

## Contents

CHEMWATCH

(click on page numbers for links)

### ENVIRONMENTAL RESEARCH

- Characteristics of growth and microcystin production of *Microcystis aeruginosa* exposed to low concentrations of naphthalene and phenanthrene under different pH values..... 3
- Development and use of interspecies correlation estimation models in China for potential application in water quality criteria ..... 3
- Suspect screening of plastic-related chemicals in northern pike (*Esox lucius*) from the St. Lawrence River, Canada. .... 4
- The dataset for antifeedant activity of eugenol derived compounds against red palm weevil (*Rhynchophorus ferrugineus*, Olivier) larvae..... 5
- Green kiwifruit extracts protect motor neurons from death in a spinal muscular atrophy model in *Caenorhabditis elegans* ..... 5

### MEDICAL RESEARCH

- Oestrogen-related receptor  $\gamma$  is a novel target for Lower-Chlorinated Polychlorinated Biphenyls and their hydroxylated and sulfated metabolites ..... 6
- Developmental Exposure to a Mixture of Unconventional Oil and Gas Chemicals Increased Risk-Taking Behaviour, Activity and Energy Expenditure in Aged Female Mice After a Metabolic Challenge ..... 7
- Mono-2-ethylhexyl phthalate (MEHP) promoted lipid accumulation via JAK2/STAT5 and aggravated oxidative stress in BRL-3A cells ..... 8
- Characterisation of rat glutathione transferases in olfactory epithelium and mucus ..... 9
- Toxicogenomic analyses of the effects of BDE-47/209, TBBPA/S and TCBPA on early neural development with a human embryonic stem cell in vitro differentiation system..... 9

### OCCUPATIONAL RESEARCH

- EXPO-S.T.O.P. 2016 and 2017 blood exposure surveys: An alarming rise ...10
- Declining blood lead levels among small-scale miners participating in a safer mining pilot programme in Nigeria..... 11
- Antifibrotic treatment response and prognostic predictors in patients with idiopathic pulmonary fibrosis and exposed to occupational dust ..... 12
- Setting up a collaborative European human biological monitoring study on occupational exposure to hexavalent chromium..... 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

An atypical *Bacillus anthracis* infection in a bull-A potential occupational health hazard.....13

### PUBLIC HEALTH RESEARCH

Biomonitoring of populations in Western New York at risk for exposure to Great Lakes contaminants.....14

German Environmental Specimen Bank: 24-hour urine samples from 1999 to 2017 reveal rapid increase in exposure to the parathalate plasticiser di(2-ethylhexyl) terephthalate (DEHTP).....15

Do stressful life events during pregnancy modify associations between phthalates and anogenital distance in newborns?.....16

Oxidative Stress Markers, Trace Elements and Endocrine Disrupting Chemicals in Children with Hashimoto's Thyroiditis.....17

Chemical characterisation and bioactivity of phenolics from Tieguanyin oolong tea .....18

### ENVIRONMENTAL RESEARCH

#### Characteristics of growth and microcystin production of *Microcystis aeruginosa* exposed to low concentrations of naphthalene and phenanthrene under different pH values

2019-11-05

In the present study, *Microcystis aeruginosa* (*M. aeruginosa*) was studied to analyse the effects of 0.5 mg L<sup>-1</sup> naphthalene and 0.05 mg L<sup>-1</sup> phenanthrene on profiles of cell growth, chlorophyll-a content and Microcystin-LR (MC-LR) production at different pH values. The results indicated that for both the naphthalene and phenanthrene treatments, the specific growth rates were higher in pH 10.0 than in either pH 7.0 or pH 5.0. In the presence of low concentrations of naphthalene or phenanthrene, chlorophyll-a in medium increased significantly more in pH 10.0 than pH 5.0. chlorophyll-a in cell was significantly lowered when exposed to naphthalene in both pH 10.0 and pH 7.0, and was higher when exposed to phenanthrene in pH 10.0 than pH 5.0. HPLC analysis revealed that the extracellular MC-LR concentrations in *M. aeruginosa* exposed to either naphthalene or phenanthrene were lower than in control *M. aeruginosa* at pH 5.0. The intracellular MC-LR levels in toxic *M. aeruginosa* cells exposed to naphthalene or phenanthrene were higher than in the controls at pH 10.0. The study suggests that the MC-LR production of *M. aeruginosa* was affected by the pH value when low concentrations of either naphthalene or phenanthrene were present in the water. These results indicate that the pH value should not be ignored when evaluating the risk of chemicals that promote MC-LR production in eutrophic waters.

Huang Y, Pan H, Liu H, Xi Y, Ren D.

Full Source: *Toxicol.* 2019 Nov; 169:103-108. doi: 10.1016/j.toxicol.2019.09.004. Epub 2019 Sep 5.

