

# Bulletin Board

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### ENVIRONMENTAL RESEARCH

#### Biotransformation of Phthalate Plasticizers and Bisphenol A by Marine-Derived, Freshwater, and Terrestrial Fungi

2020-02-28

Phthalate esters (PEs, Phthalates) are environmentally ubiquitous as a result of their extensive use as plasticizers and additives in diverse consumer products. Considerable concern relates to their reported xenoestrogenicity and consequently, microbial-based attenuation of environmental PE concentrations is of interest to combat harmful downstream effects. Fungal PE catabolism has received less attention than that by bacteria, and particularly fungi dwelling within aquatic environments remain largely overlooked in this respect. We have compared the biocatalytic and biosorptive removal rates of di-n-butyl phthalate (DBP) and diethyl phthalate (DEP), chosen to represent two environmentally prominent PEs of differing structure and hydrophobicity, by marine-, freshwater-, and terrestrial-derived fungal strains. Bisphenol A, both an extensively used plastic additive and prominent environmental xenoestrogen, was included as a reference compound due to its well-documented fungal degradation. Partial pathways of DBP metabolism by the ecophysiologicaly diverse asco- and basidiomycete strains tested were proposed with the help of UPLC-QTOF-MS analysis. Species specific biochemical reaction steps contributing to DBP metabolism were also observed. The involved reactions include initial cytochrome P450-dependent monohydroxylations of DBP with subsequent further oxidation of related metabolites, de-esterification via either hydrolytic cleavage or cytochrome P450-dependent oxidative O-dealkylation, transesterification, and demethylation steps - finally yielding phthalic acid as a central intermediate in all pathways. Due to the involvement of ecophysiologicaly and phylogenetically diverse filamentous and yeast-like fungi native to marine, freshwater, and terrestrial habitats the results of this study outline an environmentally ubiquitous pathway for the biocatalytic breakdown of plastic additives. Beyond previous research into fungal PE metabolism which emphasizes hydrolytic de-esterification as the primary catabolic step, a prominent role of cytochrome P450 monooxygenase-catalyzed reactions is established.

Authors: Carstens L, Cowan AR, Seiwert B, Schlosser D

Full Source: *Frontiers in microbiology*. 2020 Feb 28;11:317. doi: 10.3389/fmicb.2020.00317. eCollection 2020.

Considerable concern relates to their reported xenoestrogenicity and consequently, microbial-based attenuation of environmental PE concentrations is of interest to combat harmful downstream effects.

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### Bridging the Information Gap Between Science and Society: A Solution to Non-Point Source Contamination?

2020-03-19

The dissemination of information associated with scientific achievement serves to advance research and guide future experimentation. In the sphere of environmental science, such advancements aim to better characterize harmful chemicals and the factors that influence in situ toxicity, which is central to the protection of environments upon which humans depend. While some information regarding the dangers associated with common anthropogenic contaminants reaches wider audiences, the nuance of this information is often lost, potentially leading to ineffective solutions, specifically as it relates to nonpoint source contamination. Bridging the divide between scientific research, regulatory implementation, and product innovation is imperative to find meaningful and lasting environmental solutions. Road de-icing salts are applied to impervious surfaces to protect human health and maintain the efficient transportation of goods by roadways during winter months. The toxicity of these salts in freshwater ecosystems is well understood and researched within the scientific community. Tentative regulations and solutions developed to mitigate the environmental damage caused by road de-icing salts, however, perfectly represents the disconnect between the scientific community and general public. Here, we use road de-icing salt as an example of how such disconnects can manifest in the form of ineffective solutions and regulatory standards and present a general framework by which environmental scientists can more effectively bridge the gap between the scientific community and society at large. This article is protected by copyright. All rights reserved.

