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ENVIRONMENTAL RESEARCH

Heavy metals accumulation and endocrine disruption in *Prochilodus argenteus* from a polluted neotropical river

2019-03-12

Heavy metals are considered major pollutants of aquatic environments due to the difficulty of metabolisation and the bioaccumulative potential in tissues of aquatic organisms, especially fish muscle that is often used as food worldwide. In addition to causing cell damage, some metals such as aluminium (Al), cadmium (Cd), copper (Cu), and lead (Pb) can act as endocrine disrupting chemicals in fish. The Paraopeba and Abaete Rivers are important tributaries of the upper São Francisco River basin, but the Paraopeba River receives, along its course, the discharge of many types of effluents that affect fish species, including widely consumed species such as *Prochilodus argenteus*. This study evaluated histological and molecular changes caused by chronic exposure to heavy metals in *P. argenteus* from the Paraopeba River and compared this to fish from the non-impacted Abaete River. Sampled fish from both rivers were used in histological analyses and immunohistochemical assays. The results showed increased incidence of histopathologies and changes in number and morphology of germline cells in both sexes. In addition, up-regulated expression of oestrogens-induced proteins in the liver of males were detected in polluted environment. All the alterations were related to the concentration of metals in water and fish. The high concentration of various metals observed in water and fish from Paraopeba River serves as an alert to the environmental and public health regulatory authorities.

Authors: Paschoalini AL, Savassi LA, Arantes FP, Rizzo E, Bazzoli N.

Full Source: *Ecotoxicology & Environmental Safety*. 2019 Mar; 169:539-550.

doi: 10.1016/j.ecoenv.2018.11.047. Epub 2018 Nov 24.

This study evaluated histological and molecular changes caused by chronic exposure to heavy metals in *P. argenteus* from the Paraopeba River and compared this to fish from the non-impacted Abaete River.

A novel electro-coagulation-Fenton for energy efficient cyanobacteria and cyanotoxins removal without chemical addition

2019-03-12

Harmful cyanobacterial bloom is a serious threat to global aquatic ecology and drinking water safety. Electro-Fenton (EF) has emerged as an efficient process for cyanobacteria and cyanotoxins removal, but high consumption of energy and chemicals remain a major bottleneck. This study presents a novel convertible three-electrodes Electro-Coagulation-Fenton process for cyanobacteria and cyanotoxins removal with low energy consumption

and no chemicals addition. For the first time, the authors demonstrated the freely alternating between Electrocoagulation (EC) and EF by switching electrodes. The optimal aerated EC was operated at pH 8 and 100 mA to remove $91 \pm 2\%$ of cyanobacterial cells and 15% of Microcystins (MCs). Coagulants generated in EC were adsorbed on cyanobacterial cells to form a protect layer against algae disruption and cyanotoxins releasing. Residual MCs and cyanobacterial cells were completely mineralised by EF at 28 mA with iron ions and H₂O₂ generated in-situ. Compare to traditional EF, the optimal Electro-Coagulation-Fenton process increased total organic carbon (TOC) removal efficiency by 30%, yet energy consumption reduced up to 92%. The novel Electro-Coagulation-Fenton process is a promising technology for the efficient treatment of the mixture of suspended solid pollutants and persistent organic pollutants in one system with low energy consumption.

Authors: An J, Li N, Wang S, Liao C, Zhou L, Li T, Wang X, Feng Y.

Full Source: Journal of Hazardous Material. 2019 Mar 5; 365:650-658. doi: 10.1016/j.jhazmat.2018.11.058. Epub 2018 Nov 16.

Biosynthesis of iron oxide nanoparticles using leaf extract of *Ruellia tuberosa*: Antimicrobial properties and their applications in photocatalytic degradation

2019-03-12

Green synthesis of nanoparticles is one of the promising, ecofriendly and safer methods. Utilising plant sources as reducing agents will replace the use of toxic chemicals for nanoparticle synthesis. In the present study FeONPs were synthesised using *Ruellia tuberosa* (RT) leaf aqueous extract, further characterisation of FeONPs was performed using UV-vis spectroscopy analysis showing visible peak at 405 nm. The Fourier transform infrared spectroscopy (FTIR) proved the presence of Fe metallic ions. The structural characteristic using Field emission scanning electron microscopy with energy dispersive x-ray spectroscopy (FESEM-EDX) and Transmission electron microscopy (TEM) analysis revealed hexagonal nanorods with agglomeration. Dynamic light scattering (DLS) calculated the average size of FeONPs around 52.78 nm and differential scanning calorimetry (DSC) proved the stability of FeONPs till higher temperature of 165.52 °C. As an application part, the synthesised FeONPs showed potential antibacterial activity as individual and incorporating material over cotton fabrics against Gram negative and Gram-positive pathogens. FeONPs showed higher antibacterial activity against *Escherichia coli*, *Klebsiella pneumoniae* and lesser antibacterial activity against *Staphylococcus aureus*. The photocatalytic ability of the synthesised

In the present study FeONPs were synthesised using *Ruellia tuberosa* (RT) leaf aqueous extract

FeONPs was demonstrated by the degrading crystal violet dye under solar irradiation up to 80%. Thus, FeONPs synthesised using *Ruellia tuberosa* could play a vital role in killing the bacterial pathogens and degrading dye for the bioremediation of wastewater from industrial and domestic sources.