In the present study, *Microcystis aeruginosa* (*M.*

#### Development and use of interspecies correlation estimation models in China for potential application in water quality criteria

2019-11-05

Establishment of numerical water quality criteria (WQC) has brought increasing interest in China. However, toxicity data to develop robust WQC values (number of toxicity data  $\geq 8$ ) of contaminants based solely on endemic and indigenous species are insufficient. In this study, interspecies correlation estimation (ICE) models were developed using a combination of North American ICE models supplemented with China-specific

species to resolve this problem. A total of 207 significant surrogate-predicted models ( $p < 0.05$ , F-test) were derived: 119, 66 and 22 models for vertebrates, invertebrates and plant surrogate species, respectively. Model cross-validation success rate ( $\geq 80\%$ ), mean square error (MSE,  $\leq 0.54$ ),  $R^2$  ( $\geq 0.78$ ) and taxonomic distance ( $\leq 4$ , within the same class) were selected as guiding criteria to screen the resulted ICE models. The differences of 5th percentile hazard concentrations (HC5s) for 6 chemicals (2,4-dichlorophenol, triclosan, tetrabromobisphenol A, nitrobenzene, perfluorooctane sulfonate and octabromodiphenyl ether) calculated from ICE-based and measured toxicity-based SSDs were within 3-fold among models. Although the number of derived ICE models was not comprehensive and continues to be improved, they can already be used in the development of WQC targeting protection of aquatic life and environmental risk assessments for chemicals lacking toxicity data.

Authors: Wang X, Fan B, Fan M, Belanger S, Li J, Chen J, Gao X, Liu Z.  
Full Source: Chemosphere. 2019 Sep 16; 240:124848. doi: 10.1016/j.chemosphere.2019.124848. [Epub ahead of print]

### Suspect screening of plastic-related chemicals in northern pike (*Esox lucius*) from the St. Lawrence River, Canada.

2019-11-05

Environmental contaminant monitoring traditionally relies on targeted analysis, and very few tools are currently available to monitor “unexpected” or “unknown” compounds. In the present study, a non-targeted workflow (suspect screening) was developed to investigate plastic-related chemicals and other environmental contaminants in a top predator freshwater fish species, the northern pike, from the St. Lawrence River, Canada. Samples were extracted using sonication-assisted liquid extraction and analysed by high performance liquid chromatography coupled with quadrupole time of flight mass spectrometry (HPLC-QTOF-MS). Ten bisphenol compounds were used to test the analytical performances of the method, and satisfactory results were obtained in terms of instrumental linearity ( $r^2 > 0.97$ ), recoveries, (86.53-119.32%), inter-day precision and method detection limits. The non-targeted workflow data processing parameters were studied, and the peak height filters (peak filtering step) were found to influence significantly the capacity to detect and identify trace chemicals in pike muscle extracts. None of the ten bisphenol analogues were detected in pike extracts suggesting the absence of accumulation for these chemicals in pike muscle. However, the non-targeted workflow enabled the identification of diethyl phthalate (DEP) and

In the present study, a non-targeted workflow (suspect screening) was developed to investigate plastic-related chemicals and other environmental contaminants in a top predator freshwater fish species, from the St. Lawrence River, Canada.

perfluorooctanesulfonic acid (PFOS) in pike extracts. This approach thus can be also applied to various contaminants in other biological matrices and environmental samples.

Authors: Tian L, Verreault J, Houde M, Bayen S.

Full Source: Environmental Pollution. 2019 Sep 11;255(Pt 1):113223. doi: 10.1016/j.envpol.2019.113223. [Epub ahead of print]

### The dataset for antifeedant activity of eugenol derived compounds against red palm weevil (*Rhynchophorus ferrugineus*, Olivier) larvae

2019-11-05

*Rhynchophorus ferrugineus* or red palm weevil (RPW) is a destructive insect pest of major cultivated palms such as coconut, date and oil palm. One of the control management of RPW is trunk injection using monocrotophos or methamidophos, but these chemicals are found to affect ecosystems and human health. Thus, in the present study, the authors aimed to determine a bio-pesticide to replace these synthetic chemicals. The antifeedant activity of three eugenol-based compounds were tested as potential control agent against RPW larvae in vitro condition for two weeks. All these compounds show significant effect as feeding deterrent agent on 4th instar larvae, while WN16 (4-allyl-2-methoxy-1-(4-trifluoromethyl-benzyloxy)-benzene) shows the highest feeding deterrent index (FDI = 64.42%). Here the data regarding the biological aspect on treated RPW larvae as well as antifeedant activity index of these eugenol derived compounds is presented.

Authors: Yan TK, Asari A, Abdullah S, Ismail M, Azmi WA.

Full Source: Data Brief. 2019 Jul 8; 25:104227. doi: 10.1016/j.dib.2019.104227. eCollection 2019 Aug.

### Green kiwifruit extracts protect motor neurons from death in a spinal muscular atrophy model in *Caenorhabditis elegans*

2019-11-05

Kiwifruit is considered a functional food and a good source of nutraceuticals. Among the possible beneficial effects of kiwifruit species, a neuroprotective activity exerted in rats with learning and memory impairment induced by exposure to different chemicals was reported. In this study, the authors sought to investigate the neuroprotective activities of kiwifruit toward spinal muscular atrophy (SMA). To this purpose, the authors have used a recently developed *Caenorhabditis elegans* SMA

In the present study, the authors aimed to determine a bio-pesticide to replace these synthetic chemicals.

