CHEMWATCH

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ENVIRONMENTAL RESEARCH

Effects of chemical fractions from an oil sands end-pit lake on reproduction of fathead minnows

2020-04-01

Oil sands process-affected water (OSPW) is a byproduct of bitumen extraction in the surface-mining oil sands industry in Alberta, Canada. Organic compounds in OSPW can be acutely or chronically toxic to aquatic organisms, so part of a long-term strategy for remediation of OSPW is ageing of water in artificial lakes, termed end-pit lakes. BaseMine Lake (BML) is the first oil sands end-pit lake, commissioned in 2012. At the time of its establishment, an effects-directed analysis of BML-OSPW showed that naphthenic acids and polar organic chemical species containing sulfur or nitrogen contributed to its acute lethality. However, the chronic toxicity of these same chemical fractions has not yet been investigated. In this work, the short-term fathead minnow reproductive bioassay was used to assess endocrine-system effects of two fractions of BML-OSPW collected in 2015. One of the fractions (F1) contained predominantly naphthenic acids, while the other (F2) contained non-acidic polar organic chemical species. Exposure of minnows to F1 or F2 at concentrations equivalent to 25% (v/v) of the 2015 BML-OSPW sample (5-15% of the 2012 BML-OSPW sample) did not alter reproductive performance, fertilization success, or concentrations of sex steroids in female or male minnows. Additionally, there were no significant differences in fertility, hatching success, or incidence of morphological indices of embryos collected on day 7 or 14 from exposed breeding trios. However, exposure of male fathead minnow to 25% (v/v) intact 2015 BML-OSPW resulted in a significantly greater hepatosomatic index. Exposure of fathead minnow to refined fractions of dissolved organic chemicals in 2015 BML-OSPW, or a 25% (v/v) of the intact mixture did not affect fertility or fecundity as measured by use of the 21-day reproductive bioassay. These data will be useful in setting future threshold criteria for OSPW reclamation and treatment.

Authors: Morandi G, Wiseman S, Sun C, Martin JW, Giesy JP

Full Source: Chemosphere. 2020 Feb 1;249:126073. doi: 10.1016/j.chemosphere.2020.126073. [Epub ahead of print]

BaseMine Lake (BML) is the first oil sands end-pit lake, commissioned in 2012.

Mobility monitoring of two herbicides in amended soils: A field study for modeling applications

2020-04-15

This paper reports the mobility and total balance of chlorotoluron (CTL), flufenacet (FNC) and bromide ion (Br^-) throughout a sandy soil profile after the application of spent mushroom substrate (SMS) and green compost (GC). Obtaining mobility dataset is crucial to simulate the herbicides' fate under amended soil scenarios by application pesticide leaching models with regulatory application (FOCUS models). The application of organic residues is nowadays increased to improve the crop yields and there is a gap in the simulations of this kind of amended scenarios. A two-year field experiment involving unamended soil (S) and SMS- or GC-amended soil plots was conducted. CTL, FNC, and Br^- were annually applied and their residual concentrations were determined in soil profiles (0-100 cm) regularly sampled. In all the treatments the order of mobility is followed as FNC < CTL < Br^-. SMS and GC increased herbicide retention in the top 10 cm by the higher organic carbon (OC) content than the unamended soil, and their ability to increase the soil's water-holding capacity and to decrease water percolation. Simultaneously dissolved organic carbon (DOC) content facilitated herbicide transport being it favoured by the initial soil moisture content and the rainfall shortly after the chemicals' initial application. Over the first year, residual amounts (<2.6%) of Br^-, CTL and FNC were leached down to 90-100 cm depth in the three treatments. However, over the second year low CTL and FNC amounts (<1.0%) reached the bottom layer only in S + SMS although high Br^- concentrations did so in the three treatments (<20%). According to the total balance of Br^-, CTL, and FNC in the soil profiles other processes (degradation, mineralisation, bound residues formation, and/or crop uptake) different from leaching below 1 m depth might play a key role in their dissipation especially in the amended soil profiles. SMS and GC are likely to be used as organic amendments to preserve the soil and water quality but in the case of SMS, its higher DOC content could imply a higher potential risk for groundwater contamination than GC.

Authors: Carpio MJ, Rodriguez-Cruz MS, Garcia-Delgado C, Sanchez-Martin, Marin-Benito JM

Full Source: Journal of environmental management. 2020 Apr 15;260:110161. doi: 10.1016/j.jenvman.2020.110161. Epub 2020 Jan 24.

This has raised interest in the possibility to construct microorganisms with improved catabolic activities by genetic engineering.

