Bulletin Board

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MAY. 17, 2024

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CHEMICAL EFFECTS

Uncovering hidden dangers: The combined toxicity of abamectin and lambda-cyhalothrin on honey bees

2024-05-09

Studying the toxic effects of pesticides on bees has consistently been a prominent area of interest for researchers. Nonetheless, existing research has predominantly concentrated on individual toxicity assessments, leaving a gap in our understanding of mixed toxicity. This study delves into the individual and combined toxic effects of abamectin (ABA) and lambda-cyhalothrin (LCY) on honey bees (Apis mellifera) in laboratory settings. We discovered that ABA (96 h-LC50 value of 0.079 mg/L) exhibited greater acute toxicity to honey bees compared to LCY (96 h-LC50 value of 9.177 mg/L). Moreover, the mixture of ABA and LCY presented an acute antagonistic effect on honey bees. Additionally, our results indicated that exposure to LCY, at medium concentration, led to a reduction in the abundance of gut core bacterium Snodgrassella. However, an increase in the abundance of Bifidobacterium was noted when exposed to a medium concentration of LCY and its mixture with ABA. Transcriptomic analysis revealed significant regulation of certain genes in the medium concentration of all three treatments compared to the control group, primarily enriching in metabolism and immune-related pathways. Following chronic exposure to field-relevant concentrations of ABA, LCY, and their mixture, there were significant alterations in the activities of immunity-related enzyme polyphenol oxidase (PPO) and detoxification enzymes glutathione S-transferase (GST) and carboxylesterase (CarE). Additionally, the expression of four genes (abaecin, cyp9e2, cyp302a1, and GstD1) associated with immune and detoxification metabolism was significantly altered. These findings suggest a potential health risk posed by the insecticides ABA and LCY to honey bees. Despite exhibiting antagonistic effects, mixed exposure still induced damage to bees at all levels. This study advances our knowledge of the potential adverse effects of individual or combined exposure to these two pesticides on non-target pollinators and offers crucial guidance for the use of insecticides in agricultural production.

Authors: Xiaozhen Chen, Feidi Wang, Haikun Guo, Xinju Liu, Shenggan Wu, Lu Lv, Tao Tang

Full Source: The Science of the total environment 2024 May 9:173126. doi: 10.1016/j.scitotenv.2024.173126.

> Studying the toxic effects of pesticides on bees has consistently been a prominent area of interest for researchers.

Vitamin D Deficiency Exacerbates Poor Sleep Outcomes with Endocrine-Disrupting Chemicals Exposure: A Large American Population Study

2024-04-26

Phthalates and bisphenol A are recognized as the predominant endocrine-disrupting substances (EDCs) in the environment, but their impact on sleep health remains unclear. Vitamin D has often been reported to play a role in sleep health and may be affected by endocrine-disrupting compounds. The study utilized data from 5476 individuals in the NHANES project to investigate the correlation between combined exposure to environmental EDCs and sleep duration through modeling various exposures. Furthermore, it emphasizes the importance of vitamin D in the present scenario. Preliminary analyses suggested that vitamin D-deficient individuals generally slept shorter than individuals with normal vitamin D (p < 0.05). Exposure to Mono-ethyl phthalate (MEP), triclosan (TRS), and Mono-benzyl phthalate (MZP), either alone or in combination, was associated with reduced sleep duration and a greater risk of vitamin D deficiency. Individuals with low vitamin D levels exposed to TRS experienced shorter sleep duration than those with normal vitamin D levels (p < 0.05). TRS and MZP were identified as crucial factors in patient outcomes when evaluating mixed exposures (p < 0.05). The results provide new data supporting a link between exposure to EDCs and insufficient sleep length. Additionally, they imply that a vitamin D shortage may worsen the sleep problems induced by EDCs.

Authors: Ruiqi Zhou, Zhongwen Chen, Tingting Yang, Huiwen Gu, Xiaohong Yang, Shuqun Cheng

Full Source: Nutrients 2024 Apr 26;16(9):1291. doi: 10.3390/nu16091291.

