

Contents

CHEMWATCH

(click on page numbers for links)

ENVIRONMENTAL RESEARCH

Fate and toxicity of spilled chemicals in groundwater and soil environment I: strong acids.....	3
Monsanto, PCBs, and the creation of a "world-wide ecological problem"	3
Improving small-scale wastewater treatment plant performance by using a filtering tertiary treatment unit	4
A fugacity model assessment of ibuprofen, diclofenac, carbamazepine, and their transformation product concentrations in an aquatic environment.....	5
Perfluorooctanoic acid (PFOA) and perfluooctane sulfonate (PFOS) induce different modes of action in reproduction to Japanese medaka (<i>Oryzias latipes</i>).....	6

MEDICAL RESEARCH

UK clinical experience up to 52 weeks with linaclotide for irritable bowel syndrome with constipation.....	6
Toxic effects of subacute inhalation exposure to trichloroethylene on serum lipid profile, glucose and biochemical parameters in Sprague-Dawley rats.....	7
Short-term impact of PM2.5 on contemporaneous asthma medication use: Behaviour and the value of pollution reductions.....	8
Comparative analysis of US real-world dosing patterns and direct infusion-related costs for matched cohorts of rheumatoid arthritis patients treated with infliximab or intravenous golimumab	9
A randomised controlled trial of a mitochondrial therapeutic target for bipolar depression: mitochondrial agents, N-acetylcysteine, and placebo	10

OCCUPATIONAL HEALTH RESEARCH

Association of occupational exposures with cardiovascular disease among US Hispanics/Latinos	11
Occupational manganese exposure, reproductive hormones, and semen quality in male workers: A cross-sectional study	12
Monitoring early cell damage in physicians who are occupationally exposed to inhalational anaesthetics	12
Blue-yellow dyschromatopsia in toluene-exposed workers	13

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

Contents

CHEMWATCH

Urinary hydroxypyrene determination for biomonitoring of firefighters deployed at the Fort McMurray wildfire: an inter-laboratory method comparison.....14

PUBLIC HEALTH RESEARCH

Overview of known plastic packaging-associated chemicals and their hazards.....15

Different exposure profile of heavy metal and health risk between residents near a Pb-Zn mine and a Mn mine in Huayuan county, South China16

Emerging contaminants of high concern and their enzyme-assisted biodegradation - A review.....17

Occurrence of legacy and alternative plasticisers in indoor dust from various EU countries and implications for human exposure via dust ingestion and dermal absorption.....18

Understanding skin absorption of common aldehyde vapours from exposure during hazardous material incidents.....19

Technical

CHEMWATCH

ENVIRONMENTAL RESEARCH

Fate and toxicity of spilled chemicals in groundwater and soil environment I: strong acids

2019-07-22

This study reviewed the chemical/physical properties, toxicity, environmental fate, and ecotoxicity of strong acids in soil and groundwater environments. It was recommended that sulfuric acid and hydrofluoric acid be classified as chemicals of priority control based on volumes used, toxicity, carcinogenicity, and past significant spill events. Understanding the behaviour and transport of spilled strong acids in soil and groundwater environments requires a multi-disciplinary approach, as they can undergo a variety of geochemical and biochemical reactions with complex geomedia. The toxicity of spilled acid is dependent on the characteristics of the geomedia exposed to the acid and the amount of residual protons following acid-substrate interaction. Soil texture, cation exchange capacity, mineral composition, bedrock type, and aluminium content may be important factors affecting the toxicity of spilled acid in soil-groundwater environments. The authors expect that the results of this study will contribute preliminary data for future research on chemical spills.

Authors: Shin D, Kim Y, Moon HS.

Full Source: Environmental Health & Toxicology. 2018 Dec;33(4): e2018019. doi: 10.5620/eht.e2018019. Epub 2018 Dec 13.

Monsanto, PCBs, and the creation of a “world-wide ecological problem”

2019-07-22

For the past three decades, we have written on the history of occupational and environmental health, authoring books and articles on lead poisoning, silicosis, asbestosis, and angiosarcoma of the liver, among other diseases. One book, Deceit and Denial, focused specifically on the chemical and lead industries. Because of the rarity of historians who study this history, we have been asked to testify on behalf of workers who allege harm from these industrial materials and by state, county, and local governments who seek redress for environmental damages and funds to prevent future harm to children. In about 2010, we began testifying in law suits brought by individuals who claimed that they had suffered from cancers, specifically non-Hodgkin's lymphoma, because of polychlorinated biphenyls (PCBs) in their bodies. At that time, we wrote a Report to the

This study reviewed the chemical/physical properties, toxicity, environmental fate, and ecotoxicity of strong acids in soil and groundwater environments.

Court about industry knowledge of the dangers of PCBs to workers and the environment. More recently, we have been approached by attorneys representing government agencies on the West Coast of the United States which are seeking funds to abate PCB pollution in their ports, bays, and waterways. The focus of these lawsuits is the Monsanto Corporation, the sole producer of PCBs in the United States from the 1930s through 1977. Through these law suits, an enormous trove of previously private Monsanto reports, papers, memos, letters, and studies have been made available to us and this paper is the result of our examination of these hundreds of thousands of pages. The documents from this collection (with the exception of privileged materials that Monsanto has not made public, and upon which we have not relied) are available on www.ToxicDocs.org, the website we have developed with Professor Merlin Chowkwanyun of Columbia's Mailman School of Public Health. (Almost all of the references that are from this collection can be accessed by readers by clicking on the reference hyperlink.) This monograph is adapted from a report to the court that was originally produced for litigation on behalf of plaintiffs in PCB lawsuits. We are grateful to the Journal of Public Health Policy for publishing this detailed examination of these documents and we hope it will stimulate further research into this important, and now public, archive of industry records.