Authors: Nutile SA, Simpson AM, Solan ME

Full Source: Integrated Environmental Assessment and Management. 2020 Mar 19. doi: 10.1002/ieam.4269. [Epub ahead of print]

### Evaluation and development of models for estimating the sorption behaviour of pharmaceuticals in soils

2020-03-05

Sorption is one of the key process that affects the fate and mobility of pharmaceuticals in the soil environment. Several models have been developed for estimating the sorption of organic chemicals, including ionisable compounds, in soil. However, the applicability of these models to pharmaceuticals has not been extensively tested. In this study, we generated a high-quality dataset on the sorption of twenty-one

Bridging the divide between scientific research, regulatory implementation, and product innovation is imperative to find meaningful and lasting environmental solutions.

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pharmaceuticals in different soil types and used these data to evaluate existing models and to develop new improved models. Sorption coefficients ( $K_d$ ) of the pharmaceuticals ranged from 0.2 to 1249.2 L/kg. Existing models were unable to adequately estimate the measured sorption data. Using the data, new models were developed, incorporating molecular and soil descriptors, that outperformed the published models when evaluated against external data sets. While there is a need for further evaluation of these new models against broader sorption datasets obtained at environmentally relevant concentrations, in the future they could be highly useful in supporting environmental risk assessment and prioritization efforts for pharmaceutical ingredients.

Authors: Li J, Carter LJ, Boxall ABA

Full Source: Journal of hazardous materials. 2020 Mar 5;392:122469. doi: 10.1016/j.jhazmat.2020.122469. [Epub ahead of print]

### Changes in the environmental microbiome in the Anthropocene

2020-03-20

The Earth's surface is increasingly affected by human activity, from the loss of biodiversity to chemical pollution. Human impacts on the Earth ecosystem are so fundamental that a stratigraphic signature in sediments and ice has been produced. This has led to the proposal of a new geological epoch, the Anthropocene (Waters et al., 2016). The start of the early Anthropocene is marked by the spread of agriculture and deforestation, as well as large-scale species exchange. Technological revolutions in the mid-20th century fueled rapid population growth and industrialization, leading to diverse geochemical signatures, such as pollution from synthetic chemicals, and metals, and enrichment of nutrients.

Authors: Zhu YG, Penuelas J

Full Source: Global change biology. 2020 Mar 20. doi: 10.1111/gcb.15086. [Epub ahead of print]

### Development of General Exposure Factors for Risk Assessment in Korean Children

2020-03-18

There has been an increasing need for the risk assessment of external environmental hazards in children because they are more sensitive to hazardous chemical exposure than adults. Therefore, the development of general exposure factors is required for appropriate risk assessment

Human impacts on the Earth ecosystem are so fundamental that a stratigraphic signature in sediments and ice has been produced.

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in Korean children. This study aimed to determine the general exposure factors among Korean children aged  $\leq 18$  years. We developed the recommended exposure factors across five categories: physiological variables, inhalation rates, food and drinking water intake, time-activity patterns, and soil and dust ingestion. National databases were used, and direct measurements and questionnaire surveys of representative samples were performed to calculate the inhalation rate, water intake, and soil ingestion rate. With regard to the time-activity patterns, the daily inhalation rates ranged from  $9.49 \text{ m}^3/\text{day}$  for children aged 0-2 years to  $14.98 \text{ m}^3/\text{day}$  for those aged 16-18 years. This study found that Korean children spent an average of 22.64 h indoors, 0.63 h outdoors, and 0.73 h in-transit on weekdays. The general exposure factors of Korean children were studied for the first time, and these results could be used to assess children's exposure and risk. They also suggest the differences compared with the results of international results.

Authors: Yoon H, Yoo SK, Seo J, Kim T, Kim P, Kim PJ, Park J, Heo J, Yang W  
Full Source: International journal of environmental research and public health. 2020 Mar 18;17(6). pii: E1988. doi: 10.3390/ijerph17061988.