Authors: Vasantharaj S, Sathiyavimal S, Senthilkumar P, LewisOscar F, Pugazhendhi A.

Full Source: Journal of Photochemistry and Photobiology B: Biology. 2018 Dec 28; 192:74-82. doi: 10.1016/j.jphotobiol.2018.12.025. [Epub ahead of print]

Ca²⁺ protect zebrafish embryos from water acidification

2019-03-12

Ionisable strategies are routinely used to enhance the solubility and dissolution rates of various pharmaceuticals. These chemicals may directly affect aquatic environment once discharged from factories, hospitals or livestock farms. In the present study, the authors assessed the potential side effect of tetracyclines (TCs) on the development of zebrafish embryos. Tetracycline hydrochloride decreased water pH from 6.4 to 4.4 at 30 mg/L. Acidified water exceeded the tolerance of zebrafish embryos in pure water during the early ten hours post fertilization (hpf). Interestingly, it was found that Ca²⁺ in the embryo medium could increase the tolerance of embryos to acidified water. Furthermore, the authors found that the protection of Ca²⁺ was not due to the formation of TCs-Ca²⁺ complexes under acidic condition, based on spectral analysis. Meanwhile it was shown that exogenous addition of Ca²⁺ could inhibit the accumulation of Ca²⁺ from the cytoplasm to the surface of embryos. The authors concluded that these results may shed light on the strategies for protecting aquatic animals from acidic environments.

Authors: Huang X, Yan Z, Zhu K, Ding S.

Full Source: Ecotoxicology & Environmental Safety. 2019 Jan 22; 172:65-71. doi: 10.1016/j.ecoenv.2019.01.050. [Epub ahead of print]

Endocrine-disrupting chemicals impair the innate immune prophenoloxidase system in the intertidal mud crab, *Macrophthalmus japonicus*

2019-03-12

Endocrine-disrupting chemicals (EDCs), xenobiotics that interfere with endogenous hormone function, have been studied for their impacts in aquatic environments. However, there is limited information about the

In the present study, the authors assessed the potential side effect of tetracyclines (TCs) on the development of zebrafish embryos.

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potentially hazardous impact of bisphenol A (BPA) and di-(2-ethylhexyl) phthalate (DEHP) on the marine environment. The aim of this study was to investigate the effects of BPA and DEHP on the immune response of the intertidal mud crab, *Macrophthalmus japonicus*. In order to examine immunological responses involving the prophenoloxidase (proPO) system, mRNA transcript and activity levels of six immune-related genes, including lipopolysaccharide and β -1,3-glucan-binding protein (LGBP), proPO, phenoloxidase (PO), peroxinectin (PE), serine protease inhibitor (Serp), and trypsin (Tryp), were assessed in *M. japonicus* hepatopancreas and gills exposed to BPA or DEHP. Expression of immune genes generally decreased in *M. japonicus* hepatopancreas and gills exposed to all concentrations of BPA by days 4 and 7. However, at day 1, expression of Serpin and Tryp genes was significantly increased in *M. japonicus* hepatopancreas and gills exposed to BPA. For DEHP exposure, all genes, with the exception of Serpin, were significantly downregulated in *M. japonicus* gills. In the hepatopancreas, gene expression of PO, proPO, and LGBP increased at day 1, and then decreased by day 7, while mRNA expression of Serpin and Tryp exhibited up-regulation over all exposure periods. In addition, PE gene expression was upregulated in hepatopancreas at day 7 in a dose-dependent manner. Taken together, these results indicated that the crab immune responses were perturbed by exposure to BPA, and, in particular, DEHP.

Authors: Park K, Kim WS, Kwak IS.

Full Source: Fish Shellfish Immunology. 2019 Jan 22; 87:322-332. doi: 10.1016/j.fsi.2019.01.025. [Epub ahead of print]

MEDICAL RESEARCH

Effects of defined mixtures of POPs and endocrine disruptors on the steroid metabolome of the human H295R adrenocortical cell line

2019-03-12

The presence of environmental pollutants in our ecosystem may impose harmful health effects to wildlife and humans. Several of these toxic chemicals have a potential to interfere with the endocrine system. The adrenal cortex has been identified as the main target organ affected by endocrine disrupting chemicals. The aim of this study was to assess exposure effects of defined and environmentally relevant mixtures of chlorinated, brominated and perfluorinated chemicals on steroidogenesis, using the H295R adrenocortical cell line model in combination with a