Perspectives of genetically engineered microbes for groundwater bioremediation

2020-02-25

Biodegradation is the main process for the removal of organic compounds from the environment, but proceeds slowly for many synthetic chemicals of environmental concern. Research on microbial biodegradation pathways revealed that recalcitrance is - among other factors - caused by biochemical blockages resulting in dysfunctional catabolic routes. This has raised interest in the possibility to construct microorganisms with improved catabolic activities by genetic engineering. Although this goal has been pursued for decades, no full-scale applications have emerged. This perspective explores the lagging implementation of genetically engineered microorganisms in practical bioremediation. The major technical and scientific issues are illustrated by comparing two examples, that of 1,2-dichloroethane where successful full-scale application of pump-and-treat biotreatment processes has been achieved, and 1,2,3-trichloropropane, for which protein and genetic engineering yielded effective bacterial cultures that still await application.

Authors: Janssen DB, Stucki G

Full Source: Environmental science, process and impacts. 2020 Feb 25. doi: 10.1039/c9em00601j. [Epub ahead of print]

Prospects of integrating algae technologies into landfill leachate treatment. 2020 Feb 25. doi: 10.1039/c9em00601j. [Epub ahead of print]

2020-02-24

Landfilling of municipal waste, an environmental challenge worldwide, results in the continuous formation of significant amounts of leachate, which poses a severe contamination threat to ground and surface water resources. Landfill leachate (LL) is generated by rainwater percolating through disposed waste materials and must be treated effectively before safe discharge into the environment. LL contains numerous pollutants and toxic substances, such as dissolved organic matter, inorganic chemicals, heavy metals, and anthropogenic organic compounds. Currently, LL treatment is carried out by a combination of physical, chemical, and microbial technologies. Microalgae are now viewed as a promising sustainable addition to the repertoire of technologies for treating LL. Photosynthetic algae have been shown to grow in LL under laboratory conditions, while some species have also been employed in larger-scale LL treatments. Treating leachate with algae can contribute to sustainable

LL contains numerous pollutants and toxic substances, such as dissolved organic matter, inorganic chemicals, heavy metals, and anthropogenic organic compounds.

waste management at existing landfills by remediating low-quality water for recycling and reuse and generating large amounts of algal biomass for cost-effective manufacturing of biofuels and bioproducts. In this review, we will examine LL composition, traditional leachate treatment technologies, LL toxicity to algae, and the potential of employing algae at LL treatment facilities. Emphasis is placed on how algae can be integrated with existing technologies for biological treatment of LL, turning leachate from an environmental liability to an asset that can produce value-added biofuels and bioproducts for the bioeconomy.

Authors: Dogaris I, Ammar E, Phillippidis GP

Full Source: World journal of microbiology & biotechnology. 2020 Feb 24;36(3):39. doi: 10.1007/s11274-020-2810-y.

Suspect and non-target screening of pesticides and pharmaceuticals transformation products in wastewater using QTOF-MS

2020-02-25

Pesticides and pharmaceuticals are widely used in modern life and are discharged into wastewater after usage. However, a large number of transformation products (TPs) are formed through abiotic (hydrolysis/photolysis, etc.) and biotic (aerobic/anaerobic degradation by micro-organisms) wastewater treatment processes, and the structure and potential risk of TPs are still unclear. In this study, a suspect and non-target screening was performed to monitor these chemicals with HPLC-QTOF-MS. We identified 60 parent compounds by suspect screening in three Chinese wastewater treatment plants with the commercial database of pesticides and pharmaceuticals, and they were confirmed by authentic standards. Then, suspect and non-target screening strategies based on the predicted diagnostic fragment ions were used to screen TPs of the 60 parent compounds. We tentatively identified 50 TPs and confirmed thirteen of them with authentic standards. Among 13 quantified TPs, about 40% of them showed higher concentration than their parent compounds in effluent. Especially, cloquintocet, as a TP of cloquintocet-mexyl, had a concentration ratio TP/parent = 14,809 in effluent. Twenty-five TPs had higher predicted toxicity than the corresponding parent compounds by calculating their LC_{50} values towards aquatic organisms using toxicity prediction software. Twenty identified TPs were firstly

We tentatively identified 50 TPs and confirmed thirteen of them with authentic standards.

reported in this study. These results indicate the importance of TP analysis in environmental monitoring in wastewater.
Authors: Wang X, Yu N, Yang J, Jin L, Guo H, Shi W, Zhang X, Yang L, Yu H, Wei S
Full Source: Environmental International. 2020 Apr;137:105599. doi: 10.1016/j.envint.2020.105599. Epub 2020 Feb 25.