### Concentrations and profiles of organochlorine contaminants in North Pacific resident and transient killer whale (*Orcinus orca*) populations

2020-03-09

Organochlorine (OC) profiles have been used as chemical "fingerprints" to infer an animal's foraging area. North Pacific killer whale (*Orcinus orca*) populations are exposed to different levels and patterns of OCs based on their prey, distribution, and amount of time spent in a particular area. To characterize concentrations and profiles of OCs found in various populations of North Pacific killer whales, polychlorinated biphenyls (PCBs), including dioxin-like congeners, DDTs, and hexachlorobenzene (HCB), were measured in biopsy blubber samples of photo-identified resident (fish-eating) and transient (mammal-eating) killer whales collected from 1994 through 2002 from Russian Far East waters to the waters of the west coast of the United States, representing 10 populations. We compared blubber OC concentrations based on ecotype (resident vs. transient), sex and reproductive maturity, and geographic area. We also examined OC mixtures to determine if we could detect segregated geographical areas (foraging areas) among the six populations with sufficient sample sizes. Transients had significantly higher OC concentrations than residents and adult male whales had consistently higher OC levels compared to adult females, regardless of ecotype. Our

North Pacific killer whale (*Orcinus orca*) populations are exposed to different levels and patterns of OCs based on their prey, distribution, and amount of time spent in a particular area.

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OC profile findings indicate segregated foraging areas for the North Pacific killer whales, consistent with observations of their geographic distributions. Several potential health risks have also been associated with exposure to high levels of contaminants in top-level predators including reproductive impairment, immune suppression, skeletal deformities, and carcinoma. The results of this baseline study provide information on the geographic distribution of OCs found in North Pacific killer whales, results which are crucial for assessing the potential health risks associated with OC exposure in this species.

Authors: Lawson TM, Ylitalo GM, O'Neill SM, Dahlheim ME, Wade PR, Matkin CO, Burkanov V, Boyd DT

Full Source: The science of the total environment. 2020 Mar 9;722:137776. doi: 10.1016/j.scitotenv.2020.137776. [Epub ahead of print]

## CHEMICAL EFFECTS

### Association between olfactory sensitivity and behavioral responses of *Drosophila suzukii* to naturally occurring volatile compounds

2020-03-19

*Drosophila suzukii* Matsumura (Diptera: Drosophilidae) is an invasive, destructive crop pest that originated in South East Asia. *D. suzukii* recently invaded Western countries and is threatening both European and American fruit industries. It is extremely attracted to otherwise undamaged, ripening fruits, unlike most other *Drosophila* species that attack only decaying or rotten fruits. Recent studies on different insect species showed that several naturally occurring compounds of easy market availability showing deterrent action may be used to supplement mass catches with food traps. Based on these considerations, the aim of the present work was to test the effects of some natural compounds (alone or in the mixture) on the olfactory system of the *D. suzukii* and the behavioral responses evoked. We measured by electroantennogram (EAG) recordings, the olfactory sensitivity of antennae to increasing concentrations of eugenol, vanillin, menthol, cis-jasmone; eugenol + vanillin, +menthol, +cis-jasmone; vanillin + menthol, +cis-jasmone. In addition, the behavioral responses to the same compounds and mixtures were evaluated. Our electrophysiological results show a dose-response relationship between the EAG amplitudes and the increasing concentrations of the olfactory compound. The behavioral results show that the number of laid eggs is significantly different

It is extremely attracted to otherwise undamaged, ripening fruits, unlike most other *Drosophila* species that attack only decaying or rotten fruits.

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between the standard diet and the standard diet + natural compound. These results underline a specificity in the olfactory sensitivity and in the ovipositing behavior of *D. suzukii* females; also, they could be valuable for the identification of key chemicals aimed at the future development of strategies in the management and control of this harmful insect for crops. Authors: Corda G, Solari P, Dettori MA, Fabbri D, Delogu G, Crnjar R, Sollai G Full Source: Archives of insect biochemistry and physiology. 2020 Mar 19:e21669. doi: 10.1002/arch.21669. [Epub ahead of print]