The aim of this study was to assess exposure effects of defined and environmentally relevant mixtures of chlorinated, brominated and perfluorinated chemicals on steroidogenesis

newly developed liquid chromatography tandem mass spectrometry (LC-MS/MS) method. By using this approach, the authors could simultaneously analyse 19 of the steroids in the steroid biosynthesis pathway, revealing a deeper insight into possible disruption of steroidogenesis. Our results showed a noticeable down-regulation in steroid production when cells were exposed to the highest concentration of a mixture of brominated and fluorinated compounds (10,000-times human blood values). In contrast, up-regulation was observed with oestrone under the same experimental condition, as well as with some other steroids when cells were exposed to a perfluorinated mixture (1000-times human blood values), and the mixture of chlorinated and fluorinated compounds. Interestingly, the low concentration of the perfluorinated mixture alone produced a significant, albeit small, down-regulation of pregnenolone, and the total mixture a similar effect on 17-hydroxypregnenolone. Other mixtures resulted in only slight deviations from the control. Indication of synergistic effects were noted when we used a statistical model to improve data interpretation. A potential for adverse outcomes of human exposures is indicated, pointing to the need for further investigation into these mixtures.

Authors: Ahmed KEM, Frøysa HG, Karlsen OA, Blaser N, Zimmer KE, Berntsen HF, Verhaegen S, Ropstad E, Kellmann R, Goksøyr A.

Full Source: Chemosphere. 2019 Mar; 218:328-339. doi: 10.1016/j.chemosphere.2018.11.057. Epub 2018 Nov 12.

Endocrine-disrupting chemicals: Effects on neuroendocrine systems and the neurobiology of social behaviour.

2019-03-12

Endocrine-disrupting chemicals (EDCs) are pervasive in the environment. They are found in plastics and plasticisers (bisphenol A (BPA) and phthalates), in industrial chemicals such as polychlorinated biphenyls (PCBs), and include some pesticides and fungicides such as vinclozolin. These chemicals act on hormone receptors and their downstream signalling pathways, and can interfere with hormone synthesis, metabolism, and actions. Because the developing brain is particularly sensitive to endogenous hormones, disruptions by EDCs can change neural circuits that form during periods of brain organization. In the present study, the authors review the evidence that EDCs affect developing hypothalamic neuroendocrine systems, and change behavioural outcomes in juvenile, adolescent, and adult life in exposed individuals, and even in their descendants. The focus is on social, communicative and sociosexual behaviours, as how an individual behaves

In the present study, the authors review the evidence that EDCs affect developing hypothalamic neuroendocrine systems, and change behavioural outcomes in juvenile, adolescent, and adult life in exposed individuals

with a same- or opposite-sex conspecific determines that individual's ability to exist in a community, be selected as a mate, and reproduce successfully.

Authors: Gore AC, Krishnan K, Reilly MP.

Full Source: Hormones and Behavior. 2018 Dec 4. pii: S0018-506X(18)30357-X. doi: 10.1016/j.yhbeh.2018.11.006. [Epub ahead of print]

Detection and Analysis of Endogenous Polar Volatile Organic Compounds (PVOCs) in Urine for Human Exposome Research

2019-03-12

The human exposome, defined as "...everything that is not the genome", comprises all chemicals in the body interacting with life processes. The exposome drives genes x environment (GxE) interactions that can cause long-term latency and chronic diseases. The exposome constantly changes in response to external exposures and internal metabolism. Different types of compounds are found in different biological media.

OBJECTIVE: Measure polar volatile organic compounds (PVOCs) excreted in urine to document endogenous metabolites and exogenous compounds from environmental exposures.

METHODS: Use headspace collection and sorbent tube thermal desorption coupled with bench-top gas chromatography - mass spectrometry (GC-MS) for targeted and non-targeted approaches. Identify and categorize PVOCs that may distinguish among healthy and affected individuals.

RESULTS: Method is successfully demonstrated to tabulate a series of 28 PVOCs detected in human urine across 120 samples from 28 human subjects. Median concentrations range from below detect to 165 ng/ml. Certain PVOCs have potential health implications.

CONCLUSIONS: Headspace collection with sorbent tubes is an effective method for documenting PVOCs in urine that are otherwise difficult to measure. This methodology can provide probative information regarding biochemical processes and adverse outcome pathways (AOPs) for toxicity testing.

Authors: O'Lenick CR, Pleil JD, Stiegel MA, Sobus JR, Wallace MAG.

Full Source": Biomarkers. 2018 Nov 26;1-17. doi: 10.1080/1354750X.2018.1548031. [Epub ahead of print]

The human exposome, defined as "...everything that is not the genome", comprises all chemicals in the body interacting with life processes.