Authors: Markowitz G, Rosner D.

Full Source: Journal of Public Health Policy. 2018 Nov; 39(4):463-540. doi: 10.1057/s41271-018-0146-8.

Improving small-scale wastewater treatment plant performance by using a filtering tertiary treatment unit

2019-07-22

The demand for wastewater treatment plants purposed for a single household or groups of households continues to increase as the quality requirements for wastewater treatment become increasingly rigorous. Researchers are constantly searching for new methods to remove phosphorus compounds from wastewater that do not require the use of chemicals. This study describes a newly designed tertiary wastewater treatment unit that increases the effectiveness of the main small-scale (up to 1 m³/d) biological wastewater treatment unit. The tertiary treatment unit is filled with the sorbent material Filtralite P, after the main treatment wastewater flows through the filler without the use of electric power. A compact system consisting of a main (secondary) treatment unit and the newly designed tertiary wastewater treatment unit was tested in accordance with the harmonised European Standard EN 12566-3. During

This study describes a newly designed tertiary wastewater treatment unit that increases the effectiveness of the main small-scale (up to 1 m³/d) biological wastewater treatment unit.

the testing period, no surplus sludge was discharged from the system, no reagents were dosed into it, the system only consumed 119 kW of electric power, and the treated wastewater contained <1 mg/L of phosphorus. The total wastewater treatment efficiency can be explained as follows: COD - 95.2%, BOD5 - 99.2%, SS - 99.4%, NH4-N - 99.6%, Nt - 82.2%, and Pt- 91.8%. The system is efficient, the operational cost is relatively low, it does not use chemical reagents, and it is environment friendly.

Author: Mažeikienė A.

Full Source: Journal of Environmental Management. 2018 Nov 26; 232:336-341. doi: 10.1016/j.jenvman.2018.11.076. [Epub ahead of print]

A fugacity model assessment of ibuprofen, diclofenac, carbamazepine, and their transformation product concentrations in an aquatic environment

2019-07-22

An updated version of FATEMOD, a multimedia fugacity model for environmental fate of organic chemicals, was set up to assess environmental behaviour of three pharmaceuticals in northern Lake Päijänne, Finland. Concentrations of ibuprofen, diclofenac, and carbamazepine were estimated at various depths at two sites: near a wastewater treatment plant and 3.5 km downstream the plant. When compared with environmental sampling data from corresponding depths and sites, the predicted concentrations, ranging from nanograms to hundreds of nanograms per litre, were found to be in good agreement. Weather data were utilised with the model to rationalise the effects of various environmental parameters on the sampling results, and, e.g. the roles of various properties of lake dynamics and photodegradation were identified. The new model also enables simultaneous assessment of transformation products. Environmentally formed transformation product concentrations were estimated to be at highest an order of magnitude lower than those of the parent compounds, and unlikely to reach a detectable level. However, a possibility that conjugates of ibuprofen are present at higher levels than the parent compound was identified. Simulation results suggest that environmental degradation half-lives of the inspected contaminants under stratified lake conditions are in the range of some weeks to months.

Authors: Nurmi TMA, Kiljunen TK, Knuutinen JS.

Full Source: Environmental Science & Pollution Research International. 2018 Nov 5. doi: 10.1007/s11356-018-3485-x. [Epub ahead of print]

An updated version of FATEMOD, a multimedia fugacity model for environmental fate of organic chemicals, was set up to assess environmental behaviour of three pharmaceuticals in northern Lake Päijänne, Finland.

Technical

CHEMWATCH

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) induce different modes of action in reproduction to Japanese medaka (*Oryzias latipes*)

2019-07-22

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) have widely and frequently used in many industrial sectors, and thus have been frequently found in the environment. These chemicals may act as endocrine disrupting chemicals (EDCs), although the molecular mechanisms are still debated. In this study, Japanese medaka (*Oryzias latipes*) were exposed to 10 mg/l PFOA and 1 mg/l PFOS for 21 days, and the reproductive responses, such as the fecundity, secondary sexual characteristics and transcriptional levels of vitellogenin (vtg1 and vtg2) and choriogenin (chgh, chghm and chgl), were time-dependently evaluated (day 7, 14 and 21). PFOA and PFOS significantly reduced fecundity, and caused expression changes in the genes with time, although the patterns were different for each chemical and each sex. Different transcriptional regulations of vitellogenin and choriogenin in male suggest that PFOA and PFOS have different mode of actions in reproductive effects despite their similar chemical structure.

Authors: Kang JS, Ahn TG, Park JW.

Full Source: Journal of Hazardous Materials. 2019 Jan 14; 368:97-103. doi: 10.1016/j.jhazmat.2019.01.034. [Epub ahead of print]

In this study, Japanese medaka (*Oryzias latipes*) were exposed to PFOA and PFOS and the reproductive responses were evaluated.