### QSAR modeling with ETA indices for cytotoxicity and enzymatic activity of diverse chemicals

2020-03-10

The discharge of huge amount of chemicals from industries into the environment has led to toxicity towards different living species. Therefore, risk assessment of these chemicals is essential. In order to comply with the ethical issues, in this present work, we have developed quantitative structure-activity relationship (QSAR) models for cytotoxicity against GFS (goldfish scale) tissue (*Crassius auratus*) and enzymatic activity against PLHC-1 cell line (topminnow hepatoma cell line) (*Poeciliopsis lucida*). The final models were developed by means of PLS (Partial Least Squares) regression method applying only ETA (extended topochemical atom) descriptors. The results obtained from various validation parameters (obtained from the both datasets) suggested that the developed models are statistically robust and predictive. From the insights obtained from the models developed from the Neutral Red dye (NR) dataset, it can be concluded that presence of bulky atoms, unsaturation, branching and hetero atoms (most importantly N, Cl) enhance the cytotoxicity towards the Goldfish scale tissue. On the other hand, in case of the Ethoxyresorufin-O-deethylase (EROD) dataset, presence of higher electronegative atoms (O, Cl), polycyclic aromatic hydrocarbons (PAHs) with more number of rings and absence of polar groups and hydrogen bond acceptors enhance enzymatic activity of the PLHC-1 cell line.

Authors: Seth A, Ojha PK, Roy K

Full Source: Journal of Hazardous Materials. 2020 Mar 10;394:122498. doi: 10.1016/j.jhazmat.2020.122498. [Epub ahead of print]

Therefore, risk assessment of these chemicals is essential.



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**Multi-residue analysis of several high-production-volume chemicals present in the particulate matter from outdoor air. A preliminary human exposure estimation.**

2020-03-16

A multi-residue method based on gas chromatography-mass spectrometry combined with pressurised liquid extraction was developed to determine seven organophosphate esters (OPEs), six phthalate esters (PAEs), four benzotriazoles (BTRs), five benzothiazoles (BTHs) and four benzenesulfonamides (BSAs) in particulate matter samples from outdoor air. All of these compounds are among the named high-production volume chemicals (HPVCs) and some of them have shown to be harmful to human, therefore they have been subject for legal regulation in order to control their production and usage. Under optimised conditions, high recovery values (>80%) and low detection limits ( $\text{pg m}^{-3}$ ) were obtained for most of the compounds with accuracy values between 83% and 118%. Some samples from two locations surrounded by different industry activities showed the widespread occurrence of all the PAEs, followed by some OPEs. Diethylhexyl phthalate (DEHP) was the most abundant compound with concentrations ranging from 1.9 to 97.7  $\text{ng m}^{-3}$ . With the concentrations found, estimated daily intakes through outdoor inhalation were calculated for each contaminant and for different population groups classified by age (infants, children and adults) in two possible exposure scenarios (low and high). Then, hazard quotients and carcinogenic risks were estimated for several compounds, those that had toxicological parameters available. This preliminary result showed no significant risks via ambient inhalation for the exposed population, however more research is needed to confirm the present results.

Authors: Maceira A, Pecikoza I, Marcé RM, Borrull F

Full Source: Chemosphere. 2020 Mar 16;252:126514. doi: 10.1016/j.chemosphere.2020.126514. [Epub ahead of print]

**In 1 tour group, 5 of 30 members were ill; 3 cases were laboratory confirmed.**

## PHARMACEUTICAL/TOXICITY

**Early introduction of Severe Acute Respiratory Syndrome Coronavirus 2 into Europe**

2020-03-20

Early infections with severe acute respiratory syndrome coronavirus 2 in Europe were detected in travelers from Wuhan, China, in January 2020. In 1 tour group, 5 of 30 members were ill; 3 cases were laboratory confirmed.

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In addition, a healthcare worker was infected. This event documents early importation and subsequent spread of the virus in Europe.

Authors: Oisen SJ, Chen MY, Liu YL, Witschi M, Ardoin A, Calba C, Mathieu P, Masserey V, Maraglino F, Marro S, Penttinen P, Robesyn E, Pukkila J, European COVID-19 Work Group

Full Source: *Emergency Infectious Diseases*. 2020 Mar 20;26(7). doi: 10.3201/eid2607.200359. [Epub ahead of print]

### Secondary visual loss due to inhalation and cutaneous poisoning by methanol and toluene. Presentation of a clinical case.

