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CONTACT US

subscribers@chemwatch.net

tel +61 3 9572 4700

fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

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CHEMICAL EFFECTS

Toxicity of dinonylnaphthalene sulfonates to Pimephales promelas and epibenthic invertebrates

2020-11-01

Dinonylnaphthalene sulfonic acids (NSAs) are high production volume chemicals that are used primarily as additives in a wide range of industrial products (i.e., coatings, sealants, fuels, metal-extractants, paints, rubber materials). This study examined the effect of three NSA congeners on freshwater organisms: barium dinonylnaphthalene sulfonate (BaDNS), calcium dinonylnaphthalene sulfonate (CaDNS), and dinonylnaphthalene disulfonic acid (DNDS). Chronic effects were characterized by exposing fertilized fathead minnow eggs to sediment-associated NSAs and measuring various developmental and growth endpoints for 21 d. No effects in hatch success and larval growth were observed when fathead minnow eggs were exposed to CaDNS and DNDS concentrations up to 246 and 798 µg/g dry weight, respectively, in spiked sediment (~2% organic carbon). However, when NSAs were associated with substrate containing no organic carbon (sand), EC50s for fathead minnow hatch success, larval growth, biomass production, and overall survival were 58.3, 18.8, 15.5, and 13.8 µg/L, respectively, for CaDNS. Acute effect characterization was also conducted in water-only exposures for the three NSA congeners using the freshwater amphipod *Hyaella azteca*, the pulmonate snail *Planorbella pilsbryi*, and larval freshwater mussels *Lampsilis cardium* and *Lampsilis siliquoidea*. The sulfonate salts (BaDNS and CaDNS) were significantly more acutely toxic to all tested invertebrates in the water-only exposures, with LC50s ranging from 0.47 to 12.1 µg/L, compared to DNDS (LC50s ≥ 98.2 µg/L). This is the first study to provide empirical data on the aquatic toxicity of three NSA congeners.

Authors: K J Matten, J L Parrott, A J Bartlett, P L Gillis, D Milani, J Toito, V K Balakrishnan, R S Prosser

Full Source: The Science of the total environment 2020 Nov 1;741:140260. doi: 10.1016/j.scitotenv.2020.140260.

Safety Concerns of Organic Ultraviolet Filters: Special Focus on Endocrine-Disrupting Properties

2020

Acute and chronic effects of ultraviolet radiation (UVR) on human health have long been a concern. It is well known that acute UVR causes

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epidermal hyperplasia, erythema, delayed tanning, pigment darkening, and free-radical formation. Apart from acute effects of UVR, its chronic effects involve immunosuppression, photoaging, exacerbation, photodermatoses, and photocarcinogenesis. To protect skin from harmful effects of UVR, UV filters were developed. But these may cause harmful effects in humans and on the environment; adverse effects of these chemicals have been evaluated for > 20 yr. Studies show that UV filters may lead to endocrine disruption, hepatotoxicity, mutagenicity, and systemic toxicity. Literature on environmental effects of UV filters suggests that they are bioaccumulative, pseudopersistent, and possibly toxic to aquatic ecosystems. The objective of this review is to summarize toxic effects and safety concerns of organic UV filters on human beings and the environment. We focus on UV filters' organic endocrine-disrupting effects by reviewing both in vivo and in vitro studies.

Authors: Didem Oral, Anil Yirun, Pinar Erkekoglu

Full Source: Journal of environmental pathology, toxicology and oncology : official organ of the International Society for Environmental Toxicology and Cancer 2020;39(3):201-212. doi: 10.1615/JEnvironPatholToxicolOncol.2020033188.

Bio-based wood preservatives: Their efficiency, leaching and ecotoxicity compared to a commercial wood preservative

2020-08-26

Companies in the wood industry are constantly developing their outdoor products. The possibility of using bio-based chemicals as an alternative to traditional wood preservatives-regulated in Europe by The Biocidal Products Regulation No 528/2012-has been considered, but chemical leaching from the wood decreases its effectiveness and may negatively affect the environment. This study aims to compare the effectiveness of bio-based chemicals with potential use in wood preservation to commercially available preservatives, to investigate their fixation to wood and their ecotoxicity and to quantify the potentially toxic elements leached from the wood. Pyrolysis distillates of tree bark, organic acids found in distillates, Colatan GT10 tannin extract and log soaking liquid as a hardwood veneer process residue were tested and compared with commercial pine oil and a copper-based wood preservative. In the wood decay test of impregnated pine sapwood specimens, Colatan GT10 extract performed as well as the commercial wood preservatives. The same decay trial with leached specimens significantly reduced the performance of the bio-based chemicals. The results of the ecotoxicity test