> Phthalates and bisphenol A are recognized as the predominant endocrine-disrupting substances (EDCs) in the environment, but their impact on sleep health remains unclear.

Effects of Environmental Enrichment on Exposure to Human-Relevant Mixtures of Endocrine Disrupting Chemicals in Zebrafish

2024-04-25

Fish models used for chemical exposure in toxicological studies are normally kept in barren tanks without any structural environmental enrichment. Here, we tested the combined effects of environmental enrichment and exposure to two mixtures of endocrine disrupting chemicals (EDCs) in zebrafish. Firstly, we assessed whether developmental exposure to an EDC mixture (MIX G1) combined with rearing the fish in an enriched environment influenced behaviour later in life. This was evaluated using locomotion tracking one month after exposure, showing

a significant interaction effect between enrichment and the MIX G1 exposure on the measured locomotion parameters. After three months, we assessed behaviour using custom-made behaviour tanks, and found that enrichment influenced swimming activity. Control fish from the enriched environment were more active than control fish from the barren environment. Secondly, we exposed adult zebrafish to a separate EDC mixture (MIX G0) after rearing them in a barren or enriched environment. Behaviour and hepatic mRNA expression for thyroid-related genes were assessed. There was a significant interaction effect between exposure and enrichment on swimming activity and an effect of environment on latency to approach the group of conspecifics, where enriched fish took more time to approach the group, possibly indicating that they were less anxious. Hepatic gene expression of a thyroid-related gene (thrb) was significantly affected by EDC exposure, while enrichment had no discernible impact on the expression of the measured genes. In conclusion, environmental enrichment is important to consider when studying the effects of EDCs in fish.

Authors: Lina Birgersson, Sanne Odenlund, Joachim Sturve

ENVIRONMENTAL RESEARCH

Integrating Advanced Techniques and Machine Learning for Landfill Leachate Treatment: Addressing Limitations and Environmental Concerns

2024-05-09

This review article explores the challenges associated with landfill leachate resulting from the increasing disposal of municipal solid waste in landfills and open areas. The composition of landfill leachate includes antibiotics (0.001 to 100 µg), heavy metals (0.001 to 1.4 g/L), dissolved organic and inorganic components, and xenobiotics including polyaromatic hydrocarbons (10-25 µg/L). Conventional treatment methods, such as biological (microbial and phytoremediation) and physicochemical (electrochemical and membrane-based) techniques, are available but face limitations in terms of cost, accuracy, and environmental risks. To surmount these challenges, this study advocates for the integration of artificial intelligence (AI) and machine learning (ML) to strengthen treatment efficacy through predictive analytics and optimized operational parameters. It critically evaluates the risks posed by recalcitrant leachate

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components and appraises the performance of various treatment modalities, both independently and in tandem with biological and physicochemical processes. Notably, physicochemical treatments have demonstrated pollutant removal rates of up to 90% for various contaminants, while integrated biological approaches have achieved over 95% removal efficiency. However, the heterogeneous nature of solid waste composition further complicates treatment methodologies. Consequently, the integration of advanced ML algorithms such as Support Vector Regression, Artificial Neural Networks, and Genetic Algorithms is proposed to refine leachate treatment processes. This review provides valuable insights for different stakeholders specifically researchers, policymakers and practitioners, seeking to fortify waste disposal infrastructure and foster sustainable landfill leachate management practices. By leveraging AI and ML tools in conjunction with a nuanced understanding of leachate complexities, a promising pathway emerges towards effectively addressing this environmental challenge while mitigating potential adverse impacts.

Authors: Vivek Kumar Gaur, Krishna Gautam, Reena Vishvakarma, Poonam Sharma, Upasana Pandey, Janmejai Kumar Srivastava, Sunita Varjani, Jo-Shu Chang, Huu Hao Ngo, Jonathan W C Wong

Residential exposure to air pollution and incidence of leukaemia in the industrial area of Viadana, Northern Italy

2024-05-09

Background: Exposure to air pollution has been proposed as one of the potential risk factors for leukaemia. Work-related formaldehyde exposure is suspected to cause leukaemia.