CHEMICAL EFFECTS

Enzymological characterization of a novel d-lactate dehydrogenase fom Lactobacillus rossiae and its application in d-phenyllactic acid synthesis

2020-03-10
A novel lactate dehydrogenase gene, named lrldh, was cloned from Lactobacillus rossiae and heterologously expressed in Escherichia coli. The lactate dehydrogenase LrLDH is NADH-dependent with a molecular weight of approximately 39 kDa. It is active at 40 °C and pH 6.5 and stable in a neutral to alkaline environment below 35 °C. The kinetic constants, including maximal reaction rate (V_{max}), apparent Michaelis-Menten constant (K_m), turnover number (K_{cat}) and catalytic efficiency (K_{cat}/K_m) for phenylpyruvic acid were 1.95 U mg^{-1}, 2.83 mM, 12.29 s^{-1}, and 4.34 mM^{-1} s^{-1}, respectively. Using whole cells of recombinant E. coli/pET28a-lrldh, without coexpression of a cofactor regeneration system, 20.5 g l^{-1} d-phenyllactic acid with ee above 99% was produced from phenylpyruvic acid in a fed-batch biotransformation process, with a productivity of 49.2 g l^{-1} d^{-1}. Moreover, LrLDH has broad substrate specificity to a range of ketones, keto acids and ketonic esters. Taken together, LrLDH is a promising biocatalyst for the efficient synthesis of d-phenyllactic acid and other fine chemicals.

It is active at 40 °C and pH 6.5 and stable in a neutral to alkaline environment below 35 °C.

Authors: Luo X, Zhang Y, Yin F, Hu G, Jia Q, Yao C, Fu Y
Full Source: 3 Biotech. 2020 Mar;10(3):101. doi: 10.1007/s13205-020-2098-5. Epub 2020 Feb 6.

Chemical characterization, antioxidant, cytotoxicity, Anti-Toxoplasma gondii and antimicrobial potentials of the Citrus sinensis seed oil for sustainable cosmeceutical producton

2020-02-13

There are growing concerns about the chronic and acute effects of synthetic additives such as antibacterial, fragrances, colourants and stabilizing agents used in the production of various household products. Many household products and materials including cosmetic products are reportedly suspected to be carcinogenic with some acting as endocrine disruptors among other effects. Thus, environmental-friendly alternatives such as products that are rich in bioactive phytochemicals are becoming consumers' preferred choice especially in the beauty and cosmetic sector. 'Green' preparation of medicinal soaps devoid of any synthetic additives was made from underutilized tropical seed of Citrus sinensis seed oil and some natural additives comprising of natural honey, Ocimum gratissimum leaves extract, Moringa oleifera seed oil and coconut oil. Precisely, the seed oil of the underexplored C. sinensis was obtained via soxhlet extraction and saponified with natural lye solution at different ratios to produce soaps of varying characteristics. The incorporation of honey and Ocimum gratissimum leaf extract provided additional antimicrobial, antioxidant and fragrance properties. Physico-chemical parameters of the oil and soaps were determined following standard procedures while the fatty acid profile of the trans-esterified oil was determined using GC-MS. The antimicrobial potential of the oil and soaps were assessed using agar diffusion method at concentrations 200 mg/mL and below. Linoleic acid (36%) and oleic acid (27%) were the most prominent in C. sinensis seed oil. The soap had antimicrobial potential comparable to commercial product. The soap samples recorded highest anti-bacteria activities (22.0 ± 1.0-23.0 ± 1.0) against Staphylococcus aureus and Bacillus subtilis and notable anti-fungi activities (18.0 ± 1.0) against Penicillium notatum and Candida albicans. Additionally, the oil showed moderate anti-parasite (anit-toxoplasma gondii) activity (EC_{50} ≤ 500 µg/mL) but with improved selectivity that precludes oxidative stress while the prepared medicinal soaps exhibited remarkable antioxidant property. The utilization of these locally sourced resources will prevent the daily introduction of synthetic antimicrobial and antioxidant chemicals into the environment. The initiative avail a sustainable production of environmentally-benign cosmetic products besides conversion of waste

The environmental safety of SeNPs was evaluated by acute regulatory toxicity tests using Daphina magna and Vibrio fischeri as model organisms.

to wealth agrees which aligns with the Sustainable Development Goals (SDGs).
Authors: Atolani O, Adamu N, Oguntoye OS, Zubair MF, Fabiyi OA, Oyegoke RA, Adeyemi OS, Areh ET, Tarigha DE, Kambizi L, Olatunji GA
Full Source: Heliyon. 2020 Feb 13;6(2):e03399. doi: 10.1016/j.heliyon.2020.e03399. eCollection 2020 Feb.