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with photoluminescent *Aliivibrio fischeri* bacteria showed that many bio-based chemicals with potential use in wood preservation have markedly lower ecotoxicity than commercially available wood preservatives, but the ecotoxicity of some bio-based chemicals is higher, as in the case of some of the pyrolysis distillates. The wood preservation efficiency and the ecotoxicity of the studied chemicals had a poor correlation, implying that other factors besides treatment agent toxicity play a role in deterring fungal growth on treated wood. The amount of elemental toxins in the leachates was low. These results emphasize the importance of the chemical ecotoxicity of bio-based preservative compounds, as their detrimental effect on the environment can be higher than that of the traditional preservatives unless effectively linked to wood to prevent leaching.

Authors: Aitor Barbero-López, Jarkko Akkanen, Reijo Lappalainen, Sirpa Peräniemi, Antti Haapala

Full Source: The Science of the total environment 2020 Aug 26;753:142013. doi: 10.1016/j.scitotenv.2020.142013.

ENVIRONMENTAL RESEARCH

Inflammatory effects of particulate matter air pollution

2020-09-01

Air pollution is an important cause of non-communicable diseases globally with particulate matter (PM) as one of the main air pollutants. PM is composed of microscopic particles that contain a mixture of chemicals and biological elements that can be harmful to human health. The aerodynamic diameter of PM facilitates their deposition when inhaled. For instance, coarse PM having a diameter of $< 10 \mu\text{m}$ is deposited mainly in the large conducting airways, but PM of $< 2.5 \mu\text{m}$ can cross the alveolar-capillary barrier, traveling to other organs within the body. Epidemiological studies have shown the association between PM exposure and risk of disease, namely those of the respiratory system such as lung cancer, asthma, and chronic obstructive pulmonary disease (COPD). However, cardiovascular and neurological diseases have also been reported, including hypertension, atherosclerosis, acute myocardial infarction, stroke, loss of cognitive function, anxiety, and Parkinson's and Alzheimer's diseases. Inflammation is a common hallmark in the pathogenesis of many of these diseases associated with exposure to a variety of air pollutants,

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including PM. This review focuses on the main effects of PM on human health, with an emphasis on the role of inflammation.

Authors: Rubén D Arias-Pérez, Natalia A Taborda, Diana M Gómez, Jhon Fredy Narvaez, Jazmín Porras, Juan C Hernandez

Full Source: Environmental science and pollution research international 2020 Sep 1. doi: 10.1007/s11356-020-10574-w.

Assessment of ecological hazards and environmental fate of disinfectant quaternary ammonium compounds

2020-09-02

Disinfectant quaternary ammonium compounds (Quats) have diverse uses in a variety of consumer and commercial products, particularly cleaning products. With the emergence of the COVID-19 pandemic, they have become a primary tool to inactivate the SARS-CoV-2 virus on surfaces. Disinfectant Quats have very low vapor pressure, and following the use phase of the products in which they are found, disposal is typically "down-the-drain" to wastewater treatment systems. Consequently, the potential for the greatest environmental effect is to the aquatic environment, from treated effluent, and potentially to soils, which might be amended with wastewater biosolids. Among the earliest used and still common disinfectant Quats are the alkyl dimethyl benzyl ammonium chloride (ADBAC) compounds and the dialkyl dimethyl ammonium chloride (DDAC) compounds. They are cationic surfactants often found in consumer and commercial surface cleaners. Because of their biocidal properties, disinfectant Quats are heavily regulated for human and environmental safety around the world. Consequently, there is a robust database of information regarding the ecological hazards and environmental fate of ADBAC and DDAC; however, some of the data presented are from unpublished studies that have been submitted to and reviewed by regulatory agencies (i.e., EPA and European Chemicals Agency) to support antimicrobial product registration. We summarize the available environmental fate data and the acute and chronic aquatic ecotoxicity data for freshwater species, including algae, invertebrates, fish, and plants using peer-reviewed literature and unpublished data submitted to and summarized by regulatory agencies. The lower limit of the range of the ecotoxicity data for disinfectant Quats tends to be lower than that for other surface active agents, such as nonionic or anionic surfactants. However, ecotoxicity is mitigated by environmental fate characteristics, the data for which we also summarize, including high biodegradability and a strong tendency to sorb to wastewater biosolids, sediment, and soil. As a result, disinfectant Quats are largely removed during wastewater treatment, and

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those residues discharged in treated effluent are likely to rapidly bind to suspended solids or sediments, thus mitigating their toxicity.