Methods: We conducted a nested register-based case-control study on leukaemia incidence in the Viadana district, an industrial area for particleboard production in Northern Italy. We recruited 115 cases and 496 controls, frequency-matched by age, between 1999-2014. We assigned estimated exposures to particulate matter (PM10, PM2.5), nitrogen dioxide (NO2), and formaldehyde at residential addresses, averaged over the susceptibility window 3rd to 10th year prior to the index date. We considered potential confounding by sex, age, nationality, socio-economic status, occupational exposures to benzene and formaldehyde, and prior cancer diagnoses.

Results: There was no association of exposures to PM10, PM2.5, and NO2 with leukaemia incidence. However, an indication of increased risk

> Background: Exposure to air pollution has been proposed as one of the potential risk factors for leukaemia.

emerged for formaldehyde, despite wide statistical uncertainty (OR 1.46, 95%CI 0.65-3.25 per IQR-difference of 1.2 µg/m3). Estimated associations for formaldehyde were higher for acute (OR 2.07, 95%CI 0.70-6.12) and myeloid subtypes (OR 1.79, 95%CI 0.64-5.01), and in the 4-km buffer around the industrial facilities (OR 2.78, 95%CI 0.48-16.13), although they remained uncertain.

Conclusions: This was the first study investigating the link between ambient formaldehyde exposure and leukaemia incidence in the general population. The evidence presented suggests an association, although it remains inconclusive, and a potential significance of emissions related to industrial activities in the district. Further research is warranted in larger populations incorporating data on other potential risk factors.

Authors: Francesca Locatelli, Luigi Martinelli, Pierpaolo Marchetti, Gulser Caliskan, Chiara Badaloni, Nicola Caranci, Kees de Hoogh, Luciana Gatti, Paolo Giorgi Rossi, Linda Guarda, Marta Ottone, Silvia Panunzi, Massimo Stafoggia, Caterina Silocchi, Paolo Ricci, Alessandro Marcon

Full Source: Environmental research 2024 May 9:119120. doi: 10.1016/j.envres.2024.119120.

PHARMACEUTICAL/TOXICOLOGY

Key drivers of the oxidative potential of PM2.5 in Beijing in the context of air quality improvement from 2018 to 2022

2024-05-09

The mass concentration of atmospheric particulate matter (PM) has been continuously decreasing in the Beijing-Tianjin-Hebei region. However, health endpoints do not exhibit a linear correlation with PM mass concentrations. Thus, it is urgent to clarify the prior toxicological components of PM to further improve air quality. In this study, we analyzed the long-term oxidative potential (OP) of water-soluble PM2.5, which is generally considered more effective in assessing hazardous exposure to PM in Beijing from 2018 to 2022 based on the dithiothreitol assay and identified the crucial drivers of the OP of PM2.5 based on online monitoring of air pollutants, receptor model, and random forest (RF) model. Our results indicate that dust, traffic, and biomass combustion are the main sources of the OP of PM2.5 in Beijing. The complex interactions of dust particles, black carbon, and gaseous pollutants (nitrogen dioxide and sulfur dioxide) are the main factors driving the OP evolution, in particular, leading to the abnormal rise of OP in Beijing in 2022. Our data shows that a higher OP is observed in winter and spring compared to summer and autumn. The diurnal variation of the OP is characterized by

The mass concentration of atmospheric particulate matter (PM) has been continuously decreasing in the Beijing-Tianjin-Hebei region.

a declining trend from 0:00 to 14:00 and an increasing trend from 14:00 to 23:00. The spatial variation in OP of PM2.5 was observed as the OP in Beijing is lower than that in Shijiazhuang, while it is higher than that in Zhenjiang and Haikou, which is primarily influenced by the distribution of black carbon. Our results are of significance in identifying the key drivers influencing the OP of PM2.5 and provide new insights for advancing air quality improvement efforts with a focus on safeguarding human health in Beijing.