MEDICAL RESEARCH

UK clinical experience up to 52 weeks with linaclotide for irritable bowel syndrome with constipation

2019-07-22

Linaclotide, a guanylate cyclase C agonist, has been shown in clinical trials to improve symptoms of irritable bowel syndrome with constipation (IBS-C). In this study, data from a real-world study of linaclotide in the UK are reported. This 1-year, multicentre, prospective, observational study in the UK enrolled patients aged 18 years and over initiating linaclotide for IBS-C. The primary assessment was change from baseline in IBS Symptom Severity Scale (IBS-SSS) score at 12 weeks, assessed in patients with paired baseline and 12-week data. Change from baseline in IBS-SSS score at 52 weeks was a secondary assessment. Adverse events were recorded. In total, 202 patients were enrolled: 185 (91.6%) were female, median age was 44.9 years (range 18.1-77.2) and 84 (41.6%) reported baseline laxative use. Mean (standard deviation) baseline IBS-SSS score was 339

(92), with most patients (n = 129; 66.8%) classified as having severe disease (score = 300). In patients with paired data, there was a significant mean (95% confidence interval) decrease in IBS-SSS score from baseline to 12 weeks [-77.0 (-96.3, -57.7); p < 0.001; n = 124] and baseline to 52 weeks [-70.7 (-95.0, -46.5); p < 0.001; n = 76]. Overall, 174 adverse events were reported in 77 (38.1%) patients, most commonly diarrhoea (n = 54; 26.7%), abdominal pain (n = 21; 10.4%) and abdominal distension (n = 13; 6.4%). The authors concluded that Linaclotide significantly improved IBS-SSS score at 12 and 52 weeks. These results provide insights into outcomes with linaclotide treatment over 1 year in patients with IBS-C in real-world clinical practice.

Authors: Yiannakou Y, Agrawal A, Allen PB, Arebi N, Brown SR, Eugenicos MP, Farmer AD, McLain-Smith S, McLaughlin J, Sanders DS, Lawrance D, Emmanuel A.

Full Source: Therapeutic advances in gastroenterology. 2018 Oct 3; 11:1756284818798791. doi: 10.1177/1756284818798791. eCollection 2018.

Toxic effects of subacute inhalation exposure to trichloroethylene on serum lipid profile, glucose and biochemical parameters in Sprague-Dawley rats

2019-07-22

The current study evaluated the inhalation toxicity of trichloroethylene (TCE) at 0, 10, 100, 250 and 400 ppm in Sprague-Dawley rats for 10-day period, because the subacute inhalation toxicity of TCE on serum lipid profile, glucose and some biochemical parameters has not been previously reported. TCE vapours were generated using the dynamic generation system based on evaporation method in the exposure chamber. On the basis of the results, mean serum low-density lipoprotein (LDL) and albumin (ALB) decreased significantly in all the groups exposed to TCE compared with the control group (p < .005), but there was a significant increase for parameters: fasting blood glucose (FBG) and alkaline phosphatase (ALP) (p < .005). Rats exposed to 400 ppm TCE showed a significant decrease in serum cholesterol (CHOL) and protein (Pr) compared with the control group (p < .005). A negative relationship was found between triglycerides (TG), very low-density lipoprotein (VLDL), CHOL, LDL, Pr, ALB and urea levels and the subacute exposure to concentrations of TCE (R² = -0.26, p < .05), but there was a direct correlation for parameters FBG, ALP and alanine aminotransferase (ALT) (R² = 0.42, p < .05). In conclusion, studies with Sprague-Dawley rats demonstrated that subacute inhalation exposure to TCE (≥ 100 PPM) is associated with

The current study evaluated the inhalation toxicity of trichloroethylene (TCE) at 0, 10, 100, 250 and 400 ppm in Sprague-Dawley rats for 10-day period, because the subacute inhalation toxicity of TCE on serum lipid profile, glucose and some biochemical parameters has not been previously reported.

biochemical and lipotoxicity in the form of decreased serum ALB and LDL and raised ALP and glucose levels. The present study also provides additional evidence relating to decreased serum CHOL and Pr after subacute inhalation exposure to 400 ppm TCE.

Authors: Zamanian Z, Yousefinejad S, Khoshnoud MJ, Golbabaie F, Farhang Dehghan S, Modaresi A, Amanat S, Reza Zare M, Rahmani A.

Full Source: Inhalation Toxicology. 2018 Nov 27:1-7. doi: 10.1080/08958378.2018.1526233. [Epub ahead of print]

Short-term impact of PM_{2.5} on contemporaneous asthma medication use: Behaviour and the value of pollution reductions

2019-07-22

Asthma ranks among the most-costly of chronic diseases, accounting for over \$50 billion annually in direct medical expenditures in the United States. At the same time, evidence has accumulated that fine particulate matter pollution can exacerbate asthma symptoms and generate substantial economic costs. To measure these costs, the authors use a unique nationwide panel dataset tracking asthmatic individuals' use of rescue medication and their exposure to PM_{2.5} (particulate matter with an aerodynamic diameter of <2.5 µm) concentration between 2012 and 2017, to estimate the causal relationship between pollution and inhaler use. The sample consists of individuals using an asthma digital health platform, which relies on a wireless sensor to track the place and time of inhaler use events, as well as regular non-event location and time indicators. These data provide an accurate measurement of inhaler use and allow spatially and temporally resolute assignment of pollution exposure. Using a high-frequency research design and individual fixed effects, the authors find that a 1 µg/m³ (12%) increase in weekly exposure to PM_{2.5} increases weekly inhaler use by 0.82%. It was also shown that there is seasonal, regional, and income-based heterogeneity in this response. Using the response prediction, and an estimate from the literature on the willingness to pay to avoid asthma symptoms, it was shown that a nationwide 1 µg/m³ reduction in particulate matter concentration would generate nearly \$350 million annually in economic benefits.

Authors: Williams AM, Phaneuf DJ, Barrett MA, Su JG.