A monoclonal antibody against *Lates calcarifer* vitellogenin and a competitive ELISA to evaluate vitellogenin induction after exposure to xenoestrogen

2019-03-12

A monoclonal antibody specific to sea bass (*Lates calcarifer*) vitellogenin (VTG) was developed, for use as a tool for monitoring endocrine disrupting chemicals (EDCs). VTG was induced in sea bass by intramuscular injection of 17β -oestradiol (E2: 2 mg/kg) every three days. Blood was collected three days after the last injection. Plasma VTG was then purified by chromatography in hydroxyapatite and a sephacryl-S300 column. Characterizations of purified VTG were done by phospholipoglycoprotein staining on a native-PAGE with confirmation by mass spectrometry (LC-MS/MS). Antibody was raised in mice by injection of purified VTG. After monoclonal antibody production, the hybridoma clone No. 41 (MAb-sea bass VTG 41) was selected and developed for quantification of VTG by competitive enzyme-linked immunosorbent assay (ELISA). The ELISA method was sensitive with a detection limit of VTG 40 ng/mL. MAb-sea bass VTG 41 was specific to VTG from E2-treated sea bass and others EDCs (Nonylphenol, Benzo[a]pyrene and CdCl₂). Moreover, cross-reactivity was also found in E2-treated coral grouper (*Epinephelus corallicola*). The ELISA method obtained from this work can be further applied for the assessment of EDCs in Thailand and Southeast Asia's aquatic environment.

Authors: Prasatkaew W, Nanthanawat P, Khongchareonporn N, Kingtong S.
Full Source: Journal of Environmental Science (China). 2019 Jan; 75:325-333. doi: 10.1016/j.jes.2018.05.001. Epub 2018 May 12.

Phosphatidylinositol 3-kinase delta pathway: a novel therapeutic target for Sjögren's syndrome

2019-03-12

The phosphatidylinositol 3-kinase delta isoform (PI3K δ) belongs to an intracellular lipid kinase family that regulate lymphocyte metabolism, survival, proliferation, apoptosis and migration and has been successfully targeted in B-cell malignancies. Primary Sjögren's syndrome (pSS) is a chronic immune-mediated inflammatory disease characterised by exocrine gland lymphocytic infiltration and B-cell hyperactivation which results in systemic manifestations, autoantibody production and loss of glandular function. Given the central role of B cells in pSS pathogenesis, the authors investigated PI3K δ pathway activation in pSS and the functional consequences of blocking PI3K δ in a murine model of focal sialoadenitis that mimics some features of pSS. Target validation assays

A monoclonal antibody specific to sea bass (*Lates calcarifer*) vitellogenin (VTG) was developed, for use as a tool for monitoring endocrine disrupting chemicals (EDCs).

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showed significant expression of phosphorylated ribosomal protein S6 (pS6), a downstream mediator of the phosphatidylinositol 3-kinase delta (PI3K δ) pathway, within pSS salivary glands. pS6 distribution was found to co-localise with T/B cell markers within pSS aggregates and the CD138+ plasma cells infiltrating the glands. In vivo blockade of PI3K δ activity with seletalisib, a PI3K δ -selective inhibitor, in a murine model of focal sialoadenitis decreased accumulation of lymphocytes and plasma cells within the glands of treated mice in the prophylactic and therapeutic regimes. Additionally, production of lymphoid chemokines and cytokines associated with ectopic lymphoneogenesis and, remarkably, saliva flow and autoantibody production, were significantly affected by treatment with seletalisib. These data demonstrate activation of PI3K δ pathway within the glands of patients with pSS and its contribution to disease pathogenesis in a model of disease, supporting the exploration of the therapeutic potential of PI3K δ pathway inhibition in this condition.

Authors: Nayar S, Campos J, Smith CG, Iannizzotto V, Gardner DH, Colafrancesco S, Papi E, Kollert F, Hunter KJ, Brewer C, Buckley CD, Bowman SJ, Priori R, Valesini G, Juarez M, Fahy WA, Fisher BA, Payne A, Allen RA, Barone F.

Full Source: *Annals of the Rheumatic Diseases*. 2019 Feb;78(2):249-260. doi: 10.1136/annrheumdis-2017-212619. Epub 2018 Nov 24.

OCCUPATIONAL RESEARCH

Adult Asthma among Workers in Ontario: Results from the Occupational Disease Surveillance System

2019-03-12

Given that approximately 15% of new onset adult asthma cases originate due to exposures in the workplace, there is a need for systematic and ongoing monitoring of risk among workers. In this study, the authors characterised the risk of new onset adult asthma among workers in Ontario. 575,379 provincial accepted time-loss workers' compensation claimants data linked to physician billing data were utilised. Workers at-risk of new onset adult asthma were followed from cohort entry date to date of diagnosis, emigration, age 65, death, or end of study period. The case definition required 2+ records for asthma within a 12-month period, within a 3-year time window following cohort entry. Cox regression models were used to generate birth year and sex-adjusted hazard ratios (HR) by occupation, industry and exposures identified using a job exposure matrix (JEM). Sex-stratified risk estimates were also generated. Increased risks were detected among well-recognised groups including bakers (HR 1.60,

In this study, the authors characterised the risk of new onset adult asthma among workers in Ontario.