## Technical

### CHEMWATCH

model, displaying an age-dependent degeneration of motor neurons detected as locomotory defects, disappearance of fluorescent markers, and apoptotic death of targeted neurons. Although an anti-nematode activity is reported for kiwifruit, it has been verified that neither green (*Actinidia deliciosa*, cultivar Hayward) nor gold (*Actinidia chinensis*, cultivar Hort 16A) kiwifruit extracts cause detectable effects on wild-type *C. elegans* growth and life cycle. Conversely, green kiwifruit extracts have a clear effect on the *C. elegans* SMA model by partially rescuing the degeneration and death of motor neurons and the locomotion impairment. The gold species does not show the same effect. The components responsible for the neuroprotection are macromolecules with a molecular weight higher than 3 kDa, present in the green and not in the yellow kiwifruit. In conclusion, this is the first study reporting a protective activity of green kiwifruit toward motor neurons. In addition, it has been demonstrated that *C. elegans* is an animal model suitable to study the biological activities contained in kiwifruit. Therefore, this model can be exploited for future investigations aimed at identifying kiwifruit molecules with potential applications in the field of human health.

Authors: Mazzarella N, Giangrieco I, Visone S, Santonicola P, Achenbach J, Zampi G, Tamburrini M, Di Schiavi E, Ciardiello MA.

Full Source: Food Science & Nutrition. 2019 Jun 17;7(7):2327-2335. doi: 10.1002/fsn3.1078. eCollection 2019 Jul.

## MEDICAL RESEARCH

### Oestrogen-related receptor $\gamma$ is a novel target for Lower-Chlorinated Polychlorinated Biphenyls and their hydroxylated and sulfated metabolites

2019-11-05

Airborne lower-chlorinated PCBs are vulnerable to metabolism to PCB sulfates through further sulfation of the hydroxylated metabolites (OH-PCBs). However, studies on the toxic effects and mechanisms of PCB sulfates are still very limited. In the present study, the authors investigated for the first time the potential endocrine disruption effects of PCB sulfates through oestrogen-related receptor  $\gamma$  (ERR $\gamma$ ) in comparison with their OH-PCBs precursors and PCB parent compounds. The binding affinity of thirteen PCBs/OH-PCBs/PCB sulfates was measured by using fluorescence competitive binding assays based on fluorescence polarization (FP). All of the tested chemicals could bind to ERR $\gamma$  with the  $K_d$  (dissociation constant) values ranging from not available (NA) to 3.2  $\mu$ M 4-OH-PCB 12

In the present study, the authors investigated for the first time the potential endocrine disruption effects of PCB sulfates through oestrogen-related receptor  $\gamma$  (ERR $\gamma$ ) in comparison with their OH-PCBs precursors and PCB parent compounds.

showed the highest binding affinity with  $K_d$  value of  $3.2 \mu\text{M}$ , which was comparable to that of a synthetic ERR $\gamma$  agonist GSK4716. The effects of the thirteen chemicals on the ERR $\gamma$  transcriptional activity were determined by using the luciferase reporter gene assay. It was found that the PCBs/OH-PCBs/PCB sulfates acted as agonists for ERR $\gamma$ , with the lowest observed effective concentration reaching  $3 \mu\text{M}$ . The binding affinity and agonistic activity of PCBs towards ERR $\gamma$  were both enhanced after hydroxylation, while further sulfation of OH-PCBs decreased the activity instead. Molecular docking simulation showed that OH-PCBs had lower binding energy than the corresponding PCBs and PCB sulfates, indicating that OH-PCBs had higher binding affinity theoretically. In addition, OH-PCBs could form hydrogen bonds with amino acids Glu316 and Arg247 while PCBs and PCB sulfates could not, which might be the main factor impacting the binding affinity and agonistic activity. Overall, ERR $\gamma$  is a novel target for lower-chlorinated PCBs and their metabolites.

Authors: Cao LY, Ren XM, Guo LH.

Full Source: Environmental Pollution. 2019 Nov;254(Pt B):113088. doi: 10.1016/j.envpol.2019.113088. Epub 2019 Aug 27.

### Developmental Exposure to a Mixture of Unconventional Oil and Gas Chemicals Increased Risk-Taking Behaviour, Activity and Energy Expenditure in Aged Female Mice After a Metabolic Challenge

2019-11-05

Chemicals used in unconventional oil and gas (UOG) operations can act as endocrine disrupting chemicals and metabolic disruptors. The authors have reported altered energy expenditure and activity in C57BL/6J mice that were preconceptionally, gestationally, and lactationally exposed via maternal drinking water to a laboratory-created mixture of 23 UOG chemicals from gestational day 1 to postnatal day 21 in 7-month-old female mice with no change in body composition. The authors hypothesised that allowing the mice to age and exposing them to a high fat, high sugar diet might reveal underlying changes in energy balance. To investigate whether aging and metabolic challenge would exacerbate this phenotype, these mice were aged to 12 months and given a high fat, high sugar diet (HFHSD) challenge. The short 3-day HFHSD challenge increased body weight and fasting blood glucose in all mice. Developmental exposure to the 23 UOG mixture was associated with increased activity and non-resting energy expenditure in the light cycle, increased exploratory behaviour in the elevated plus maze test, and decreased sleep in 12-month female mice. Each of these effects was seen in the light

Chemicals used in unconventional oil and gas (UOG) operations can act as endocrine disrupting chemicals and metabolic disruptors.

cycle when mice are normally less active. Further studies are needed to better understand the behavioural changes observed after developmental exposure to UOG chemicals.

