Reaction (LDR). The multiplicative model was fitted using non-conditional logistic regression and additive model was fitted using crossover analysis to analyze the interaction between p-Al concentrations and the ApoEε4 gene. Finally, a dose-response relationship between p-Al concentrations and cognitive impairment was observed, with the p-Al concentrations increased, cognitive function performance gradually becomes worse (Ptrend 0.05), and the risk of cognitive impairment gradually increases (Ptrend 0.05), mainly in executive/visuospatial impairment, auditory memory impairment (particularly the working memory impairment). And ApoEε4 gene may be a risk factor for cognitive impairment, while no association between the ApoEε2 gene and cognitive impairment is observed. Additionally, an additive but no multiplicative interaction between p-Al concentrations and ApoEε4 gene is observed, and when the two factors work together, the risk of cognitive impairment further increased, of which 44.2% can be attributed to the interaction effect.
Authors: Shanshan Wang, Yingjun Xue, Jintao Zhang, Huaxing Meng, Jingsi Zhang, Xiaoyan Li, Zhuoran Zhang, Huan Li, Baolong Pan, Xiaoting Lu, Qinli Zhang, Qiao Niu
Full Source: Chemosphere 2023 Mar 1;323:138282. doi: 10.1016/j.chemosphere.2023.138282.

The occurrence and development of cognitive impairment, the early stage of AD, may be affected both by factors of environmental (aluminum exposure) and genetic (ApoEε4 gene).

Nickel exposure induces gut microbiome disorder and serum uric acid elevation

2023-03-0
Serum uric acid elevation has been found in long-term nickel (Ni) exposure occupational workers, but the mechanism is unclear. In this study, the relationship between Ni exposure and uric acid elevation was explored in a cohort of 109 participants composed of a Ni-exposed workers group and a control group. The results showed that Ni concentration (5.70 ± 3.21 μg/L) and uric acid level (355.95 ± 67.87 μmol/L) in the serum were increased in the exposure group with a significant positive correlation ($r = 0.413$, $p < 0.0001$). The composition of gut microbiota and metabolome revealed that the abundance of uric acid-lowering bacteria, such as Lactobacillus, Lachnospiraceae_Unclassfied and Blautia were reduced while pathogenic bacteria including Parabacteriadies and Escherichia-Shigella were enriched in Ni group, accompanied by impaired intestinal degradation of purines and upregulated biosynthesis of primary bile acids. Consistent with human results, the mice experiments showed that Ni treatment significantly promotes uric acid elevation and systemic inflammation. Lactobacillus and Blautia in gut microbiota were reduced and inflammation-related taxa Alistipes and Mycoplasma were enriched in the Ni treatment. In addition, LC-MS/MS metabolomic analysis indicated that purine nucleosides were accumulated in mice feces, which increased purine absorption and uric acid elevation in the serum. In summary, this study provides evidence that UA elevation was correlated with heavy metals exposure and highlighted the role of gut microbiota in intestinal purine catabolism and in the pathogenesis of heavy metal-induced hyperuricemia.
Authors: Jinfeng Yang, Pengya Feng, Zhenmin Ling, Aman Khan, Xing Wang, Yanli Chen, Gohar Ali, Yitian Fang, El-Sayed Salama, Ximei Wang, Pu Liu, Xiangkai Li
Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Mar 2;324:121349. doi: 10.1016/j.envpol.2023.121349.

Serum uric acid elevation has been found in long-term nickel (Ni) exposure occupational workers, but the mechanism is unclear.