Full Source: Proceedings of the National Academy of Sciences of the United States of America. 2018 Nov 26. pii: 201805647. doi: 10.1073/pnas.1805647115. [Epub ahead of print]

Technical

CHEMWATCH

Comparative analysis of US real-world dosing patterns and direct infusion-related costs for matched cohorts of rheumatoid arthritis patients treated with infliximab or intravenous golimumab

2019-07-22

The objectives of this study were to evaluate and compare treatment patterns and infusion-related health care resource expenditures for rheumatoid arthritis (RA) patients initiating golimumab for intravenous use (GLM-IV) and infliximab (IFX) therapy and to assess cost implications from the commercial perspective. Adult RA patients with a new episode of GLM-IV or IFX treatment between 1 January 2014 and 31 March 2016 were identified from MarketScan databases and evaluated for maintenance infusion intervals and related costs of treatment. IFX and GLM-IV patients were matched 1:1 on index medication treatment duration, gender, payer type, prior biologic use, and post-index methotrexate use. Paid amounts for drugs and associated administration costs were applied to treatment group dosing patterns. Final matched treatment groups included 547 GLM-IV and 547 IFX patients (mean age = 55-56 years). Mean (SD) follow-up was 609 (161) days for GLM-IV and 613 (163) days for IFX. Treatment duration was 396 (240) days for GLM-IV and 397 (239) days for IFX. Overall, 80% of GLM-IV and 39% of IFX maintenance infusions were given approximately every 8 weeks; and 6% of GLM-IV and 53% of IFX maintenance infusions occurred more frequently than every 8 weeks ($P < 0.001$). When weighting of the maintenance infusion interval was applied, the mean number of induction plus maintenance infusions during the first year of treatment was estimated at 7.03 for GLM-IV and 9.48 for IFX. From the commercial perspective, drug plus administration costs per infusion were \$5,846 for GLM-IV and \$5,444 for IFX with total annual cost of therapy for GLM-IV patients costing \$10,507 less than that for IFX patients in the first year and \$6,774 less than that for IFX patients in subsequent years. Annual GLM-IV drug plus administration costs for commercial health plans were significantly less than IFX in RA patients due to differences in real-world dosing and administration.

Authors: Ellis LA, Malangone-Monaco E, Varker H, Stetsovsky D, Kubacki M, DeHoratius RJ, Kafka S.

Full Source: ClinicoEconomics and Outcomes Research. 2019 Jan 15; 11:99-110. doi: 10.2147/CEOR.S185547. eCollection 2019.

The objectives of this study were to evaluate and compare treatment patterns and infusion-related health care resource expenditures for rheumatoid arthritis (RA) patients initiating golimumab for intravenous use (GLM-IV) and infliximab (IFX) therapy and to assess cost implications from the commercial perspective.

Technical

CHEMWATCH

A randomised controlled trial of a mitochondrial therapeutic target for bipolar depression: mitochondrial agents, N-acetylcysteine, and placebo

2019-07-22

A phasic dysregulation of mitochondrial bioenergetics may operate in bipolar disorder, increased in mania and decreased in depression. In this study, the authors aimed to examine efficacy of two add-on treatments in bipolar depression: N-acetylcysteine (NAC) and NAC with a combination of nutraceutical agents that may increase mitochondrial biogenesis. A three-arm 16-week, double-blind, randomised, placebo-controlled trial, adjunctive to usual treatment, was conducted. Participants (n = 181) with bipolar disorder and current depressive symptoms were randomised to 2000 mg/day NAC (n = 59), 2000 mg/day NAC with the combination nutraceutical treatment (CT, n = 61), or placebo (n = 61). The primary outcome was change in Montgomery-Åsberg Depression Rating Scale (MADRS) total score from baseline to week 16. Young Mania Rating Scale, Clinical Global Impression (CGI)-Improvement and CGI-Severity scales, Patient Global Impression scale, Social and Occupational Functioning Assessment Scale (SOFAS), Longitudinal Interval Follow-Up Evaluation - Range of Impaired Functioning Tool (LIFE-RIFT), and Quality of Life Enjoyment, and Satisfaction Questionnaire Short Form (Q-LES-Q-SF) were secondary outcomes. One hundred forty-eight participants had post-randomisation data and were analysed (NAC = 52, CT = 47, Placebo = 49). No between-group differences were found for the rate of change between baseline and 16 weeks on any of the clinical and functioning variables. Improvements in MADRS, BDRS, SOFAS, and LIFE-RIFT scores from baseline to the week 20 post-discontinuation visit were significantly greater in the CT group compared to those in the placebo. At week 20, the CGI-I was significantly lower in the CT group versus placebo. Gastrointestinal symptoms were significantly greater in the NAC than in the placebo group. These overall negative results, with no significant differences between groups detected at the primary outcome but some positive secondary signals, suggest either delayed benefit of the combination or an improvement of symptoms on withdrawal which warrants further exploration regarding the composition, mechanisms, and application

In this study, the authors aimed to examine efficacy of two add-on treatments in bipolar depression: N-acetylcysteine (NAC) and NAC with a combination of nutraceutical agents that may increase mitochondrial biogenesis.

Technical

CHEMWATCH

of mitochondrial agents in illnesses characterised by mitochondrial dysfunction.

Authors: Berk M, Turner A, Malhi GS, Ng CH, Cotton SM, Dodd S, Samuni Y, Tanious M, McAulay C, Dowling N, Sarris J, Owen L, Waterdrinker A, Smith D, Dean OM.

Full Source: BMC Medicine. 2019 Jan 25;17(1):18. doi: 10.1186/s12916-019-1257-1.