Authors: Jinwen Li, Chenjie Hua, Li Ma, Kaiyun Chen, Feixue Zheng, Qingcai Chen, Xiaolei Bao, Juan Sun, Rongfu Xie, Federico Bianchi, Veli-Matti Kerminen, Tuukka Petäjä, Markku Kulmala, Yongchun Liu

Full Source: Environment international 2024 May 9:187:108724. doi: 10.1016/j.envint.2024.108724.

The impact of ozone treatment on the removal effectiveness of various refractory compounds in wastewater from petroleum refineries

2024-05-10

Large volumes of wastewater are generated during petroleum refining processes. Petroleum refinery wastewater (PRW) can contain highly toxic compounds that can harm the environment. These toxic compounds can be a challenge in biological treatment technologies due to the effects of these compounds on microorganisms. These challenges can be overcome by using ozone (O3) as a standalone or as a pretreatment to the biological treatment. Ozone was used in this study to degrade the organic pollutants in the heavily contaminated PRW from a refinery in Mpumalanga province of South Africa. The objective was achieved by treating the raw PRW using ozone at different ozone treatment times (15, 30, 45, and 60 min) at a fixed ozone concentration of 3.53 mg/dm3. The ozone treatment was carried out in a 2-liter custom-designed plexiglass cylindrical reactor. Ozone was generated from an Eco-Lab-24 corona discharge ozone generator using clean, dry air from the Afrox air cylinder as feed. The chemical oxygen demand, gas chromatograph characterization, and pH analysis were performed on the pretreated and post-treated PRW samples to ascertain the impact of the ozone treatment. The ozone treatment was effective in reducing the benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds in the PRW. The 60-min ozone treatment of different BTEX pollutants in the PRW resulted in the following percentage reduction: benzene 95%, toluene 77%, m + p-xylene 70%, ethylbenzene 69%,

Large volumes of wastewater are generated during petroleum refining processes.

and o-xylene 65%. This study has shown the success of using ozone in reducing the toxic BTEX compounds in a heavily contaminated PRW.

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OCCUPATIONAL

Carbon Monoxide Poisoning: From Occupational Health to Emergency Medicine

2024-04-23

Carbon monoxide poisoning remains a leading cause of accidental poisoning worldwide (both at home and at work), and it is also a cause of suicidal poisoning. Such poisoning can arise following prolonged exposure to low levels of CO or following brief exposure to high concentrations of the gas. In fact, despite exposure limits, high safety standards, and the availability of CO alarms, nearly 50,000 people in the United States visit the emergency department each year due to poisoning. Additionally, CO poisoning in the United States causes up to 500 deaths each year. Despite the widespread nature of this form of poisoning, known about for centuries and whose damage mechanisms have been recognized (or rather hypothesized about) since the 1800s, early recognition, especially of late complications, and treatment remain a medical challenge. A well-designed therapeutic diagnostic process is necessary so that indication for hyperbaric or normobaric therapy is correctly made and so that patients are followed up even after acute exposure to diagnose late complications early. Furthermore, it is necessary to consider that in the setting of emergency medicine, CO poisoning can be part of a differential diagnosis along with other more frequent conditions, making its recognition difficult. The last thirty years have been marked by a significant increase in knowledge regarding the toxicity of CO, as well as its functioning and its importance at physiological concentrations in mammalian systems. This review, taking into account the significant progress made in recent years, aims to reconsider the pathogenicity of CO, which is not trivially just poisonous to tissues. A revision of the paradigm, especially as regards

> Carbon monoxide poisoning remains a leading cause of accidental poisoning worldwide (both at home and at work), and it is also a cause of suicidal poisoning.

treatment and sequelae, appears necessary, and new studies should focus on this new point of view.

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Fetal bisphenol and phthalate exposure and early childhood growth in a New York City birth cohort

2024-05-08

Background: Exposure to endocrine-disrupting chemicals such as bisphenols and phthalates during pregnancy may disrupt fetal developmental programming and influence early-life growth. We hypothesized that prenatal bisphenol and phthalate exposure was associated with alterations in adiposity through 4 years. This associations might change over time.