2020-03-17

Methanol poisoning is often described in the literature, but not transdermal or inhalational poisoning. It usually involves variable multi-organ damage, among which visual, neurological, and gastrointestinal involvement, as well as the metabolic and electrolyte changes that can lead to death. Contact with toluene by occupational or intentional inhalation may also cause neurological abnormalities. This article describes the case of a female patient who was seen in the Emergency Department due to bilateral visual loss secondary to accidental poisoning (inhalation-transdermal) with a solvent containing methanol and toluene. She had a favourable outcome during admission after treatment with ethanol in perfusion and corticosteroids.

Authors: Gómez Perera S, Rodríguez Talavera I, Tapia Quijada HE, Guerrero-Martir M, Diaz de Aguilar Osona M, Falcón Roca R

Full Source: *Archivos de la Sociedad Española de Oftalmología*. 2020 Mar 17. pii: S0365-6691(20)30068-X. doi: 10.1016/j.ofal.2020.02.004. [Epub ahead of print]

Contact with toluene by occupational or intentional inhalation may also cause neurological abnormalities.

### Maternal exposure to a human relevant mixture of persistent organic pollutants reduces colorectal carcinogenesis in A/J Min/+ mice

2020-03-13

An increased risk of developing colorectal cancer has been associated with exposure to persistent organic pollutants (POPs) and alteration in the gut bacterial community. However, there is limited understanding about the impact of maternal exposure to POPs on colorectal cancer and gut microbiota. This study characterized the influence of exposure to a human relevant mixture of POPs during gestation and lactation on colorectal cancer, intestinal metabolite composition and microbiota in the A/J Min/+

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mouse model. Surprisingly, the maternal POP exposure decreased colonic tumor burden, as shown by light microscopy and histopathological evaluation, indicating a restriction of colorectal carcinogenesis. <sup>1</sup>H nuclear magnetic resonance spectroscopy-based metabolomic analysis identified alterations in the metabolism of amino acids, lipids, glycerophospholipids and energy in intestinal tissue. In addition, 16S rRNA sequencing of gut microbiota indicated that maternal exposure modified fecal bacterial composition. In conclusion, the results showed that early-life exposure to a mixture of POPs reduced colorectal cancer initiation and promotion, possibly through modulation of the microbial and biochemical environment. Further studies should focus on the development of colorectal cancer after combined maternal and dietary exposures to environmentally relevant low-dose POP mixtures.

Authors: Johanson SM, Swann JR, Umu ÖCO, Aleksandersen M, Müller MHB, Berntsen HF, Zimmer KE, Østby GC, Paulsen JE, Ropstad E  
Full Source: Chemosphere. 2020 Mar 13;252:126484. doi: 10.1016/j.chemosphere.2020.126484. [Epub ahead of print]

### Synthesis and SAR studies of novel 1,2,4-oxadiazole-sulfonamide based compounds as potential anticancer agents for colorectal cancer therapy.

2020-03-13

A diverse series of 1,2,4-oxadiazoles based substituted compounds were designed, synthesized and evaluated as anticancer agents targeting carbonic anhydrase IX (CAIX). Initial structure-activity analysis suggested that the thiazole/thiophene-sulfonamide conjugates of 1,2,4-oxadiazoles exhibited potent anticancer activities with low  $\mu\text{M}$  potencies. Compound OX12 exhibited antiproliferative activity ( $\text{IC}_{50} = 11.1 \mu\text{M}$ ) along with appreciable inhibition potential for tumor-associated CAIX ( $\text{IC}_{50} = 4.23 \mu\text{M}$ ) isoform. Therefore, OX12 was structurally optimized and its SAR oriented derivatives (OX17-27) were synthesized and evaluated. This iteration resulted in compound OX27 with an almost two-fold increase in antiproliferative effect ( $\text{IC}_{50} = 6.0 \mu\text{M}$ ) comparable to the clinical drug doxorubicin and significantly higher potency against CAIX ( $\text{IC}_{50} = 0.74 \mu\text{M}$ ). Additionally, OX27 treatment decreases the expression of CAIX, induces apoptosis and ROS production, inhibited colony formation and migration of colon cancer cells. Our studies provide preclinical rationale for the

Initial structure-activity analysis suggested that the thiazole/thiophene-sulfonamide conjugates of 1,2,4-oxadiazoles exhibited potent anticancer activities with low  $\mu\text{M}$  potencies.