Stability and toxicity of differently coated selenium nanoparticles under model environmental exposure settings

2020-02-20
This study, motivated to fill the knowledge gap on environmental safety of selenium nanoparticles (SeNPs), provides information on the stability and environmental safety of four differently coated SeNPs rendering both positive and negative surface charges. The stability and dissolution behaviour of SeNPs were determined in an aquatic model media of different ionic strength to provide information regarding the environmental fate of SeNPs in different environmental conditions. The environmental safety of SeNPs was evaluated by acute regulatory toxicity tests using Daphina magna and Vibrio fischeri as model organisms. Agglomeration was observed for all studied SeNPs in test media with higher ionic strength caused by the disruption of surface charge leading to electrostatic instability. Toxicity of SeNPs on both aquatic species was dose-dependent and increased with exposure time. The obtained data indicated that all of the tested SeNPs could be classified as harmful to the natural bacteria V. fischeri and harmful to toxic to crustaceans D. magna, but dependent on the coating agent used for SeNPs stabilization. Although SeNPs have attracted great interest for use in biomedicine, this study demonstrated that their ecotoxicological effects should be considered during the design of new of SeNPs-based products.
Authors: Selmani A, Ulm L, Kasemets K, Kurvet I, Erceg I, Babir R, Pem B, Santini P, Marion ID, Vinković T, Krivohlavek A, Sikirić MD, Kahru A, Vinkovi ć Vrćek I
Full Source: Chemosphere. 2020 Feb 20;250:126265. doi: 10.1016/j.chemosphere.2020.126265. [Epub ahead of print]

Toxicological research must evolve and utilize adaptive technologies in an effort to improve public, environmental, and occupational health.

PHARMACEUTICAL/TOXICITY

Determining the biological mechanisms of action for environmental exposures: Applying CRISPR/Cas9 to toxicological assessments

2020-02-27

Toxicology is a constantly evolving field, especially in the area of developing alternatives to animal testing. Toxicological research must evolve and utilize adaptive technologies in an effort to improve public, environmental, and occupational health. The most commonly cited mechanisms of toxic action after exposure to a chemical or particle test substance is oxidative stress. However, because oxidative stress involves a plethora of genes and proteins, the exact mechanism(s) are not commonly defined. Exact mechanisms of toxicity can be revealed using an emerging laboratory technique referred to as CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats). This paper reviews the most common CRISPR techniques utilized today and how each may be applied in toxicological science. Specifically, the CRISPR/CRISPR-associated (Cas) protein complex is used for single gene knock-outs, while CRISPR interference/activation (CRISPRi/CRISPRa) is used for silencing or activating (respectively) ribonucleic acid (RNA). Finally, CRISPR libraries are used for knocking-out entire gene pathways. This review highlights the application of CRISPR in toxicology to elucidate the exact mechanism through which toxicants perturb normal cellular functions.

Authors: Lujan H, Romer E, Salisburt R, Hussain S, Sayes C

Full Source: Toxicological sciences: an official journal of the Society of Toxicology. 2020 Feb 27. pii: kfaa028. doi: 10.1093/toxsci/kfaa028. [Epub ahead of print]

A possible role for hepcidin in the detection of iron deficiency in severely anaemic HIV-infected patients in Malawi

2020-02-27

INTRODUCTION:

Iron deficiency is a treatable cause of severe anaemia in low-and-middle-income-countries (LMIC). Diagnosing it remains challenging as peripheral blood markers poorly reflect bone-marrow iron deficiency (BM-ID), especially in the context of HIV-infection.

METHODS:

BM-ID deficiency was common in severely anaemic HIV-infected patients.