OCCUPATIONAL HEALTH RESEARCH

Association of occupational exposures with cardiovascular disease among US Hispanics/Latinos

2019-07-22

Cardiovascular disease (CVD) is a leading cause of mortality and morbidity in the USA. The role of occupational exposures to chemicals in the development of CVD has rarely been studied even though many agents possess cardiotoxic properties. In the present study, the authors evaluated associations of self-reported exposures to organic solvents, metals and pesticides in relation to CVD prevalence among diverse Hispanic/Latino workers. Cross-sectional data from 7404 employed individuals, aged 18-74 years, enrolled in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) were analysed. Participants from four US cities provided questionnaire data and underwent clinical examinations, including ECGs. CVD was defined as the presence of at least one of the following: coronary heart disease, atrial fibrillation, heart failure or cerebrovascular disease. Prevalence ratios reflecting the relationship between each occupational exposure and CVD as well as CVD subtypes were calculated using Poisson regression models. Hispanic/Latino workers reported exposures to organic solvents (6.5%), metals (8.5%) and pesticides (4.7%) at their current jobs. Overall, 6.1% of participants had some form of CVD, with coronary heart disease as the most common (4.3%) followed by cerebrovascular disease (1.0%), heart failure (0.8%) and atrial fibrillation (0.7%). For individuals who reported working with pesticides, the prevalence ratios for any CVD were 2.18 (95% CI 1.34 to 3.55), coronary heart disease 2.20 (95% CI 1.31 to 3.71), cerebrovascular disease 1.38 (95% CI 0.62 3.03), heart failure 0.91 (95% CI 0.23 to 3.54) and atrial fibrillation 5.92 (95% CI 1.89 to 18.61) after adjustment for sociodemographic, acculturation, lifestyle and occupational characteristics. Metal exposures were associated with an almost fourfold (3.78, 95% CI 1.24 to 11.46) greater prevalence of atrial fibrillation. Null associations were observed for organic solvent exposures. The results suggest that working with metals and pesticides could be risk

In the present study, the authors evaluated associations of self-reported exposures to organic solvents, metals and pesticides in relation to CVD prevalence among diverse Hispanic/Latino workers.

factors for CVD among Hispanic/Latino workers. Further work is needed to evaluate these relationships prospectively.

Authors: Bulka CM, Daviglius ML, Persky VW, Durazo-Arvizu RA, Lash JP, Elfassy T, Lee DJ, Ramos AR, Tarraf W, Argos M.

Full Source: Heart. 2019 Mar;105(6):439-448. doi: 10.1136/heartjnl-2018-313463. Epub 2018 Dec 11.

Occupational manganese exposure, reproductive hormones, and semen quality in male workers: A cross-sectional study

2019-07-22

It has been found that exposure to manganese (Mn) could induce reproductive dysfunction, but its occupational risk in male workers is unclear. This study aims to assess the association of occupational Mn exposure with reproductive hormones and semen quality in a cross-sectional study. Urinary Mn, semen quality, and reproductive hormones were explored in 84 male workers occupationally exposed to Mn and 92 referents. Multiple linear regression analyses were used to assess the relationship. Urinary Mn levels in Mn-exposed workers ranged from 0.56 to 34.25 µg/L, and the average level was 15.92 ± 8.49 µg/L. Compared with the control group, gonadotropin-releasing hormone (GnRH) levels and luteinising hormone (LH) levels increased significantly and the levels of testosterone (TSTO) decreased significantly in the Mn-exposed group. There was a significant positive linear association between urinary Mn and GnRH and LH, while the linear association between urinary Mn and TSTO was negative. Sperm progressive motility and total motility decreased significantly in the Mn-exposed group. There was a significantly negative linear association between urinary Mn and sperm progressive motility and total motility. In conclusion, occupational Mn exposure was inversely associated with reproductive health of male workers, resulting in the abnormality of hormones secretion and decrease of sperm motility.

Authors: Yang H, Wang J, Yang X, Wu F, Qi Z, Xu B, Liu W, Deng Y.

Full Source: Toxicology & Industrial Health. 2018 Nov 22:748233718810109. doi: 10.1177/0748233718810109. [Epub ahead of print]

This study aims to assess the association of occupational Mn exposure with reproductive hormones and semen quality in a cross-sectional study.

Monitoring early cell damage in physicians who are occupationally exposed to inhalational anaesthetics

2019-07-22

Worldwide, millions of professionals who work in operating rooms are occupationally exposed to inhalational anaesthetics. Thus, the

Technical

CHEMWATCH

potential health effects of the continuous exposure to inhalational anaesthetics on individuals in the operating room remain a subject of debate. Human biomonitoring is a potentially useful tool for assessing the health of exposed professionals. No report has yet evaluated the possible cytotoxic and genotoxic effects of the most commonly used inhalational anaesthetics on young professionals who are occupationally exposed. Considering the importance of this issue, the authors monitored physicians who were exposed to inhalational anaesthetics during their first year of a medical residency program to evaluate the possible early damage events. Twenty-six young physicians who had been occupationally exposed to the anaesthetic's isoflurane, sevoflurane, desflurane, and nitrous oxide and who worked in operating rooms using modern anaesthesia workstations during their medical residency program, participated in this study. Blood samples were evaluated before the start of the program (before the exposure), and after 1/2 year and 1 year of exposure. We monitored the subjects by assessing the cytotoxicity (early apoptosis and loss of the mitochondrial membrane potential) using flow cytometry and genotoxicity using the comet assay. No significant changes were observed in the biomarkers of cytotoxicity or genotoxicity ($p > 0.05$). Thus, biomonitoring showed that short-term exposure to inhalational anaesthetics did not induce early cell damage during the first year of medical residency. Based on the results, brief occupational exposure to anaesthetics does not induce either cytotoxicity or genotoxicity in mononuclear cells under the conditions of this study. Thus, young physicians should undergo additional biomonitoring at the beginning of their careers to determine possible toxic effects on their cells and genetic material, and further investigations are warranted to determine whether a longer exposure to inhalational anaesthetics results in mitochondrial depolarization, apoptosis and DNA breaks.