Authors: Balise VD, Cornelius-Green JN, Parmenter B, Baxter S, Kassotis CD, Rector RS, Thyfault JP, Paterlini S, Palanza P, Ruiz D, Sargis R, Nagel SC.  
Full Source: *Frontiers in Endocrinology* (Lausanne). 2019 Jul 25; 10:460. doi: 10.3389/fendo.2019.00460. eCollection 2019.

### Mono-2-ethylhexyl phthalate (MEHP) promoted lipid accumulation via JAK2/STAT5 and aggravated oxidative stress in BRL-3A cells

2019-11-05

Mono-2-ethylhexyl phthalate (MEHP), as the major metabolite of Di-(2-ethylhexyl) phthalate (DEHP), can induce lipid accumulation in hepatocytes and further leads to non-alcoholic fatty liver disease (NAFLD), while the underlying mechanism is unclear. The authors aim to clarify the effects of JAK2/STAT5 pathway on lipid accumulation induced by MEHP and the role of oxidation stress in NAFLD. BRL-3A hepatocytes were exposed to MEHP (0, 10, 50, 100 and 200  $\mu$ M) for 24 h and 48 h. Then the lipid droplets in cells were observed by Oil-Red-O staining and quantified by isopropyl alcohol. The levels of TG, SOD, TBARS, AST and ALT were all detected by commercial kits. RT-PCR was used to detect mRNA expression, and western blotting was used to detect the expression of proteins encoded by JAK2/STAT5 pathway genes and lipid metabolism-related genes. As a result, MEHP promoted the lipid synthesis and accumulation in BRL-3A cells. MEHP down-regulated the expression and inhibited the activation of JAK2/STAT5. Moreover, the lipid metabolism-related kinases levels were elevated after MEHP exposure. In addition, the SOD levels were gradually decreased and the TBARS levels were increased in MEHP-treated groups. The lipid metabolism-related proteins levels were correlated with the oxidation stress levels. Furthermore, the ALT and AST levels were elevated after MEHP exposure. Therefore, the authors concluded that MEHP led to lipid accumulation through inhibiting JAK2/STAT5 pathway, resulted in damaging liver parenchyma and NAFLD by aggravating oxidation stress.

Authors: Zhang Y, Wang S, Zhao T, Yang L, Guo S, Shi Y, Zhang X, Zhou L, Ye L.

Full Source: *Ecotoxicology & Environmental Safety*. 2019 Nov 30; 184:109611. doi: 10.1016/j.ecoenv.2019.109611. Epub 2019 Sep 3.

Mono-2-ethylhexyl phthalate (MEHP), as the major metabolite of Di-(2-ethylhexyl) phthalate (DEHP), can induce lipid accumulation in hepatocytes and further leads to non-alcoholic fatty liver disease (NAFLD), while the underlying mechanism is unclear.

### Characterisation of rat glutathione transferases in olfactory epithelium and mucus

2019-11-05

The olfactory epithelium is continuously exposed to exogenous chemicals, including odorants. During the past decade, the enzymes surrounding the olfactory receptors have been shown to make an important contribution to the process of olfaction. Mammalian xenobiotic metabolising enzymes, such as cytochrome P450, esterases and glutathione transferases (GSTs), have been shown to participate in odorant clearance from the olfactory receptor environment, consequently contributing to the maintenance of sensitivity toward odorants. GSTs have previously been shown to be involved in numerous physiological processes, including detoxification, steroid hormone biosynthesis, and amino acid catabolism. These enzymes ensure either the capture or the glutathione conjugation of a large number of ligands. Using a multi-technique approach (proteomic, immunocytochemistry and activity assays), the results indicate that GSTs play an important role in the rat olfactory process. First, proteomic analysis demonstrated the presence of different putative odorant metabolising enzymes, including different GSTs, in the rat nasal mucus. Second, GST expression was investigated in situ in rat olfactory tissues using immunohistochemical methods. Third, the activity of the main GST (GSTM2) odorant was studied with in vitro experiments. Recombinant GSTM2 was used to screen a set of odorants and characterise the nature of its interaction with the odorants. These results support a significant role of GSTs in the modulation of odorant availability for receptors in the peripheral olfactory process.

Authors: Heydel JM, Menetrier F, Belloir C, Canon F, Faure P, Lirussi F, Chavanne E, Saliou JM, Artur Y, Canivenc-Lavier MC, Briand L, Neiers F.  
Full Source: PLoS One. 2019 Jul 24;14(7): e0220259. doi: 10.1371/journal.pone.0220259. eCollection 2019.