Severely anaemic (haemoglobin ≤70g/l) HIV-infected adults were recruited at Queen Elizabeth Central Hospital, Blantyre, Malawi. BM-ID was evaluated. Accuracy of blood markers (including hepcidin, mean corpuscular volume, mean cellular haemoglobin concentration, serum iron, serum ferritin, soluble transferrin receptor (sTfR), sTfR index, sTfR-ratio) to detect BM-ID was evaluated by ROC area under the curve (AUCROC).
RESULTS:
Seventy-three patients were enrolled and 35 (48.0%) had BM-ID. Although hepcidin and MCV performed best (AUCROC of 0.593 and 0.545 respectively) all markers performed poorly in identifying BM-ID (ROC<0.6). The AUCROC of hepcidin in males was 0.767 (sensitivity 80%, specificity 78%) and in women 0.490 (sensitivity 60%, specificity 61%).
CONCLUSION:
BM-ID deficiency was common in severely anaemic HIV-infected patients. It is an important and potential treatable contributor to severe anaemia but lack of definitive biomarkers makes it difficult to accurately assess iron status in these patients. Further investigation of the potential of hepcidin is needed, including exploration of the differences in hepcidin results between males and females.

Authors: Hulbers MHW, Calis JC, Allain TJ, Coupland SE, Phiri C, Phiri KS, Swinkels DW, Boele van Hensbroek M, Bates I
Full Source: PLoS One. 2020 Feb 27;15(2):e0218694. doi: 10.1371/journal.pone.0218694. eCollection 2020

A Hands-on Approach to Contact Dermatitis and Patch Testing

2020-02-26

Contact dermatitis (CD) is a common skin condition caused by contact with an exogenous agent that elicits an inflammatory response. While history and physical exam can be helpful in distinguishing between irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD), the gold standard for diagnosing ACD is patch testing. While the actual patch test (PT) procedure and application is relatively straightforward, the decisions involving which allergens to use, interpretation of results, determination of relevant allergens and subsequent patient management requires more skill and expertise. Often, the distribution of the presenting dermatitis can provide insight into the potential causative allergens and should be taken into account when selecting PT allergens. Commercially available PT panels and personal care products can be used for patch testing. Determining the clinical relevance of PT results is a critical component of

While history and physical exam can be helpful in distinguishing between irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD), the gold standard for diagnosing ACD is patch testing.

the PT procedure. Patients must be educated on avoidance of relevant allergens and given guidance on alternative products available for use. Special populations, including children with ACD, occupational contact dermatitis (OCD), and patients with biomedical devices have unique allergen considerations and PT panels should be directed as such to address all potential allergens.
Authors: Schmidlin K, Sani S, Bernstein DI, Fonacier L
Full Source: The Journal of allergy and clinical immunology, in practice. 2020 Feb 26. pii: S2213-2198(20)30158-6. doi: 10.1016/j.jaip.2020.02.009. [Epub ahead of print]

Medical cannibus as an alternative for opiods for chronic pain: A case report

2020-02-12
Opioid medication-related deaths have increased to epidemic proportions in the last decade. This report describes a case of 43-year-old female with a traumatic brain injury who developed chronic pain and opioid dependence. The patient expressed concerns and wanted weaning off opioids. Recent legalization of medical marijuana in Pennsylvania allows us to try it as an alternative to opioids for chronic pain. Medical cannibus has risks associated with administration but is safer than opioids. Our patient was successfully weaned off her opioid medications with the help of medical cannibus and pain remained well controlled. More studies need to be done on using medical cannibus as an alternative to opioids.
Authors: Caldera FE
Full Source: SAGE Open Medical Case Reports.2020 Feb 12;8:2050313X20907015. doi: 10.1177/2050313X20907015. eCollection 2020.

The finding suggests that sodium benzoate may have potential to benefit cognitive function in a fraction of BPSD patients after 6 weeks of treatment.

Precision Medicine of Sodium Benzoate for the Treatment of Behavioral and Psychological Symptoms of Dementia (BPSD)

2020-02-20
OBJECTIVE:
Behavioral and psychological symptoms of dementia (BPSD) are associated with poorer prognosis of dementia. A 24-week study demonstrated that sodium benzoate, a D-amino acid oxidase (DAAO) inhibitor, surpassed placebo in improving cognitive function in early-phase Alzheimer's disease; however, benzoate did not excel placebo in another 6-week study on BPSD. The current study examined whether the