Authors: Aun AG, Golim MA, Nogueira FR, Souza KM, Arruda NM, Braz JRC, Braz LG, Braz MG.

Full Source: Mutation Research. 2018 Nov; 812:5-9. doi: 10.1016/j.mrfmmm.2018.10.002. Epub 2018 Oct 9.

This study evaluated the effects of a chronic occupational exposure to toluene on colour vision.

Blue-yellow dyschromatopsia in toluene-exposed workers

2019-07-22

This study evaluated the effects of a chronic occupational exposure to toluene on colour vision. Colour vision was tested in 51 workers exposed to pure toluene and in 51 matched control subjects. Current exposure was determined by biological monitoring. Blood samples were taken at the end of a Friday shift. Colour vision ability was assessed using the Ishihara

plates (to screen for congenital dyschromatopsia), the Farnsworth panel D-15 test, the Lanthony panel D-15 desaturated test, the Velhagen plates, and the Standard Pseudoisochromatic Plates Part 2. Median toluene concentration was 1.59 mg/l (quartiles 0.78 and 2.65). The whole group of workers did not perform worse than the controls. The same applies to 20 printers, who regularly assessed hues. Assessed with the most sensitive Lanthony panel D-15 desaturated test, colour vision of 24 permanently exposed assistants was impaired (median colour confusion index of the 1st eyes 1.08 vs. 1.02, $p < 0.02$; 2nd eyes 1.08 vs. 1.0, $p < 0.05$; sign test). The assistants made almost exclusively blue-yellow errors. The other colour vision tests did not reveal any differences between the groups. Changes in the retina are a possible explanation for the observed blue-yellow dyschromatopsia.

Authors: Muttray A, Wolters V, Rose DM.

Full Source: International Archives in Occupational & Environmental Health. 2019 Jan 25. doi: 10.1007/s00420-019-01405-8. [Epub ahead of print]

Urinary hydroxypyrene determination for biomonitoring of firefighters deployed at the Fort McMurray wildfire: an inter-laboratory method comparison

2019-07-22

Urinary 1-hydroxypyrene (OH-Pyr) is widely used for biomonitoring human exposures to polycyclic aromatic hydrocarbons (PAHs) from air pollution and tobacco smoke. However, there have been few rigorous validation studies reported to ensure reliable OH-Pyr determination for occupational health and risk assessment. In the present study, the authors report an inter-laboratory method comparison for urinary OH-Pyr when using gas chromatography-high-resolution mass spectrometry (GC-HRMS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) on urine specimens collected from firefighters ($n = 42$) deployed at the 2016 Fort McMurray wildfire. Overall, there was good mutual agreement in urinary OH-Pyr quantification following enzyme deconjugation with an average bias of 39% with no significant deviation from linearity (slope = 1.36; $p > 0.05$), whereas technical precision ($< 12\%$) and average recovery ($> 85\%$) were acceptable when using a stable-isotope internal standard. Faster analysis times (4 min) were achieved by LC-MS/MS without chemical derivatisation, whereas lower detection limits (0.64 ng/L, $S/N = 3$) was realised with solid-phase extraction prior to GC-HRMS. A median creatinine normalised OH-Pyr concentration of 128 ng/g was measured for firefighters that were below the recommended biological exposure

In the present study, the authors report an inter-laboratory method comparison for urinary OH-Pyr when using gas chromatography-high-resolution mass spectrometry (GC-HRMS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) on urine specimens collected from firefighters deployed at the 2016 Fort McMurray wildfire.

index due to delays between early stages of emergency firefighting and urine sample collection. Similar outcomes were also measured for 3-hydroxyphenanthrene and 9-hydroxyfluorene that were positively correlated with urinary OH-Pyr ($p < 0.05$), implying similar uptake, distribution, and liver biotransformation processes. Optimal specimen collection strategies post-deployment together with standardised protocols for OH-PAH analysis are critical to accurately evaluate smoke exposure in firefighters, including experimental conditions to ensure quantitative enzyme hydrolysis of urine samples. Graphical abstract. Authors: Gill B, Mell A, Shanmuganathan M, Jobst K, Zhang X, Kinniburgh D, Cherry N, Britz-McKibbin P. Full Source: Analytical and Bioanalytical Chemistry. 2019 Jan 25. doi: 10.1007/s00216-018-01569-1. [Epub ahead of print]

PUBLIC HEALTH RESEARCH

Overview of known plastic packaging-associated chemicals and their hazards

2019-07-22

Global plastics production has reached 380 million metric tons in 2015, with around 40% used for packaging. Plastic packaging is diverse and made of multiple polymers and numerous additives, along with other components, such as adhesives or coatings. Further, packaging can contain residues from substances used during manufacturing, such as solvents, along with non-intentionally added substances (NIAS), such as impurities, oligomers, or degradation products. To characterise risks from chemicals potentially released during manufacturing, use, disposal, and/or recycling of packaging, comprehensive information on all chemicals involved is needed. In this study, the authors present a database of Chemicals associated with Plastic Packaging (CPPdb), which includes chemicals used during manufacturing and/or present in final packaging articles. The CPPdb lists 906 chemicals likely associated with plastic packaging and 3377 substances that are possibly associated. Of the 906 chemicals likely associated with plastic packaging, 63 rank highest for human health hazards and 68 for environmental hazards according to the harmonised hazard classifications assigned by the European Chemicals Agency within the Classification, Labelling and Packaging (CLP) regulation implementing the United Nations' Globally Harmonized System (GHS). Further, 7 of the 906 substances are classified in the European Union as persistent, bioaccumulative, and toxic (PBT), or very persistent, very bioaccumulative (vPvB), and 15 as endocrine disrupting