95% confidence interval (CI)=1.22-2.09) and painters and decorators (HR 1.67, 95% CI=1.23-2.28). In the JEM analysis, flour and isocyanates were associated with increased risk of asthma. Concrete finishers (HR 1.93, 95% CI=1.12-3.32) and shipping and receiving clerks (HR 1.21, 95% CI=1.03-1.43) also showed elevated risk, while results varied across woodworker groups. Decreased risks were detected for nursing and farming groups. This practical data linkage approach was successful for examining associations across hundreds of jobs. Unexpected and previously unrecognised findings deserve further investigation and emphasise the importance of an ongoing system to guide research, as well as prevention.

Authors: Logar-Henderson C, MacLeod JS, Arrandale VH, Holness DL, McLeod CB, Peter A, Demers PA.

Full Source: Annals of the American Thoracic Society. 2019 Jan 25. doi: 10.1513/AnnalsATS.201810-701OC. [Epub ahead of print]

Exposure to Pesticides and Health Effects on Farm Owners and Workers From Conventional and Organic Agricultural Farms in Costa Rica: Protocol for a Cross-Sectional Study

2019-03-12

Pesticide use is increasing in low- and middle-income countries (LMICs) including Costa Rica. This increase poses health risks to farm owners, farm workers, and communities living near agricultural farms. The authors aimed to examine the health effects associated with occupational pesticide exposure in farm owners and workers from conventional and organic smallholder farms in Costa Rica. A cross-sectional study was conducted involving 300 owners and workers from organic and conventional horticultural smallholder farms in Zarcero County, Costa Rica. During the baseline study visit, a structured, tablet-based questionnaire was administered to collect data on sociodemographic characteristics, pesticide exposure, and health conditions (eg, respiratory and allergic outcomes and acute pesticide intoxication symptoms) and administered a neurobehavioral test battery (eg, Finger Tapping Test and Purdue Pegboard); we measured blood pressure, anthropometry (height, weight, and waist circumference), and erythrocytic acetylcholinesterase activity and also collected urine samples. In addition, a functional neuroimaging assessment using near-infrared spectroscopy was conducted with a subset of 50 study participants. During the follow-up study visit (~2-4 weeks after the baseline), the authors administered participants a short questionnaire on recent pesticide exposure and farming practices and collected hair, toenail, and urine samples. Urine samples will be analysed for various pesticide metabolites, whereas toenails and hair will be

The authors aimed to examine the health effects associated with occupational pesticide exposure in farm owners and workers from conventional and organic smallholder farms in Costa Rica.

analysed for manganese (Mn), a biomarker of exposure to Mn-containing fungicides. Self-reported pesticide exposure data will be used to develop exposure intensity scores using an exposure algorithm. Furthermore, exposure-outcome associations will be examined using linear and logistic mixed-effects regression models. Fieldwork for the study was conducted between May 2016 and August 2016. In total, 113 farm owners and 187 workers from 9 organic and 83 conventional horticultural smallholder farms were enrolled. Data analyses are ongoing and expected to be published between 2019 and 2020. This study is one of the first to examine differences in health effects due to pesticide exposure between farm owners and workers from organic and conventional smallholder farms in an LMIC. The authors expect that this study will provide critical data on farming practices, exposure pathways, and how occupational exposure to pesticides may affect farm owners and workers' health. Finally, it is hoped that this study will allow the authors to identify strategies to reduce pesticide exposure in farm owners and workers and will potentially lay the groundwork for a future longitudinal study of health outcomes in farm owners and workers exposed to pesticides.

Authors: Fuhrmann S, Winkler MS, Staudacher P, Weiss FT, Stamm C, Eggen RI, Lindh CH, Menezes-Filho JA, Baker JM, Ramírez-Muñoz F, Gutiérrez-Vargas R, Mora AM.

Full Source: JMIR Research Protocol. 2019 Jan 25;8(1): e10914. doi: 10.2196/10914.

Screening for hand dermatitis in healthcare workers: Comparing workplace screening with dermatologist photo screening

2019-03-12

Healthcare workers are at an increased risk for occupational contact dermatitis due to wet work exposure. Early detection and management improves outcomes. While several diagnostic tools are available, none are appropriate for rapid screening. This study assessed the validity and feasibility of the Hand Dermatitis Screening Tool in the acute healthcare sector. Screening of 508 employees at three hospitals in Ontario, Canada was done using the Hand Dermatitis Screening Tool either by an occupational health nurse (OHN, N=225) or by self-administration (N=283). Two occupational dermatologists rated photos of participants' hands. 30.5% of participants screened positive for hand dermatitis. A positive screen was associated with wet work, history of eczema, dermatitis, or other rash, and presently having a rash. Ninety-four per cent of participants reported that using the tool took < 2 minutes, 99% indicated

This study assessed the validity and feasibility of the Hand Dermatitis Screening Tool in the acute healthcare sector.

the tool was easy to use and 86% reported workplace screening to be very important. Workplace and dermatologist photo screening showed fair agreement. The prevalence of hand dermatitis and identified risk factors were consistent with the literature. These findings, along with positive feasibility results, support further testing of the tool despite only fair agreement between workplace and dermatologist screening.