### Toxicogenomic analyses of the effects of BDE-47/209, TBBPA/S and TCBPA on early neural development with a human embryonic stem cell in vitro differentiation system

2019-11-05

Flame retardants are detected in the environment worldwide, and thus pose great risks to human health. The potential effects of these chemicals on the development of the central nervous system, have recently raised public concern. In this study, to explore the toxicity of these chemicals during the early developmental stages of the human central nervous

The olfactory epithelium is continuously exposed to exogenous chemicals, including odorants.

system, the authors induced human embryonic stem cells to differentiate into neural ectoderm in the presence of five halogenated flame retardants, BDE-47, BDE-209, TBBPA, TBBPS and TCBPA, individually or in combination. A set of neural development-related biological processes that responded to these chemicals were identified, by analysing the whole transcriptional changes. The authors confirmed the RNA-seq results by qRT-PCR and found that transcription factors crucial for neural development, such as ZIC1, ZIC3, HES3, IGFBP3 and DLX5, were dysregulated by those chemicals. In addition, the five flame retardants might also influence axon growth/guidance and neuron transmission-related processes, by dysregulating genes including CNTN2, SLIT1, LRRC4C, RELN, CBLN1, CHRNB4 and GDF7. Furthermore, the chemical treatments seemed to interfere with the WNT and AHR signalling pathways. Overall, the current findings revealed that BDE-209 had similar toxicity as BDE-47, whereas TBBPS and TCBPA might not be safe alternatives to TBBPA. Interestingly, no obvious synergistic effects were observed when the authors mixed those five flame retardants together.

Authors: Liang S, Liang S, Yin N, Hu B, Faiola F.

Full Source: Toxicology & Applied Pharmacology. 2019 Jul 18; 379:114685. doi: 10.1016/j.taap.2019.114685. [Epub ahead of print]

## OCCUPATIONAL RESEARCH

### EXPO-S.T.O.P. 2016 and 2017 blood exposure surveys: An alarming rise

2019-11-05

The annual Exposure Survey of Trends in Occupational Practice (EXPO-S.T.O.P.), conducted by the Association of Occupational Health Professionals in Healthcare, provides a U.S. national overview of sharps injuries (SIs) and mucocutaneous exposures (MCEs). This study presents the 2016 and 2017 surveys. An 18-item survey was distributed to Association of Occupational Health Professionals in Healthcare members and colleagues and requested total SIs and MCEs; SI in nurses, doctors, and surgery; staffed beds; teaching status; full-time equivalent staff (FTE), nurse FTE, and average daily census (ADC). In 2016, 170 hospitals reported 10,271 exposures (72.9% SIs); in 2017, 224 hospitals reported 12,672 exposures (74.4% SIs). In 2016, SI rates were 27.0 per 100 ADC, 2.3 per 100 FTE, and 2.8 per 100 nurse FTE. Of the total SIs, 36.4% were nurses, 35.6% were doctors, and 39.0% occurred during surgery. In 2017, the respective SI rates were 27.7 per 100 ADC, 2.5 per 100 FTE, and 2.7 per 100 nurse FTE. Of the total SIs, 37.6% were nurses, 32.7% were doctors, and

## Technical

### CHEMWATCH

39.9% occurred during surgery. In 2016, MCE rates were 11.2 per 100 ADC and 0.82 per 100 FTE, and in 2017, MCE rates were 9.6 per 100 ADC and 0.87 per 100 FTE. Teaching hospitals had higher rates than nonteaching hospitals. EXPO-S.T.O.P. SI rates have risen year-on-year for 3 years and now match 2001-2005 levels. There is an urgent need for aggressive SI-reduction strategies, including leadership support, safety-engineered devices (SED) training/education, and adoption of safer, less user-dependent SED. Further research on SI mechanisms, SED effectiveness, and reduction strategies is required.

Authors: Grimmond T, Good L.

Full Source: American Journal of Infection Control. 2019 Aug 8. pii: S0196-6553(19)30684-4. doi: 10.1016/j.ajic.2019.07.004. [Epub ahead of print]

### Declining blood lead levels among small-scale miners participating in a safer mining pilot programme in Nigeria

2019-11-05

In this study, the authors aimed to monitor blood lead levels (BLLs) of miners and ore processors participating in a pilot program to reduce lead poisoning and take-home exposures from artisanal small-scale gold mining. A medical surveillance program was established to assess exposures as new methods aimed at reducing lead exposures from ore were introduced in a community in Nigeria where children experienced substantial lead-related morbidity and mortality. Extensive outreach and education were offered to miners, and investments were made to adopt wet methods to reduce exposures during mining and processing. The authors conducted medical surveillance, including a physical exam and repeated blood lead testing, for 61 miners selected from among several hundred who participated in the safer mining pilot programme and consented to testing. Venous blood lead concentrations were analysed using the LeadCare II device at approximately 3-month intervals over a period of 19 months. Overall geometric mean (GM) BLLs decreased by 32% from 31.6 to 21.5  $\mu\text{g}/\text{dL}$  during the 19-month project. Women had a somewhat lower reduction in GM BLLs (23%) compared with men (36%). There was a statistically significant reduction in log BLLs from baseline to the final test taken by each participant ( $p < 0.001$ ). The observed reductions in GM BLLs during the pilot intervention among this representative group of miners and ore processors demonstrated the effectiveness of the safer mining program in this community. Such measures are feasible,

In this study, the authors aimed to monitor blood lead levels (BLLs) of miners and ore processors participating in a pilot program to reduce lead poisoning and take-home exposures from artisanal small-scale gold mining.

cost-effective and can greatly improve health outcomes in mining communities.

Authors: Gottesfeld P, Meltzer G, Costello S, Greig J, Thurtle N, Bil K, Mwangombe BJ, Nota MM.