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further optimization of identified OX27 as a suitable lead for the possible treatment of CRC.

Authors: Shamsi F, Hasan P, Queen A, Hussain A, Khan P, Zeya B, King HM, Rana S, Garrison J, Alajmi MF, Rizvi MMA, Zahid M, Imtaiyaz Hussan M, Abid M

Full Source: Bio-organic Chemistry. 2020 Mar 13;98:103754. doi: 10.1016/j.bioorg.2020.103754. [Epub ahead of print]

### A study on the relationship between air pollution and pulmonary tuberculosis based on the general additive model in Wulumuqi, China

2020-03-18

#### OBJECTIVE:

Our purpose was to explore the impact of atmospheric pollutants on the incidence of tuberculosis and provide new ideas for the prevention and control of tuberculosis in the future.

#### METHODS:

We explored the relationship between air pollutants and meteorological factors, as well as between air pollutants and heating through Spearman correlation analysis and rank sum test. Additionally, we analyzed the relationship between air pollutants and tuberculosis incidence using the general additive model. Statistical analysis results at the  $P < 0.05$  level were considered significant.

#### RESULTS:

Three months after exposure to air pollutants ( $PM_{2.5}$ ,  $SO_2$ ,  $NO_2$  and CO), tuberculosis incidence increased. However, tuberculosis incidence increased 9 months after exposure to  $PM_{10}$ . The single pollutant model showed when concentrations of  $PM_{2.5}$ ,  $PM_{10}$ ,  $SO_2$ ,  $NO_2$ , CO and  $O_3$  increased by  $1 \mu g/m^3$  (or  $1 mg/m^3$ ), the number of tuberculosis cases would increase 0.09%, 0.08%, 0.58%, 0.42%, 6.9% and 0.57%, respectively. The optimal multi-pollutant model was a two-factor model ( $PM_{10} + NO_2$ ).

#### CONCLUSION:

Air pollutants including  $PM_{2.5}$ ,  $PM_{10}$ ,  $SO_2$ ,  $NO_2$ , CO and  $O_3$  increased the risk of tuberculosis. Few studies have been conducted in this area of research, especially regarding the mechanism; thus, the results of this study should contribute to our understanding of TB incidence and prompt additional research.

Authors: Jiandog Y, Mengxi Z, Yanggui C, Li M, Rayibai Y, Yaoqin L, Lengwei L, Yujiao P, Ran X, Baolin R

Full Source: International Journal of Infectious Diseases: IJIF: official publication of the International Society for Infectious Diseases. 2020 Mar

Three months after exposure to air pollutants ( $PM_{2.5}$ ,  $SO_2$ ,  $NO_2$  and CO), tuberculosis incidence increased.

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18. pii: S1201-9712(20)30164-8. doi: 10.1016/j.ijid.2020.03.032. [Epub ahead of print]

### OCCUPATIONAL

#### Twelve-week study of moxa smoke: occupational exposure in female rats

2020-04-01

##### OBJECTIVE:

To assess the toxicity of moxa smoke in rats.

##### METHODS:

Forty-eight female Wister rats were randomly divided into 4 groups (n = 12/group) to simulate moxa smoke exposure in Chinese medicine clinics (CMCs): the control group, and three moxa-smoke exposed groups of PM10 mass concentrations 3-5, 7-9 and 27-30 mg/m<sup>3</sup>, respectively. These concentrations were 1 ×, 2-3 ×, and 7-9 × fold the concentrations found in CMCs. Exposures continued for 12 weeks (200 min/d, 5 d/week).