Methods: Among 1091 mother-child pairs in a New York City birth cohort study, we measured maternal urinary concentrations of bisphenols and phthalates at three time points in pregnancy and child weight, height, and triceps and subscapular skinfold thickness at ages 1, 2, 3, and 4 years. We used linear mixed models to assess associations of prenatal individual and grouped bisphenols and phthalates with overall and time-point-specific adiposity outcomes from birth to 4 years.

Results: We observed associations of higher maternal urinary second trimester total bisphenol and bisphenol A concentrations in pregnancy and overall child weight between birth and 4 years only (Beta 0.10 (95 % confidence interval 0.04, 0.16) and 0.07 (0.02, 0.12) standard deviation score (SDS) change in weight per natural log increase in exposure), We reported an interaction of the exposures with time, and analysis showed associations of higher pregnancy-averaged mono-(2-carboxymethyl) phthalate with higher child weight at 3 years (0.14 (0.06, 0.22)), and of higher high-molecular-weight phthalate, di-2-ethylhexyl phthalate, mono-(2-ethyl-5-carboxypentyl) phthalate, mono-(2-carboxymethyl) phthalate, and mono-(2-ethylhexyl) phthalate with higher child weight at 4 years (0.16 (0.04, 0.28), 0.15 (0.03, 0.27), 0.19 (0.07, 0.31), 0.16 (0.07, 0.24), 0.11 (0.03, 0.19)). Higher pregnancy-averaged high-molecular-weight phthalate, di-2-ethylhexyl phthalate, mono-(2-ethyl-5-carboxypentyl) phthalate, mono-(2-ethyl-5-hydroxyhexyl) phthalate, and mono-2(ethyl-5-oxohexyl) phthalate concentrations were associated with higher child BMI at 4 years (0.20 (0.05, 0.35), 0.20 (0.05, 0.35), 0.22 (0.06, 0.37), 0.20

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(0.05, 0.34), 0.20 (0.05, 0.34)). For skinfold thicknesses, we observed no associations.

Discussion: This study contributes to the evidence suggesting associations of prenatal exposure to bisphenols and high-molecular-weight phthalates on childhood weight and BMI.

Authors: Sophia M Blaauwendraad, Sarvenaz Shahin, Carol Duh-Leong, Mengling Liu, Kurunthachalam Kannan, Linda G Kahn, Vincent W V Jaddoe, Akhgar Ghassabian, Leonardo Trasande

Quality of life in retired workers with past exposure to asbestos

2024-05-11

Background: Asbestos causes cancer and non-cancerous lung and pleural diseases and can also have a negative psychological impact but little is known about its effect on health-related quality of life.

Objectives: The aim of this study is to describe the health-related quality of life (HRQoL) of retired men with a history of occupational exposure to asbestos and examine factors linked with low HRQoL.

Methods: Retired male workers of the French Asbestos-Related Disease Cohort (ARDCO) completed self-questionnaires that included SF-36v2 and HAD scales, questions about their perception of asbestos (perceived dangers and level of exposure, expectations to fall ill, or knowing someone who is) and their respiratory symptoms. Asbestos exposure was assessed by industrial hygienists. A perceived risk score was created using factorial analysis. Multivariable regressions were performed for all SF-36 subscales.

Results: A total of 1266 of 2075 questionnaires (61%) were returned complete and included in analysis. After adjustment for potential confounders, an increase in perceived risk score resulted in a decrease in physical component summary score (PCS), up to 10.7 points (p = 0.048) and in mental component summary score (MCS) (p = 0.044). Presence of respiratory symptoms was also associated with significantly decreased PCS and MCS (p < 0.001). Poor HRQoL was linked to higher perceived risk score with p ≤ 0.01 for all SF-36 dimensions. Asbestos exposure assessed by an expert was not associated with any outcome.

Conclusions: All dimensions of HRQoL appear to be affected by the perceived risk of incurring asbestos-related disease and respiratory symptoms.

Authors: Emmanuelle Siefert, Fleur Delva, Christophe Paris, Jean-Claude Pairon, Isabelle Thaon