Full Source: Occupational & Environmental Medicine. 2019 Sep 5. pii: oemed-2019-105830. doi: 10.1136/oemed-2019-105830. [Epub ahead of print]

### Antifibrotic treatment response and prognostic predictors in patients with idiopathic pulmonary fibrosis and exposed to occupational dust

2019-11-05

Idiopathic Pulmonary Fibrosis (IPF) is an aggressive interstitial lung disease with an unpredictable course. Occupational dust exposure may contribute to IPF onset, but its impact on antifibrotic treatment and disease prognosis is still unknown. In the present study, the authors evaluated clinical characteristics, respiratory function and prognostic predictors at diagnosis and at 12-month treatment of pirfenidone or nintedanib in IPF patients according to occupational dust exposure. A total of 115 IPF patients were recruited. At diagnosis, the authors collected demographic, clinical characteristics, occupational history. Pulmonary function tests were performed and two prognostic indices [Gender, Age, Physiology (GAP) and Composite Physiologic Index (CPI)] calculated, both at diagnosis and after the 12-month treatment. The date of long-term oxygen therapy (LTOT) initiation was recorded during the entire follow-up (mean = 37.85, range 12-60 months). At baseline, patients exposed to occupational dust [ $\geq 10$  years ( $n=62$ )] showed a lower percentage of graduates (19.3% vs 54.7%;  $p=0.04$ ) and a higher percentage of asbestos exposure (46.8% vs 18.9%;  $p=0.002$ ) than patients not exposed [ $< 10$  years ( $n=53$ )]. Both at diagnosis and after 12 months of antifibrotics, no significant differences for respiratory function and prognostic predictors were found. The multivariate analysis confirmed that occupational dust exposure did not affect neither FVC and DLCO after 12-month therapy nor the timing of LTOT initiation. Occupational dust exposure lasting 10 years or more does not seem to influence the therapeutic effects of antifibrotics and the prognostic predictors in patients with IPF.

Authors: Casillo V, Cerri S, Ciervo A, Stendardo M, Manzoli L, Flacco ME, Manno M, Bocchino M, Luppi F, Boschetto P.

Full Source: BMC Pulmonary Medicine. 2019 Sep 5;19(1):170. doi: 10.1186/s12890-019-0930-7.

In the present study, the authors evaluated clinical characteristics, respiratory function and prognostic predictors at diagnosis and at 12-month treatment of pirfenidone or nintedanib in IPF patients according to occupational dust exposure.

### Setting up a collaborative European human biological monitoring study on occupational exposure to hexavalent chromium

2019-11-05

The EU human biomonitoring initiative, HBM4EU, aims to co-ordinate and advance human biomonitoring (HBM) across Europe. Within its remit, the project is gathering new, policy relevant, EU-wide data on occupational exposure to relevant priority chemicals and developing new approaches for occupational biomonitoring. In this study, the hexavalent chromium [Cr(VI)] study design is presented as the first example of this HBM4EU approach. This study involves eight European countries and plans to recruit 400 workers performing Cr(VI) surface treatment e.g. electroplating or stainless- steel welding activities. The aim is to collect new data on current occupational exposure to Cr(VI) in Europe and to test new methods for Cr biomonitoring, specifically the analysis of Cr(VI) in exhaled breath condensate (EBC) and Cr in red blood cells (RBC) in addition to traditional urinary total Cr analyses. Furthermore, exposure data will be complemented with early biological effects data, including genetic and epigenetic effects. Personal air samples and wipe samples are collected in parallel to help informing the biomonitoring results. We present standard operational procedures (SOPs) to support the harmonised methodologies for the collection of occupational hygiene and HBM samples in different countries.

Authors: Santonen T, Alimonti A, Bocca B, Duca RC, Galea KS, Godderis L, Göen T, Gomes B, Hanser O, Iavicoli I, Janasik B, Jones K, Kiilunen M, Koch HM, Leese E, Leso V, Louro H, Ndaw S, Porrás SP, Robert A, Ruggieri F, Scheepers PTJ, Silva MJ, Viegas S, Wasowicz W, Castano A, Sepai O.  
Full Source: Environmental Research. 2019 Jul 10; 177:108583. doi: 10.1016/j.envres.2019.108583. [Epub ahead of print]

The aim is to collect new data on current occupational exposure to Cr(VI) in Europe and to test new methods for Cr biomonitoring, specifically the analysis of Cr(VI) in exhaled breath condensate (EBC) and Cr in red blood cells (RBC) in addition to traditional urinary total Cr analyses.

### An atypical *Bacillus anthracis* infection in a bull-A potential occupational health hazard

2019-11-05

*Bacillus anthracis* infecting cattle is usually identified based on the typical symptom: sudden death. *Bacillus anthracis* causing atypical symptoms may remain undiagnosed and represent a potential occupational health hazard for, that is veterinarians and producers, butchers and tanners. In the year 2004, one case of sudden death in a dairy farm in southern Finland was diagnosed as bovine anthrax. Four years later 2008, an atypical case of anthrax was diagnosed in the same holding. The bull was taken to

## Technical

### CHEMWATCH

the Production Animal Hospital of the Faculty of Veterinary Medicine, University of Helsinki because of fever, loss of appetite and a symmetrically swollen scrotal sac. Penicillin treatment cured the fever but not the swollen scrotum. Before the intended therapeutic castration, a punctuate consisting of 10 ml fluid collected into a syringe from the scrotal sac was cultivated on blood agar at 37°C. After 24 hr, an almost pure culture of a completely non-haemolytic *Bacillus cereus*-like bacteria was obtained. The strain was identified as *B. anthracis* using Ba-specific primers by the Finnish Food Safety Authority (RUOKAVIRASTO). After the diagnosis, the bull was euthanised and destroyed, the personnel were treated with prophylactic antibiotics and the clinic was disinfected. In this particular case, treatment with water, Virkon S and lime seemed to be effective to eliminate endospores and vegetative cells since no relapses of anthrax have occurred in 10 years. This case is the last reported anthrax case in Finland.