Authors: Nichol K, Copes R, Kersey K, Eriksson J, Holness DL.

Full Source: Contact Dermatitis. 2019 Jan 24. doi: 10.1111/cod.13231.

[Epub ahead of print]

Biomonitoring chronic lead exposure among battery manufacturing workers in Tunisia

2019-03-12

The aim of the study was the biomonitoring of the chronic exposure to Pb by measuring its levels in blood, urine, and hair of battery workers. Blood lead (BPb), urinary lead (UPb), hair lead (HPb), and urinary δ -aminolevulinic acid (UALA) levels were determined for 52 workers in a battery plant and compared to those of 20 non-occupational exposed subjects (controls). BPb and UPb levels were determined by graphite furnace atomic absorption spectrometry (GFAAS). HPb levels were measured by triple quadrupole ICP-MS and UALA levels were determined using cation exchanger column. The measured levels were significantly higher compared to the controls exceeding the OSHA cut-off values ($p < 0.01$). The GM mean levels of BPb, UPb, UALA, and HPb of workers were 715 $\mu\text{g L}^{-1}$, 331 $\mu\text{g L}^{-1}$, 16.3 mg g^{-1} , and 234 $\mu\text{g g}^{-1}$, respectively. The GM mean levels of BPb, UPb, UALA, and HPb of controls were 93.6 $\mu\text{g L}^{-1}$, 36.3 $\mu\text{g L}^{-1}$, 1.9 mg g^{-1} , and 1.8 $\mu\text{g g}^{-1}$, respectively. Significant correlations were observed between BPb and UALA ($r = 0.630$, $p = 0.000$), UPb and UALA ($r = 0.566$, $p = 0.000$), and between BPb and HPb ($r = 0.466$, $p = 0.004$). The significant correlation between BPb and HPb suggests the usefulness of hair for assessing occupational exposure particularly when the study area presents medium to high levels of Pb pollution. The association between Pb biomarkers and potential confounding factors revealed significant influence of the occupational factor over smoking and alcohol consumption. The results of this study urge for the reinforcement of the implemented engineering controls and safety measures in order to reduce exposure and to address the health issues related to Pb poisoning.

Authors: Nouioui MA, Araoud M, Milliand ML, Bessueille-Barbier F, Amira D, Ayouni-Derouiche L, Hedhili A.

Full Source: Environmental Science & Pollution Research International.

2019 Jan 25. doi: 10.1007/s11356-019-04209-y. [Epub ahead of print]

The aim of the study was the biomonitoring of the chronic exposure to Pb by measuring its levels in blood, urine, and hair of battery workers.

Early prediction of liver carcinogenicity due to occupational exposure to pesticides

2019-03-12

Several studies linked between pesticides exposure and development of liver cancer, through several mechanisms inform of genotoxicity, cytotoxicity, tumor promotion, immunotoxicity and hormonal actions. This study aimed to estimate novel biomarkers for early prediction of liver malignancy due to occupational exposure to pesticides in two groups of workers with different socioeconomic standard (highly educated urban researchers and low educated rural pesticides sprayers). This study included 50 urban researchers and 50 rural pesticides sprayers occupationally exposed to pesticides. They were compared with 50 non-exposed urban researchers and 50 non-exposed rural subjects. Several tumor biomarkers were estimated; P53 protein, Alfa fetoprotein (AFP), and Alpha-L-fucosidase (AFU). Additionally, telomerase enzyme activity, Relative telomere length (RTL), and DNA damage using comet assay were measured. Furthermore, the glutathione-S-Transferase (GST) gene polymorphisms were identified for both exposed groups. Statistical analysis revealed elevated level of tumor biomarkers among exposed subjects relative to control groups in spite of being within the normal range. Increase in the DNA damage was detected, with shortening of telomere length and decrease in telomerase enzyme activity in pesticides-exposed subjects compared to their controls. Most of these changes were related to the levels of butyrylcholinesterase. Subjects with GSTT1 genotype were suggested to be more susceptible to hepatic carcinogenicity. Telomere relative length and comets assay together with GST genes polymorphisms could be used as early predictors for liver cancer susceptibility among pesticides exposed workers.

Authors: Saad-Hussein A, Beshir S, Taha MM, Shahy EM, Shaheen W, Abdel-Shafy EA, Thabet E.

Full Source: Mutation Research. 2019 Feb; 838:46-53. doi: 10.1016/j.mrgentox.2018.12.004. Epub 2018 Dec 12.