In this study, the authors present a database of Chemicals associated with Plastic Packaging (CP-Pdb), which includes chemicals used during manufacturing and/or present in final packaging articles.

chemicals (EDC). Thirty-four of the 906 chemicals are also recognized as EDC or potential EDC in the recent EDC report by the United Nations Environment Programme. The identified hazardous chemicals are used in plastics as monomers, intermediates, solvents, surfactants, plasticisers, stabilisers, biocides, flame retardants, accelerators, and colorants, among other functions. This study was challenged by a lack of transparency and incompleteness of publicly available information on both the use and toxicity of numerous substances. The most hazardous chemicals identified here should be assessed in detail as potential candidates for substitution.

Authors: Groh KJ, Backhaus T, Carney-Almroth B, Geueke B, Inostroza PA, Lennquist A, Leslie HA, Maffini M, Slunge D, Trasande L, Warhurst AM, Muncke J.

Full Source: Science of the Total Environment. 2019 Feb 15;651(Pt 2):3253-3268. doi: 10.1016/j.scitotenv.2018.10.015. Epub 2018 Oct 4.

Different exposure profile of heavy metal and health risk between residents near a Pb-Zn mine and a Mn mine in Huayuan county, South China

2019-07-22

Heavy metal contamination of environmental media in mining area is a global major concern because of its potential threat for human health through food chain. However, the comparison of exposure level and health risk is scarce among people living in the vicinity of mining area with different pollution source. In this study, the concentrations of Mn, Cd, As, Pb, Cu, Zn, Cr and Ni in soil, air, water, rice, vegetable, fish, poultry meat and pork from a Pb-Zn mining area and a Mn mining area in Huayuan county, China were determined by inductively coupled plasma mass spectrometry. Results showed that the environmental media and foodstuffs in the two areas were contaminated by Cd, Pb, Zn, Cu, Cr and Ni. However, the pollution was more serious in Pb-Zn mining area than Mn mining area. The total hazard index (HI) was 6.59 and 4.55 in Pb-Zn mining area and Mn mining area, respectively, indicating a moderate non-carcinogenic risk of local people. As intake via rice ingestion was the predominant contributor to the total HI in the two mining areas, accounting for 25% and 35%, respectively. For Pb-Zn mining area, Cd intake through vegetable consumption and Mn intake via air inhalation appeared to be another two important components contributing to HI. This study highlights the multi-element and multi-pathway exposure assessment to evaluate the potential health risk and emphasizes concerns

In this study, the concentrations of Mn, Cd, As, Pb, Cu, Zn, Cr and Ni in soil, air, water, rice, vegetable, fish, poultry meat and pork from a Pb-Zn mining area and a Mn mining area in Huayuan county, China were determined by inductively coupled plasma mass spectrometry.

to reduce As and Cd in agricultural products as well as Mn in air to decrease the detrimental health effects of local resident.

Authors: Du Y, Chen L, Ding P, Liu L, He Q, Chen B, Duan Y.

Full Source: Chemosphere. 2019 Feb; 216:352-364. doi: 10.1016/j.chemosphere.2018.10.142. Epub 2018 Oct 20.

Emerging contaminants of high concern and their enzyme-assisted biodegradation - A review.

2019-07-22

The widespread occurrence and adverse environmental and health-related impacts of various types of emerging contaminants (ECs) have become an issue of high concern. With ever increasing scientific knowledge, socio-economic awareness, health-related problems and ecological apprehensions, people are more concerned about the widespread ECs, around the globe. Among ECs, biologically active compounds from pharmaceutical, cosmeceutical, biomedical, personal care products (PPCPs), endocrine-disrupting chemicals (EDCs), and flame-retardants are of paramount concern. The presence and persistence of ECs in water bodies are of continued and burning interest, worldwide. Various types of ECs are being discharged knowingly/unknowingly with/without partial treatments into the aquatic environments that pose serious health issues and affects the entire living ecosystem. So far, various approaches have been developed for ECs degradation and removal to diminish their adverse impact. Many previous and/or ongoing studies have focused on contaminants degradation and efficient removal via numerous treatment strategies, i.e. (1) physical, (2) chemical and (3) biological. However, the experimental evidence is lacking to enable specific predictions about ECs mechanistic degradation and removal fate across various in-practice systems. In this context, the deployment oxidoreductases such as peroxidases (lignin peroxidases, manganese-dependent peroxidases, and horseradish peroxidase), aromatic dioxygenases, various oxygenases, laccases, and tyrosinases have received considerable research attention. Immobilisation is highlighted as a promising approach to improve enzyme catalytic performance and stabilisation, as well as, to protect the three-dimensional structure of the enzyme against the undesirable consequences of harsh reaction environment. This study overviews the current and state-of-the-art critical aspect related to hazardous pollutants at large and ECs in particular by the immobilised oxidoreductase enzymes. The first part of the review focuses on the occurrence, physiochemical behaviour, potent sources and significant routes of ECs. Following that, environmentally-related adverse impacts and health-related issues of ECs

This study overviews the current and state-of-the-art critical aspect related to hazardous pollutants at large and ECs in particular by the immobilised oxidoreductase enzymes.

are discussed in the second part. In the third part, biodegradation and removal strategies with a comparative overview of several conventional vs. non-conventional methods are presented briefly. The fourth part majorly focuses on operational modes of different oxidoreductase enzyme-based biocatalytic processes for the biodegradation and biotransformation of a wide array of harmful environmental contaminants. Finally, the left behind research gaps, concluding remarks as well as future trends and recommendations in the use of carrier-immobilised oxidoreductases for environmental perspective are also discussed.