Authors: Friman M, Kakko L, Constantin C, Simojoki H, Andersson MA, Nagy S, Salonen H, Andersson M.

Full Source: Reproduction in Domestic Animals. 2019 Jul 26. doi: 10.1111/rda.13532. [Epub ahead of print]

## PUBLIC HEALTH RESEARCH

### Biomonitoring of populations in Western New York at risk for exposure to Great Lakes contaminants

2019-11-05

The New York State Department of Health conducted the Healthy Fishing Communities Program in collaboration with the Agency for Toxic Substances and Disease Registry to assess human exposure to contaminants common to Lake Ontario, Lake Erie and surrounding rivers and waterways among populations in western New York State who eat locally caught fish. The program enrolled licensed anglers and Burmese refugees and immigrants, living near four designated Great Lakes Areas of Concern: Buffalo River, Niagara River, Eighteenmile Creek, and the Rochester Embayment. These target populations were sampled and enrolled independently into the program between February and October of 2013. A core set of contaminants were measured in blood and urine of 409 licensed anglers and 206 Burmese refugees and immigrants which included lead, cadmium, mercury, PCBs, PBDEs, organochlorine pesticides (hexachlorobenzene, mirex, DDT, DDE, and chlordane and its metabolites oxychlordane and trans-Nonachlor), and PFOS and PFOA. Biomonitoring results showed that both groups had higher geometric means for blood

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lead, total blood mercury, and serum PFOS compared to the 2013-2014 NHANES reference levels. The Burmese refugee group also showed higher geometric means for creatinine-adjusted urine mercury and lipid-adjusted serum DDE compared to national levels. Licensed angler participants reported eating a median of 16 locally caught fish meals in the past year. Burmese participants consumed local fish throughout the year, and most frequently in the summer (median 39 fish meals or 3 times a week). The study results provide valuable information on populations at high risk of exposure to contaminants in the Great Lakes Basin of western New York. The results provide the foundation for developing and implementing public health actions to reduce potential exposures to Great Lakes pollutants.

Authors: Savadatti SS, Liu M, Caglayan C, Reuther J, Lewis-Michl EL, Aldous KM, Parsons PJ, Kannan K, Rej R, Wang W, Palmer CD, Steuerwald AJ, Wattigney WA, Irvin-Barnwell E, Hwang SA.

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**German Environmental Specimen Bank: 24-hour urine samples from 1999 to 2017 reveal rapid increase in exposure to the para-phthalate plasticiser di(2-ethylhexyl) terephthalate (DEHTP).**

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The worldwide plasticiser markets are facing constant substitution processes. Many classic ortho-phthalate plasticizers like di(2-ethylhexyl) phthalate (DEHP) are phased out, due to their proven toxicity to reproduction. Assumedly less critical, less regulated plasticizers such as di(2-ethylhexyl) terephthalate (DEHTP) are increasingly applied in consumer near products like toys, food contact materials, and medical devices. With the increasing use of DEHTP, increasing exposures of the general population have to be expected likewise. Human biomonitoring is a well-established tool to determine population exposures. In the present study, the authors investigate the time trend of exposure to DEHTP using 24-hour urine samples of the German Environmental Specimen Bank (ESB) collected from 1999 to 2017. In these samples (60 per odd-numbered year, 600 samples in total) collected from young German adults (20-29 years, equal gender distribution) we determined four specific urinary metabolites as biomarkers of DEHTP exposure. From 1999 to 2009, the main specific urinary metabolite 5cx-MEPTP was quantifiable in <10% of the samples. Thereafter, detection rates and levels constantly increased, in line with rapidly increasing DEHTP consumption volumes. In 2017, all

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samples had 5cx-MEPTP levels above the limit of quantification (LOQ) with a median concentration of 3.35 µg/L (95th percentile: 12.8 µg/L). The other metabolites were detected less frequently and at lower levels but correlated well with 5cx-MEPTP robustly confirming the increasing DEHTP exposure. All 5cx-MEPTP concentrations were well below the German health-based guidance value (HBM-I) of 2800 µg/L for adults. Likewise, the median calculated daily intake, based on 5cx-MEPTP measured in 2017, was 0.74 µg/kg bw d (95th percentile: 3.86 µg/kg bw d), still well below the tolerable daily intake (TDI) of 1000 µg/kg bw d. Based on current toxicological knowledge we can hence conclude that for the population investigated, DEHTP exposure gives no reason for immediate concern. However, the steep ongoing increase of DEHTP exposure warrants further close monitoring in the future, preferably also in sub-populations with known higher exposures to plasticizers, especially children.

Authors: Lessmann F, Kolossa-Gehring M, Apel P, Rütther M, Pälmeke C, Harth V, Brüning T, Koch HM.