This study aimed to estimate novel biomarkers for early prediction of liver malignancy due to occupational exposure to pesticides in two groups of workers with different socio-economic standard

PUBLIC HEALTH RESEARCH

Profiling and comparison of toxicant metabolites in hair and urine using a mass spectrometry-based metabolomic data processing method

2019-03-12

Urine and hair are used for assessing human exposure to toxicants. Urine tests can show acute toxicant exposure. Hair analysis can be used to determine chronic toxicant exposure after months to years; however, compared to urine, hair analysis in exposure assessments is much less frequently investigated. Urine and hair are different matrices, and their mechanisms of toxicant metabolite incorporation are different. The toxicant metabolites present in urine and hair may also be different. To clarify this issue, a procedure was developed to identify toxicant metabolites in rat samples using a mass spectrometry-based metabolomic data processing method. Di-(2-propylheptyl) phthalate (DHP), an industrial plasticiser, was used as the model toxicant. The developed procedure identified not only known DHP metabolites (mono-(propyl-6-oxo-heptyl) phthalate, mono-(propyl-6-hydroxyheptyl) phthalate, and mono-(propyl-6-carboxyhexyl) phthalate) but also novel metabolites that were structurally related to DHP in the rat samples, indicating that the developed procedure successfully identified toxicant metabolites in in vivo samples. Among the 62 tentative metabolites identified from the 7th-day urine and the 28th-day hair samples, 33 were detected in only the urine samples, 19 were detected in only the hair samples, and 10 were identified in both the urine and hair samples. A total of 15 out of the 62 metabolites were confirmed as DHP structure-related metabolites based on MS/MS analysis. Among the 15 DHP structure-related metabolites, only 2 metabolites were present in both the urine and hair samples. These results suggested that the metabolites identified in urine could not be applied to exposure assessments based on hair analysis.

Authors: Shih CL, Wu HY, Liao PM, Hsu JY, Tsao CY, Zgoda VG, Liao PC.

Full Source: *Analytica Chimica Acta*. 2019 Apr 4; 1052:84-95. doi: 10.1016/j.aca.2018.11.009. Epub 2018 Nov 13.

Technical

CHEMWATCH

Using behaviour change theory to train health workers on tobacco cessation support for tuberculosis patients: a mixed-methods study in Bangladesh, Nepal and Pakistan

2019-03-12

Low- and middle-income countries (LMICs) are disproportionately impacted by interacting epidemics of tuberculosis (TB) and tobacco consumption. Research indicates behavioural support delivered by health workers effectively promotes tobacco cessation. There is, however, a paucity of training to support LMIC health workers deliver effective tobacco cessation behavioural support. The TB and Tobacco Consortium undertook research in South Asia to understand factors affecting TB health workers' delivery of tobacco cessation behavioural support, and subsequently developed a training package for LMICs. Using the "capability, opportunity, and motivation as determinants of behaviour" (COM-B) framework to understand any issues facing health worker delivery of behaviour support, we analysed 25 semi-structured interviews and one focus group discussion with TB health workers, facility in-charges, and national tuberculosis control program (NTP) staff members in each country. Results were integrated with findings of an adapted COM-B questionnaire on health worker confidence in tobacco cessation support delivery, administered to 36 TB health workers. Based on findings, we designed a guide and training programme on tobacco cessation support for health workers. Qualitative results highlighted gaps in the majority of health workers' knowledge on tobacco cessation and TB and tobacco interaction, inadequate training on patient communication, insufficient resources and staff support, and NTPs' non-prioritisation of tobacco cessation in all three countries. Questionnaire results reiterated the knowledge deficits and low confidence in patient communication. Participants suggested strengthening knowledge, skills, and competence through training and professional incentives. Based on findings, the authors developed an interactive two-day training and TB health worker guide adaptable for LMICs, focusing on evidence of best practice on TB and tobacco cessation support, communication, and rapport building with patients. TB health workers are essential in addressing the dual burden of TB and tobacco faced by many LMICs. Factors affecting their delivery of tobacco cessation support can be identified using the COM-B framework, and include issues such as individuals' knowledge and skills, as well as structural barriers like professional support through monitoring and supervision. While structural changes are needed to tackle the latter, the authors have developed an adaptable and engaging health worker

The objective of this study was to investigate the associations between ambient particulate matter exposure and pulmonary and cardiovascular diseases.

training package to address the former that can be delivered in routine TB care.

Authors: Warsi S, Eley H, Boeckmann M, Noor M, Khan A, Barua D, Nasreen S, Huque S, Huque R, Khanal S, Shrestha P, Newell J, Dogar O, Siddiqi K; TB & Tobacco consortium.

Full Source: BMC Health Services Research. 2019 Jan 25;19(1):71. doi: 10.1186/s12913-019-3909-4.