precision medicine approach was able to identify specific individuals with BPSD who could benefit from benzoate treatment.
METHODS:
In the randomized, double-blind, placebo-controlled, 6-week trial, 97 patients with BPSD were allocated to receive 250-1500 mg/day of sodium benzoate or placebo. Cognitive function was measured by the Alzheimer's disease assessment scale-cognitive subscale (ADAS-cog) and behavioral and psychological symptoms were mainly measured by Behavioral Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD). DAAO level, amino acids (L-serine, D-serine, L-alanine, and D-alanine, glycine), and two antioxidants (catalase, superoxide dismutase) were assayed in peripheral blood.
RESULTS:
After benzoate treatment, DAAO inhibition was correlated with ADAS-cog decrease ($p = 0.034$), while baseline DAAO level was correlated with baseline BEHAVE-AD score. Multiple linear regression analyses showed that cognitive improvement after benzoate treatment was correlated with DAAO decrease, female gender, younger age, BMI, baseline BPSD severity, and antipsychotic use.
CONCLUSION:
The finding suggests that sodium benzoate may have potential to benefit cognitive function in a fraction of BPSD patients after 6 weeks of treatment. Of note, the precision medicine approach may be helpful for identifying individuals who could respond to benzoate. More studies are warranted to confirm the preliminary findings.
Authors: Lin CH, Yang HT, Chen PL< Wang SH, Lane HY
Full Source: Neuropsychiatric disease and treatment 2020 Feb 20;16:509-518. doi: 10.2147/NDT.S234371. eCollection 2020.

Currently, biomarkers of DnBA exposure and methods for their determination are not available.

Determination of di-n-butyl adipate (DnBA) metabolites as possible biomarkers of exposure in human urine by online-SPE-LC-MS/MS

2020-03-15
Di-n-butyl adipate (DnBA) is an alternative to the anti-androgenic and strictly regulated di-n-butyl phthalate (DnBP) used as a cosmetic ingredient, plasticizer, and in various articles of everyday life. Hence, exposures of the general population have to be expected. Currently, biomarkers of DnBA exposure and methods for their determination are not available. Here, we describe a sensitive, rugged and precise analytical method for the determination of the DnBA monoester metabolite mono-n-butyl adipate (MnBA), as well as its potential downstream metabolites

3-hydroxy-mono-n-butyl adipate (3OH-MnBA) and 3-carboxy-mono-n-propyl adipate (3cx-MnPrA) in human urine. Glucuronic acid conjugates present in urine were deconjugated using a pure β-glucuronidase. The metabolites were then analyzed by liquid chromatography on a C18 column with superficially porous particles coupled to electrospray ionization-triple quadrupole-tandem mass spectrometry, applying online turbulent flow chromatography for analyte enrichment and matrix depletion (online-SPE-LC-MS/MS). The metabolites were quantified using stable isotope dilution analysis with limits of quantification of 0.05 µg/L (MnBA), 0.1 µg/L (3OH-MnBA), and 0.5 µg/L (3cx-MnPrA). Method imprecision in urinary matrix was below 7% (coefficient of variation) for all analytes. Mean relative recoveries were between 93% and 107%. The suitability of the DnBA metabolites as biomarkers of exposure was demonstrated after dermal application of a commercially available sunscreen containing DnBA. Maximum concentrations were reached 6.5 h after dose (219 µg/L 3cx-MnPrA, 91 µg/L MnBA, and 3.9 µg/L 3OH-MnBA). Elimination kinetics were similar for all three metabolites. We were able to quantify 3cx-MnPrA and MnBA until 4 d after sunscreen application. In a sample set of 35 urine samples from the general German population, 3cx-MnPrA was quantified in 94% (median 2.54 µg/L, maximum 78.3 µg/L) and MnBA in 3% (median < LOQ, maximum 0.18 µg/L) of the samples. The method will be applied in future human metabolism and human biomonitoring population studies.

Authors: Ringbeck B, Bury D, Hayen H, Weiss T, Br Üning T, Koch HM

Full Source: Journal of chromatography B, Analytical technologies in the biomedical and life sciences. 2020 Mar 15;1141:122029. doi: 10.1016/j.jchromb.2020.122029. Epub 2020 Feb 13.

Most exposures occurred in the manufacture of fabricated metal products (50%) and among metal finishing-, plating- and coating-machine operators (42%).

OCCUPATIONAL

Assessment of exposure to cobalt and its compounds in Italian industrial settings

2020-02-24

BACKGROUND:

Adverse health effects of occupational exposure to cobalt and its compounds are well-documented.

OBJECTIVES:

The aim of the study is to evaluate exposures to cobalt in Italian industrial settings.

METHODS:

Data on cobalt and its compounds were collected from an occupational exposure registry. Statistical analysis was carried out for some exposure-related variables (i.e., cobalt compound, activity sector, occupational group, firm size). The number of workers potentially exposed was estimated for selected industrial sectors.
RESULTS:
Overall 1,701 measurements were analyzed in the period 1996-2016. The geometric mean of cobalt airborne concentration was 0.33 µg/m3. Most exposures occurred in the manufacture of fabricated metal products (50%) and among metal finishing-, plating- and coating-machine operators (42%). A total of 30,401 workers potentially exposed to cobalt was estimated, over 72% were male.
CONCLUSIONS:
Identifying professional groups at high-risk of exposure can help to control the most dangerous situations for workers' health. Surveillance systems based on occupational exposure registries contribute to support systematic improvement of working conditions.
Authors: Scarselli A, Di Marzio D, Iavicoli S
Full Source: La Medicina del lavoro. 2020 Feb 24;111(1):22-31. doi: 10.23749/mdl.v111i1.8869.