Full Source: Environment International. 2019 Nov; 132:105102. doi: 10.1016/j.envint.2019.105102. Epub 2019 Sep 3.

### Do stressful life events during pregnancy modify associations between phthalates and anogenital distance in newborns?

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Anogenital distance (AGD) has been used as a marker of foetal androgen action to identify endocrine disrupting chemicals. A US study (TIDES) has reported that the association between some phthalates and reduced AGD in males was only apparent in sons of mothers reporting no stressful life events (SLEs) during pregnancy. The objective of the current study was to examine the potential modifying effect of SLEs and their subjective impact on associations between prenatal phthalates and AGD. First trimester urines from the MIREC Study were analysed for phthalate metabolites and AGD was measured in neonates. Post-delivery, the women answered questions on SLEs during the pregnancy. Women reporting 1 or more SLEs during pregnancy were considered a "higher stressor" group, whereas women reporting no SLEs or who reported a SLE that was perceived as not at all stressful were considered a "lower stressor" group. Multivariable linear regression models were fit stratified by stressor group. Maternal stressor, AGD and phthalates results were available for 153 females and 147 males. A summary measure of androgen-disrupting phthalates ( $\Sigma$  AD) was associated with significantly longer AGDs in females from the higher stressor group. These effect sizes were increased when the perceived

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impact was restricted to moderately or very much stressful. In males, all phthalates were associated with longer anopenile distance (APD), regardless of stressor group; however, higher  $\Sigma$  AD was associated with significantly longer APD in the lower stressor group. In contrast to the TIDES study, the authors did not observe shorter AGDs in male infants prenatally exposed to di-(2-ethylhexyl) phthalates, regardless of maternal stressor level. In conclusion, we were unable to replicate the findings of the TIDES study, but did find some evidence that prenatal SLEs may modify associations between phthalates and female AGD. Further research with other populations and measures of prenatal stress may shed more light on whether prenatal stress is an important effect modifier of associations between phthalates (or other chemicals) and anogenital distance.

Authors: Arbuckle TE, MacPherson S, Barrett E, Muckle G, Séguin JR, Foster WG, Sathyanarayana S, Dodds L, Fisher M, Agarwal A, Monnier P, Walker M, Fraser WD.

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### Oxidative Stress Markers, Trace Elements and Endocrine Disrupting Chemicals in Children with Hashimoto's Thyroiditis

2019-11-05

In this study, the authors aimed to investigate whether bisphenol A (BPA) and di(2-ethylhexyl) phthalate (DEHP) exposure has any association with Hashimoto's thyroiditis (HT) and its biomarkers and to determine whether oxidative stress biomarkers and trace element levels showed any alterations in children with HT. The authors found that superoxide dismutase and glutathione peroxidase activities are lower in HT group from control (24% and 46% respectively,  $p < 0.05$ ). Zinc levels were significantly lower in HT group vs. control. In addition, the levels of mono(2-ethylhexyl) phthalate (MEHP) which is the primary metabolite for DEHP, were markedly higher in HT group compared to control ( $p < 0.05$ ). A negative correlation was observed between urinary BPA levels and fT4. In children with HT, oxidant/antioxidant balance is changed and these differences may be related by EDC exposure, the importance of which should be elucidated with further studies.

Authors: Sur U, Erkekoglu P, Bulus AD, Andiran N, Kocer-Gumusel B.

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### Chemical characterisation and bioactivity of phenolics from Tieguanyin oolong tea

2019-11-05

Phenolics are the main bioactive components in tea and greatly contribute to human health. Three phenolic-enriched extracts, the ethyl acetate fraction (TEF), n-butanol fraction (TBF), and water fraction (TWF), were obtained from Tieguanyin oolong tea, which is considered a typical type of semi-fermented tea. The chemicals in the extracts and their antioxidant activity and cytotoxicity against 4T1 breast cancer cells were investigated in the present work. TEF was found to have the highest contents of phenolics, flavonoids, procyanidins, sugars, and catechin monomers. Meanwhile, TEF exhibited the strongest antioxidant capacity, which may be due to its abundant bioactive compounds, as validated by Pearson correlation and hierarchical clustering analysis. Furthermore, TEF showed greater inhibition of the growth of 4T1 murine breast cancer cells than TBF and TWF. Fermentation during the processing of oolong tea causes many alterations in polyphenols, leading to different bioactivities. In the present work, three phenolic-enriched extracts, the ethyl acetate fraction (TEF), n-butanol fraction (TBF), and water fraction (TWF), were obtained from Tieguanyin oolong tea. Further tests showed that TEF and TBF from Tieguanyin oolong tea possessed remarkable antioxidant activity and inhibitory potential inhibition of the growth of 4T1 murine breast cancer cells in vitro due to their main bioactive compounds, including phenolics and flavonoids. Thus, the phenolic-enriched extracts from Tieguanyin tea are expected to have a potential application in the food and pharmaceutical industries after further study.

Authors: Wang Y, Kong D, Gao Y, Ying L, Huang Q, Xu P.

Full Source: Journal of Food Biochemistry. 2019 Jul;43(7): e12894. doi: 10.1111/jfbc.12894. Epub 2019 May 15.

Phenolics are the main bioactive components in tea and greatly contribute to human health.