Identification of osteopontin as a biomarker of human exposure to fine particulate matter

2019-03-12

Ambient particulate matter (PM) exposure is associated with pulmonary and cardiovascular diseases; however, there is scant research linking data on animal and human cells. The objective of this study was to investigate these associations. Vascular remodelling plays a crucial role in both pulmonary and cardiovascular diseases. Therefore, we conducted a transcriptomic analysis using vascular smooth muscle cells (VSMCs) to identify potential regulators or markers of PM exposure. The authors demonstrated that fine and coarse PM increased VSMC proliferation in mice. A genome-wide cDNA microarray analysis was conducted, followed by a pathway analysis of VSMCs treated with coarse PM for durations of 24, 48, and 72 h. Sixteen genes were discovered to be time-dependently upregulated and involved in VSMC proliferation. Osteopontin (OPN) is indicated as one of the regulators of these upregulated genes. Both fine and coarse PM from industrial and urban areas significantly increased OPN expression in VSMCs and macrophages. Moreover, oropharyngeal instillation of fine and coarse PM for 8 weeks increased the VSMCs in the pulmonary arteries of mice. OPN level was consistently increased in the lung tissues, bronchoalveolar lavage fluid, and serum of mice. Moreover, the authors analysed the plasma OPN levels of 72 healthy participants recruited from the studied metropolitan area. Each participant wore a personal PM_{2.5} sampler to assess their PM_{2.5} exposure over a 24 h period. The results indicate that personal exposure to fine PM is positively correlated with plasma OPN level in young adults. The data obtained in this study suggest that exposure to fine and coarse PM may cause pulmonary vascular lesions in humans and that OPN level may be a biomarker of PM exposure in humans.

Authors: Ho CC, Wu WT, Chen YC, Liou SH, Yet SF, Lee CH, Tsai HT, Weng CY, Tsai MH, Lin P.

Full Source: Environmental Pollution. 2019 Feb; 245:975-985. doi: 10.1016/j.envpol.2018.11.071. Epub 2018 Nov 25.

This study focuses on exposure to specifically silver nanoparticles which are present in beddings and mattresses.

Is using nanosilver mattresses/pillows safe? A review of potential health implications of silver nanoparticles on human health

2019-03-12

Human exposure to engineered nanoparticles has become inevitable in today's extensive commercial use and large-scale production of engineered nanoparticles. Even though several studies have characterised the exposure to nanomaterials during wakeful state (related to occupational exposures and exposures from commercially available particles), very few studies on human exposure during sleep exist. As the study of exposure to all possible nanomaterials during sleep is extensive, this study focuses on exposure to specifically silver nanoparticles which are present in beddings and mattresses. The reasoning behind the use of silver nanoparticles in bedding and related materials, possible routes of entry to various population groups in several sleep positions, exposure characterisation and toxicity potential of such silver nanoparticles are reviewed in this study. The toxicity potential of silver nanoparticles in vivo tests with relation to mammals and in vitro tests on human cells has been tabulated to understand the risks associated during oral, dermal and inhalation exposure to silver nanoparticles. The exposure to humans with regard to dermal absorption and oral intake has been summarised. Although potential inhalation exposure to silver nanoparticles is increasing, only a few studies address the possible toxic effect of inhaled silver particles. Determination of exposure to silver nanoparticles in beddings is a topic that has been less researched, and this review aims to provide background information for future research and help establish a comprehensive risk assessment during sleep in the times of increasing usage of nanoparticles in our daily activities. Despite the current limitations of our understanding, risk assessments must utilise the available data and apply extrapolation procedures in the face of uncertainty, in order to address the needs of regulatory programs. This would enable safe use of the antimicrobial properties of silver nanoparticles without negatively impacting human health. Until then, it would be better to adopt a conservative approach on the usage of silver nanoparticles in daily used commercial items.

Authors: Prasath S, Palaniappan K.

Full Source: Environmental Geochemistry and Health. 2019 Jan 22. doi: 10.1007/s10653-019-00240-7. [Epub ahead of print]

This study explored the effects of long-term bathing in radon hot springs on oxidative damage and antioxidation function in humans.

Technical

CHEMWATCH

Changes of 8-OHdG and TrxR in the Residents Who Bathe in Radon Hot Springs

2019-03-12

This study explored the effects of long-term bathing in radon hot springs on oxidative damage and antioxidation function in humans. In this study, blood was collected from residents in the Pingshan radon hot spring area (RHSA), Jiangzha RHSA, and control area (CA). 8-Hydroxydeoxyguanosine (8-OHdG) and thioredoxin reductase (TrxR), representing oxidation and antioxidant levels, respectively, were analysed as indices. Compared to the CA group, the RHSA group in the Pingshan and Jiangzha areas showed significantly decreased 8-OHdG levels ($Z = -3.350, -3.316$, respectively, $P < .05$) and increased TrxR levels ($Z = 2.394, 3.773$, respectively, $P < .05$). The RHSA and CA groups in Jiangzha had lower levels of TrxR and 8-OHdG compared to those in Pingshan. This finding may be related to the different radon concentration levels, bathing time and other factors. Results suggested that long-term bathing in radon hot spring may activate antioxidant function and reduce oxidative damage in the body.

Authors: Yanxiao G, Mei T, Gang G, Xiaochun W, Jianxiang L.

Full Source: Dose Response. 2019 Jan 7;17(1):1559325818820974. doi: 10.1177/1559325818820974. eCollection 2019 Jan-Mar.