Authors: Paul C DeLeo, Carolyn Huynh, Mala Pattanayek, Katherine Clark Schmid, Nathan Pechacek

Full Source: Ecotoxicology and environmental safety 2020 Sep 2;206:111116. doi: 10.1016/j.ecoenv.2020.111116.

OCCUPATIONAL

Years of life lost from ischaemic and haemorrhagic stroke related to ambient nitrogen dioxide exposure: A multicity study in China

2020-10-15

Few multicity studies have been conducted in developing countries to distinguish the acute effects of ambient nitrogen dioxide (NO₂) on the years of life lost (YLL) from different subtypes of stroke. We aimed to differentiate the associations between NO₂ exposure and YLL from major pathological types of stroke in China, and estimate the relevant economic loss. A time-series study was conducted to explore the associations between short-term NO₂ exposure and YLL from ischaemic and haemorrhagic stroke from 2013 to 2017 in 48 Chinese cities. Daily NO₂ data and stroke mortality counts for each city were obtained from the National Urban Air Quality Real-time Publishing Platform and Chinese Center for Disease Control and Prevention, respectively. Generalized additive models were applied to estimate the cumulative effects of NO₂ in each city, and meta-analysis was used to combine the city-specific estimates. The relevant economic loss was estimated using the method of the value per statistical life year (VSLY). A 10 µg/m³ increase in ambient NO₂ concentration on the present day and previous day (lag 0-1) would lead to relatively higher increments in percentage change of YLL from ischaemic stroke (0.82%, 95% CI: 0.46%, 1.19%) than haemorrhagic stroke (0.46%, 95% CI: 0.09%, 0.84%). The association was significantly stronger in the low-education population than high-education population for ischaemic stroke. Furthermore, significantly higher association was found in South China than those in North China for both subtypes of stroke. Economic loss due to excess YLL from ischaemic stroke related to NO₂ exposure was higher than that for haemorrhagic stroke. Our study indicated higher association and economic loss of ischaemic than haemorrhagic stroke related to NO₂ exposure in China, which informed

Few multicity studies have been conducted in developing countries to distinguish the acute effects of ambient nitrogen dioxide (NO₂) on the years of life lost (YLL) from different subtypes of stroke.

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priorities for type-specific stroke prevention strategies related to NO₂ pollution and vulnerable population protection.

Authors: Jie Li, Jing Huang, Yuxin Wang, Peng Yin, Lijun Wang, Yang Liu, Xiaochuan Pan, Maigeng Zhou, Guoxing Li

Full Source: Ecotoxicology and environmental safety 2020 Oct 15;203:111018. doi: 10.1016/j.ecoenv.2020.111018.

Early genotoxic damage through micronucleus test in exfoliated buccal cells and occupational dust exposure in construction workers: a cross-sectional study in L'Aquila, Italy

2020-10-15

Aim: The city of L'Aquila (central Italy) was hit by a strong earthquake in 2009 that caused the collapse of several buildings, deaths and injured people. In the following years, a great number of building sites were activated, building workers resulted intensely exposed and represent a relevant target for research on environmental mutagenesis and epidemiological surveillance. Cells of buccal mucosa are considered an appropriate site for early detecting of cytogenetic damage, since it represents the first barrier in inhalation or ingestion and can metabolize carcinogenic agents into reactive chemicals. Our study is aimed 1) at comparing the early genotoxic damage as measured by the buccal mucosa micronucleus test in two subgroups of workers defined by different occupational exposure and 2) at evaluating possible confounding variables such as lifestyle factors.

Methods and results: A cross-sectional study was conducted in L'Aquila, on 24 outdoor workers (OWs) highly exposed on the construction sites and 26 indoor workers (IW), all subjected to the compulsory occupational surveillance system, in the period 2017-2018. Buccal cells samples were collected and, based on the Micronucleus test, the exfoliated cells were classified in respect of nuclear changes observed. Moreover, a self-report questionnaire composed of 84 items, was administered to the workers. **Results:** Significant differences were observed between Exp+ (OWs) and Exp- (IW) in the number of the analyzed cells (expressed as mean value out of 1000 cells): respectively 954.46 vs 990.06 normal cells, (p < 0.001); 19.79 vs 4.95 micronucleated cells, as marker of chromosomal damage (p < 0.001); 13.93 vs 8.96 binucleated cells, as marker of failed cytokinesis (p < 0.001); 2.09 vs 1.18 karyolytic cells, as marker of cell death and damaged DNA (p < 0.05). According with a multivariate regression analysis, in addition to the job exposure (OW vs IW, beta = 12.221, p < 0.001), the only variable independently