Chromosomal Instability in Farmers Exposed to Pesticides: High Prevalence of Clonal and Non-Clonal Chromosomal Alterations

2020-02-11
INTRODUCTION:
An important economic activity in Colombia is agricultural production and farmers are frequently exposed to pesticides. Occupational exposure to pesticides is associated with an increased incidence of various diseases, including cancer, Parkinson's disease, Alzheimer's disease, reproductive disorders, and birth defects. However, although high genotoxicity is associated with these chemicals, information about the type and frequency of specific chromosomal alterations (CAs) and the level of chromosomal instability (CIN) induced by exposure to pesticides is scarce or absent.
METHODS:
In this study, CAs and CIN were assessed in peripheral blood lymphocytes (PBLs) from five farmers occupationally exposed to pesticides and from five unexposed individuals using GTG-banding and molecular cytogenetic analysis.
RESULTS:

Occupational exposure to pesticides is associated with an increased incidence of various diseases, including cancer, Parkinson's disease, Alzheimer's disease, reproductive disorders, and birth defects.

A significant increase in clonal and non-clonal chromosomal alterations was observed in pesticide-exposed individuals compared with unexposed individuals (510±12,2 vs 73±5,7, respectively; p<0.008). Among all CAs, monosomies and deletions were more frequently observed in the exposed group. Also, a high frequency of fragilities was observed in the exposed group.
CONCLUSION:
Together, these findings suggest that exposure to pesticides could be associated with CIN in PBLs and indicate the need for the establishment of educational programs on safety precautions when handling pesticides, such as wearing gloves, masks and boots, changing clothes and maintaining proper hygiene, among others. Further evaluation in other similar studies that include a greater number of individuals exposed to pesticides is necessary.
Authors: Cepeda S, Forero-Castro M, Cardenas-Nicto D, Matinez-Agüero M, Rondon-Lagos M
Full Source: Risk management and healthcare policy. 2020 Feb 11;13:97-110. doi: 10.2147/RMHP.S230953. eCollection 2020.

Occupational exposure to manganese and risk of creatine kinase and creatine kinase-MB elevation among ferromanganese refinery workers

Our results suggest that occupational exposure to Mn is associated with increased risk of CK and CK-MB elevation.

2020-02-29
BACKGROUND:
Elevated exposure to manganese (Mn) could induce cardiovascular dysfunction. However, limited research is available on the effects of occupational Mn exposure on myocardial enzymes. We aimed to evaluate the relationships between Mn exposure and myocardial enzyme elevation among Mn-exposed workers.
METHODS:
Data were from a follow-up investigation of a Mn-exposed workers healthy cohort in 2017. A total of 744 workers were divided into low-exposure and high-exposure groups according to Mn time-weighted average (Mn-TWA) of less than or equal to 0.15 mg/m^3 or greater than 0.15 mg/m^3 , respectively. Serum levels of myocardial enzymes, including creatine kinase (CK) and creatine kinase-MB (CK-MB), lactic dehydrogenase, α-hydroxybutyrate dehydrogenase, and aspartate transaminase, were assessed, as well as airborne Mn exposure levels.
RESULTS:
After adjustment for sex, body mass index, seniority, education, current smoking status, current drinking status, and hypertension, Mn-TWA

levels were positively associated with the risk of CK elevation (odds ratio [OR] = 1.47 (95% confidence interval [CI]: 1.18-1.83) per interquartile range [IQR] increase), and risk of CK-MB elevation [OR = 1.57 (95% CI: 1.03-2.38) per IQR increase]. In a stratified analysis, Mn-TWA levels were positively correlated with CK elevation in workers of seniority greater than 19 years, male workers, current smokers, and drinkers.
CONCLUSION:
Our results suggest that occupational exposure to Mn is associated with increased risk of CK and CK-MB elevation. The potential mechanisms of the associations between airborne exposure to Mn and increased risk of these myocardial enzyme elevations warrant further investigation.
Authors: Huang S, Liu Z, Ge X, Luo X, Zhou Y, Li D, Li L, Chen X, Huang L, Cheng H, Hou Q, Zan G, Tan Y, Liu C, Zou Y, Yang X
Full Source: American Journal of Industrial Medicine. 2020 Feb 29. doi: 10.1002/ajim.23097. [Epub ahead of print]