##### RESULTS:

No deaths were noted. After the exposure, the body weights, ratios of organ weight to body weight, urinary parameters, hematological parameters, clinical chemistry parameters and microscopic examinations revealed no obvious toxicity.

##### CONCLUSION:

Moxa smoke did not induce toxic effects in female rats in the study. These findings provide new evidence to the toxicity of moxa smoke.

Authors: Han L, Liu C, Sun W, Yang X, Zhang C, Zhao B, Huang C, Yang J, Wnag L, Bai H, Liu J, Lim M, He R, Huang J, Liu P, Ju D, Lao L

Full Source: Journal of traditional Chinese medicine – Chung i tsa chih ying wen pan. 2019 Apr;39(2):207-212.

Determination of airborne CFR was done by environmental sampling with active samplers, 11 of which were stationary and 19 personal samplings.

#### Occupational exposure to carbon fibers impregnated with epoxy resins and evaluation of their respirability

2020-03-20

**Objectives:** The study aims to investigate occupational exposure to carbon fibers impregnated with epoxy resins (carbon fiber reinforced [CFR]) in workers at an airplane fuselage section construction plant, by environmental and biological monitoring.

**Materials and methods:** Determination of airborne CFR was done by environmental sampling with active samplers, 11 of which were stationary and 19 personal samplings. The subsequent analyses were performed

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in the scanning electron microscope fitted with an X-ray microanalysis system (SEM-EDXA). Biological monitoring was carried out by determining CFR in exhaled breath condensate (EBC) collected from 19 male workers who wore personal environmental samplers (exposed workers) and from 10 male workers at the same factory who had no occupational exposure to CFR (internal controls). CFR analysis was done by SEM, applying the method used for determining asbestos fibers in aqueous samples.

**Results:** The airborne CFR concentrations were found to be significantly higher ( $p=0.03$ ) at personal samplings (median value 7.01 ff/L, range 1.24-11.16 ff/L) than stationary samplings (median value 1.93 ff/L, range 0.55-10.09 ff/L). The aerodynamic diameters calculated starting from the length and geometric diameter of the sampled CFRs were always higher than 20  $\mu\text{m}$ . CFR was not found in any of the EBC samples collected from the exposed workers and controls.

**Conclusions:** Despite the evidence of occupational exposure to low concentrations of CFR, the absence of such fibers in the EBC in the exposed workers confirms their non-respirability, as expected based on their aerodynamic diameter.

Authors: Lovreglio P, Stufano A, Mele D, Acquafredda P, Cottica D, Gardinali F, Vimercati L, Soleo L, De Palma G

Full Source: Inhalation Toxicology. 2020 Mar 20:1-5. doi:

10.1080/08958378.2020.1735582. [Epub ahead of print]

### Artisanal and small-scale gold mining: A cross-sectional assessment of occupational mercury exposure and exposure risk factors in Kadoma and Shurugwi, Zimbabwe.

2020-03-11

In artisanal and small-scale gold mining (ASGM) the toxic metal mercury is used for gold extraction. The objective of this cross-sectional study was to assess mercury concentrations in urine and blood and mercury-related symptoms of participants identifying themselves as miners from Kadoma and Shurugwi, Zimbabwe. Moreover, we aimed to explore possible risk factors influencing mercury body burden. In 2019, urine and blood samples of 207 participants were collected and analyzed for mercury using atomic absorption spectroscopy. All participants answered questions regarding their exposure risks. The median urine mercury value was 4.75  $\mu\text{g/L}$  with a maximum of 612  $\mu\text{g/L}$ . Median mercury concentration in creatinine corrected urine values was 3.98  $\mu\text{g/g}$  with a maximum value of 478  $\mu\text{g/g}$ . The median blood mercury value was 2.70  $\mu\text{g/L}$  with a maximum of 167  $\mu\text{g/L}$ . Correlations between exposure risks factors such as the lack of retort use and elevated mercury values were demonstrated. ASGM is very

In 2019, urine and blood samples of 207 participants were collected and analyzed for mercury using atomic absorption spectroscopy.