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associated with an increase in Micronuclei (MNs) is the smoking habit (OWs vs IWs, beta = 6.683, $p < 0.001$) which, even if not associated with dust exposure, worsens cell integrity. Moreover, this worsening effect is weaker in workers not exposed to the site dust (moderation effect). Within social demographic factors, the high educational level only apparently seems to affect MNs number: even if unbalanced in favor of IWs vs OWs, this variable resulted a confounder, since its effect disappears when the interaction between these two factors is considered, because it is a covariate of smoking habit as well as of the job condition. Conclusion: Despite some limitation, our findings clearly confirm the role of occupational exposure as a marker of cytogenetic damage associated with MNs number in construction workers. Moreover, smoking status appears as the only other investigated factor independently associated to the outcome. The statistical model, in addition, highlights possible moderation and confounding effects, such as interaction between smoking and occupational exposure and the unbalanced school education level in workers. Micronucleus test in exfoliated buccal cells would be considered a suitable method for studying the early genotoxic damage in the construction occupational setting as well as in evaluating the efficacy of preventive practices.

Authors: Sara Leonardi, Anna Mg Poma, Sabrina Colafarina, Francesco D'Aloisio, Maria Scatigna, Osvaldo Zarivi, Riccardo Mastrantonio, Loreta Tobia, Leila Fabiani

Full Source: Ecotoxicology and environmental safety 2020 Oct 15;203:110989. doi: 10.1016/j.ecoenv.2020.110989.

PHARMACEUTICAL/TOXICOLOGY

Effect of Asian dust on respiratory symptoms among children with and without asthma, and their sensitivity

2020-08-18

There has been little study on the effect of Asian dust exposure on respiratory symptoms among children who are vulnerable to environmental factors. In this panel study, we investigated the effect of Asian dust on respiratory symptoms among children with and without asthma, and their sensitivity. Children attending two elementary schools (137 total), and 23 children with asthma from cooperating medical institutions in Fukuoka prefecture were recruited. Subjects measured peak expiratory flow rate (PEF), and recorded asthma-like symptoms, cough, nasal symptoms and use of medication in a diary from April 1, 2013 to June 30, 2013. To assess exposure to Asian dust, we used Light

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Detection and Ranging (LIDAR) data. For the analysis of the association between Asian dust and respiratory symptoms, the case-crossover design and generalized estimating equation (GEE) models were used. Taking individual sensitivity to respiratory aggravation into consideration, the subjects were classified into three groups: children without asthma, children with asthma who do not use long-term preventive medication (CA) and children with asthma who use long-term preventive medication (CA-LTM). For CA, Asian dust exposure was significantly associated with asthma-like symptoms, with a hazard ratio of 5.17 [95%CI: 1.02=26.12] at Lag0, and the change in %maxPEF, -1.65% [95%CI:-2.82, -0.48] at Lag0. For children without asthma, a statistically significant association was found between Asian dust exposure and the change in %maxPEF, -0.56% [95%CI: -1.31, -0.08] at Lag1. However, no adverse effects were observed in CA-LTM. Temperature had significant effects on %maxPEF for three groups. Asian dust, photochemical oxidant and pollen caused simultaneously additive adverse effects on nasal symptoms for children without asthma. This study suggests the possibility that long-term preventive medication to manage asthma may suppress aggravation of respiratory symptoms due to Asian dust and may be an effective prevention.

Authors: Hideki Hasunuma, Ayano Takeuchi, Rintaro Ono, Yuko Amimoto, Yoon Ha Hwang, Itsushi Uno, Atsushi Shimizu, Yuji Nishiwaki, Masahiro Hashizume, David J Askew, Hiroshi Odajima

Full Source: The Science of the total environment 2020 Aug 18;753:141585. doi: 10.1016/j.scitotenv.2020.141585.