Authors: Bilal M, Adeel M, Rasheed T, Zhao Y, Iqbal HMN.

Full Source: Environment International. 2019 Mar; 124:336-353. doi:

10.1016/j.envint.2019.01.011. Epub 2019 Jan 17

Occurrence of legacy and alternative plasticisers in indoor dust from various EU countries and implications for human exposure via dust ingestion and dermal absorption

2019-07-22

Plasticisers are a category of chemicals extensively used in consumer products and, consequently, their presence is ubiquitous in the indoor environment. In the present study, an analytical method has been developed for the quantification of plasticisers (7 legacy phthalate esters (LPEs) and 14 alternative plasticisers (APs)) in indoor floor dust based on ultrasonic and vortex extraction, Florisil fractionation and GC-(EI)-MS analysis. Dust samples (n = 54) were collected from homes, offices, and daycare centres from different EU countries (Belgium, the Netherlands, Ireland and Sweden). Method LOQs ranged from 0.2 to 5 µg/g. Tri-n-hexyl trimellitate (THTM) was not detected in any sample, whereas dimethyl phthalate (DMP), diphenyl phthalate and acetyl triethyl citrate (ATEC) were detected only in 6, 2 and 1 out of 54 samples, respectively. The highest concentrations of plasticisers were measured in Swedish offices, at a mean concentration of total plasticisers of 1800 µg/g, followed by Swedish daycare centres at 1200 and 670 µg/g for winter and spring sampling, respectively. Generally, the contribution of APs was slightly higher than for LPEs for all indoor environments (mean contribution 60% and 40%, respectively based on contributions per indoor environment). For the APs, main contributors were DINP in Belgian homes (28%), Swedish offices (60%), Swedish daycare centres (48%), and Dutch offices (31%) and DEHT in Belgian (28%), Irish (40%) and Dutch homes (37%) of total APs. The predominant LPE was bis-2-ethylhexyl-phthalate (DEHP) with a mean contribution varying from 60% to 85% of total LPEs. Human exposure was evaluated for dust ingestion and dermal absorption using hazard

In the present study, an analytical method has been developed for the quantification of plasticisers in indoor floor dust based on ultrasonic and vortex extraction, Florisil fractionation and GC-(EI)-MS analysis.

quotients (HQs) of plasticisers (ratio between average daily doses and the reference dose). None of the HQs of plasticisers exceeded 1, meaning that the risk for adverse human health effects from these plasticisers via dust ingestion and dermal absorption is unlikely.

Authors: Christia C, Poma G, Harrad S, de Wit CA, Sjoström Y, Leonards P, Lamoree M, Covaci A.

Full Source: Environmental Research. 2018 Nov 22; 171:204-212. doi: 10.1016/j.envres.2018.11.034. [Epub ahead of print]

Understanding skin absorption of common aldehyde vapours from exposure during hazardous material incidents

2019-07-22

The toxic release of aldehyde vapours during a hazardous material (HAZMAT) incident primarily results in respiratory concerns for the unprotected public. However, skin absorption may be an important concurrent exposure route that is poorly understood for this scenario. This study provides experimental data on the skin absorption properties of common aldehydes used in industry, including acetaldehyde, acrolein, benzaldehyde and formaldehyde, in gaseous or vapour form using an adapted in vitro technique. Two of the four tested aldehydes were found to penetrate the skin in appreciable amounts following 30-min exposure at HAZMAT relevant atmospheric concentrations: acetaldehyde ($5.29 \pm 3.24 \mu\text{g}/\text{cm}^2$) and formaldehyde ($3.45 \pm 2.58 \mu\text{g}/\text{cm}^2$). Whereas only low levels of acrolein ($0.480 \pm 0.417 \mu\text{g}/\text{cm}^2$) and benzaldehyde ($1.46 \pm 0.393 \mu\text{g}/\text{cm}^2$) skin penetration was noted. The aldehydes demonstrated differing levels of interaction with fabric. Formaldehyde and acetaldehyde adsorbed strongly to denim, whereas benzaldehyde and acrolein displayed no sink properties. However, denim was shown to be an initial protective barrier and reduced penetration outcomes for all aldehydes. This study provides important information to assist first responders and confirms the relevance of using physicochemical properties (e.g. solubility, molecular weight, partition coefficient) to predict skin permeation potential in the absence of empirical data during HAZMAT incidents involving different types of aldehydes.

Authors: Thredgold L, Gaskin S, Heath L, Pisaniello D, Logan M, Baxter C.

Full Source: Journal of Exposure Science & Environmental Epidemiology. 2019 Feb 15. doi: 10.1038/s41370-019-0127-4. [Epub ahead of print]

This study provides experimental data on the skin absorption properties of common aldehydes used in industry, including acetaldehyde, acrolein, benzaldehyde and formaldehyde, in gaseous or vapour form using an adapted in vitro technique.