Occupational risk assessment of exposure to metals in chrome plating workers

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Inhalation of xenobiotics during manufacture process in chrome plating bath produce hazards to workers' health. Chromium (Cr) is a metal widely used by industry, and its hexavalent (VI) form has been classified as mutagenic and carcinogenic. This study aimed to evaluate the occupational risk of exposure to metals in chrome plating workers. Biological monitoring was performed through quantification of Cr, Pb, As, Ni, and V in blood by ICP-MS in 50 male chrome-plating workers from the exposed group and 50 male non-exposed workers. The inflammatory parameters assessed were β-2 integrin, intercellular adhesion molecule-1 (ICAM-1), and L-selectin expression in lymphocytes. The genotoxicity was evaluated with comet and micronucleus (MN) assays and as a biomarker of oxidative damage the lipid peroxidation (MDA) and protein carbonyl (PCO). The results demonstrated that Cr levels in blood and urine were increased in the exposed group compared to the non-exposed group. Although the biomarkers of exposure proved to be within the levels considered safe in exposed individuals, chrome plating workers presented significantly increase in the percentage of lymphocytes expressing β-2 integrin, ICAM-1, and L-selectin as well as DNA damage (comet assay) and plasmatic MDA and PCO levels. Therefore, it is possible also assign the injuries caused to lipids, proteins, and DNA assessed due to the increased presence of other metals such as Pb, As, Ni, and V in exposed subjects. These results suggest that exposure to xenobiotics present in the

Chromium (Cr) is a metal widely used by industry, and its hexavalent (VI) form has been classified as mutagenic and carcinogenic.

occupational environment in chrome plating industry could play a crucial role toward the inflammation, genetic, and oxidative damage.
Authors: Muller CD, Garcia SC, Burcker N, Goethel G, Sauer E, Lacerda LM, Oliveira E,Trombini TL, Machado AB, Pressotto A, Rech VC, Klauck CR, Basso da Silva L, Gioda A, Feksa LR
Full Source: Drug and chemical toxicology. 2020 Feb 27:1-8. doi: 10.1080/01480545.2020.1731527. [Epub ahead of print]

Occupational Exposure to Dust Produced when Milling Thermally Modified Wood

2020-02-25

During production, thermally modified wood is processed using the same machining operations as unmodified wood. Machining wood is always accompanied with the creation of dust particles. The smaller they become, the more hazardous they are. Employees are exposed to a greater health hazard when machining thermally modified wood because a considerable amount of fine dust is produced under the same processing conditions than in the case of unmodified wood. The International Agency for Research on Cancer (IARC) states that wood dust causes cancer of the nasal cavity and paranasal sinuses and of the nasopharynx. Wood dust is also associated with toxic effects, irritation of the eyes, nose and throat, dermatitis, and respiratory system effects which include decreased lung capacity, chronic obstructive pulmonary disease, asthma and allergic reactions. In our research, granular composition of particles resulting from the process of longitudinal milling of heat-treated oak and spruce wood under variable conditions (i.e., the temperature of modification of 160, 180, 200 and 220 °C and feed rate of 6, 10 and 15 $m.min^{-1}$) are presented in the paper. Sieve analysis was used to determine the granular composition of particles. An increase in fine particle fraction when the temperature of modification rises was confirmed by the research. This can be due to the lower strength of thermally modified wood. Moreover, a different effect of the temperature modification on granularity due to the tree species was observed. In the case of oak wood, changes occurred at a temperature of 160 °C and in the case of spruce wood, changes occurred at the temperatures of 200 and 220 °C. At the temperatures of modification of 200 and 220 °C, the dust fraction (i.e., that occurred in the mesh sieves, particles with the size ≤ 0.08 mm) ranged from 2.99% (oak wood, feed rate of 10 $m.min^{-1}$) to 8.07% (spruce wood, feed rate of 6 $m.min^{-1}$). Such

An increase in fine particle fraction when the temperature of modification rises was confirmed by the research.

particles might have a harmful effect on employee health in wood-processing facilities.
Authors: Očkajová A, Kučerka M, Kminiak R, Krišťák Ľ, Igaz R, Réh R.
Full Source: International journal of environmental research and public health. 2020 Feb 25;17(5). pii: E1478. doi: 10.3390/ijerph17051478.