Biodistribution and pulmonary metabolic effects of silver nanoparticles in mice following acute intratracheal instillations

2020-09-03

The respiratory tract is the route of entry for accidentally inhaled AgNPs, which can reach the lungs and redistribute to other main organs through systemic circulation. In the present work, we aimed to evaluate silver biodistribution and biological effects after 1 or 2 intratracheal instillations (IT) of two differently sized PVP-coated AgNPs (5 and 50 nm-3 mg/kg) and ionic silver (AgNO₃-1 mg/kg bw) in mice. Furthermore, nuclear magnetic resonance (NMR) metabolomics was applied to unveil pulmonary metabolic variations. Animals exposed to 5 nm AgNP (AgNP5) showed higher levels of ionic silver in organs, especially in the lung, spleen, kidney and liver, while animals exposed to 50 nm AgNP (AgNP50) showed higher levels of silver in the blood. Animals exposed to AgNP50 excreted higher

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amounts of silver than those exposed to AgNP5, which is consistent with higher tissue accumulation of silver in animals exposed to the latter. Lung metabolic profiling revealed several Ag-induced alterations in metabolites involved in different pathways, such as glycolysis and tricarboxylic acid (TCA) cycle, amino acid and phospholipid metabolism, and antioxidant defense. Notably, most of the metabolic changes observed after 1 IT were absent in animals subjected to 2 IT of AgNO₃, or reversed for AgNPs, suggesting adaptation mechanisms to cope with the initial insult and recover homeostasis. Graphical abstract.

Authors: Fernanda Rosário, Iola F Duarte, Ricardo J B Pinto, Conceição Santos, Peter H M Hoet, Helena Oliveira

Full Source: Environmental science and pollution research international 2020 Sep 3. doi: 10.1007/s11356-020-10563-z.

Safety and immunogenicity of an investigational maternal trivalent group B streptococcus vaccine in pregnant women and their infants: Results from a randomized placebo-controlled phase II trial

2020-08-31

Background: This study evaluated the safety and immunogenicity of an investigational trivalent group B streptococcus (GBS) vaccine in US pregnant women, transplacental serotype-specific antibody transfer and persistence in infants, and serotype-specific antibodies in breast milk. Methods: This randomized, observer-blind, placebo-controlled trial administered one dose of trivalent GBS vaccine (n = 49) or placebo (n = 26) to healthy pregnant 18-40-year-old women at 240/7-346/7 weeks' gestation. Women were enrolled from March 2014 to August 2015. Safety follow-up continued through postpartum day 180. Primary immunogenicity objectives were to evaluate serotype Ia/Ib/III-specific immunoglobulin G (IgG) levels in sera from women on day 1 (pre-vaccination), day 31, delivery and postpartum days 42 and 90, and from infants at birth (cord blood), days 42 and 90. Antibody transfer ratios (cord blood/maternal sera at delivery) and serotype-specific secretory immunoglobulin A (sIgA) and IgG in breast milk after delivery and on postpartum days 42 and 90 were evaluated. The planned sample size was not based on statistical assumptions for this descriptive study. Results: Baseline characteristics were similar between groups. Serious adverse events were reported for 16% of GBS-vaccinated women and 15% of their infants, and 15% of placebo recipients and 12% of their infants; none were fatal or deemed vaccine-related. Serotype-specific IgG geometric mean concentrations (GMCs) were 13-23-fold higher in vaccine

Background: This study evaluated the safety and immunogenicity of an investigational trivalent group B streptococcus (GBS) vaccine in US pregnant women, transplacental serotype-specific antibody transfer and persistence in infants, and serotype-specific antibodies in breast milk.

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vs placebo recipients on day 31 and persisted until postpartum day 90. Median antibody concentrations were substantially higher in women with detectable pre-vaccination antibody concentrations. Antibody transfer ratios in the vaccine group were 0.62-0.82. Infant IgG GMCs and breast milk sIgA GMCs were higher in the vaccine vs the placebo group at all timepoints.

Conclusions: Maternal immunization with the trivalent GBS vaccine in US women had a favorable safety profile, elicited antibodies that were transplacentally transferred and persisted in infants for a minimum of 3 months.

Clinical trial registration: [Clinicaltrials.gov, NCT02046148](https://clinicaltrials.gov/ct2/show/study/NCT02046148).

Authors: Geeta K Swamy, Torri D Metz, Kathryn M Edwards, David E Soper, Richard H Beigi, James D Campbell, Luca Grassano, Giada Buffi, Annette Dreisbach, Immaculada Margarit, Annette Karsten, Ouzama Henry, Maria Lattanzi, Zourab Bebia

Full Source: Vaccine 2020 Aug 31;S0264-410X(20)31108-7. doi: 10.1016/j.vaccine.2020.08.056.