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common in Zimbabwe. Thus, mercury exposure is a major occupational health risk for miners. Moreover, this study emphasizes the impact of exposure risk factors on the mercury body burden.

Authors: Mambrey V, Rakete S, Tobollik M, Shoko D, Moyo D, Schutzmeier P, Steckling-Muschack N, Muteti-Fana S, Bose-O'Reilly S

Full Source: Environmental research. 2020 Mar 11;184:109379. doi: 10.1016/j.envres.2020.109379. [Epub ahead of print]

### Fractional Exhaled Nitric Oxide and Nanomaterial Exposure in Workplaces

2020-03-20

#### BACKGROUND:

The widespread application of engineered nanomaterials (ENMs) and the increasing likelihood of general and occupational exposure raised concerns on their possible human health impact. ENMs, in fact, may induce alterations in different organ systems, and particularly in the respiratory tract. This makes important to identify possible biomarkers of early lung effect in exposed workers. In this regard, the possibility to use the fractional exhaled levels of nitric oxide (FENO) in biological monitoring has attracted great interest.

#### OBJECTIVE:

To comprehensively assess the role of FENO as a possible biomarker of lung effect in ENM exposed workers.

#### METHODS:

A systematic search was performed on Pubmed, Scopus, and ISI Web of Knowledge databases according to the PRISMA guidelines.

#### RESULTS:

Seven studies investigated FENO in workers exposed to different kinds of metal- (i.e. silver and gold), metal oxide- (titanium and silica dioxide), and carbon-based ENMs (carbon nanotubes). In general, no significant alterations were detected between exposed workers and controls.

#### CONCLUSIONS:

Definite conclusions on the function of FENO in occupational biological monitoring, cannot be extrapolated due to the limited number of available studies and the small size of investigated populations. Additionally, the lack of environmental monitoring data and the fragmented knowledge on ENM modes of action prevent to establish dose-response relationships. Future research appears necessary to deeply define the possibility to employ FENO as an early biomarker of lung effects taking in consideration possible occupational exposure issues, i.e. differently characterized ENMs

In 2019, urine and blood samples of 207 participants were collected and analyzed for mercury using atomic absorption spectroscopy.

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and work tasks, as well as individual influencing factors, i.e. smoking and atopy.

Authors: Iavicoli I, Fontana L, Leso V, Macrini MC, Pelclova D

Full Source: Current Medicinal Chemistry. 2020 Mar 20. doi: 10.2174/0929867327666200320154545. [Epub ahead of print]

### Toxicity and occupational exposure assessment for hydroprocessed esters and fatty acids (HEFA) alternative jet fuels

2020-03-20

The U.S. Air Force (USAF) has pursued development of alternative fuels to augment or replace petroleum-based jet fuels. Hydroprocessed esters and fatty acids (HEFA) renewable jet fuel is certified for use in commercial and USAF aircraft. HEFA feedstocks include camelina seed oil (*Camelina sativa*, HEFA-C); rendered animal fat (tallow, HEFA-T); and mixed fats and oils (HEFA-F). The aim of this study was to examine potential toxic effects associated with HEFA fuels exposures. All 3 HEFA fuels were less dermally irritating to rabbits than petroleum-derived JP-8 currently in use. Inhalation studies using male and female Fischer-344 rats included acute (1 day, with and without an 11-day recovery), 5-, 10- or 90-day durations. Rats were exposed to 0, 200, 700 or 2000 mg/m<sup>3</sup> HEFA-F (6 hr/day, 5 days/week). Acute, 5- and 10-day responses included minor urinalysis effects. Kidney weight increases might be attributed to male rat specific hyaline droplet formation. Nasal cavity changes included olfactory epithelial degeneration at 2000 mg/m<sup>3</sup>. Alveolar inflammation was observed at ≥700 mg/m<sup>3</sup>. For the 90-day study using HEFA-C, no significant neurobehavioral effects were detected. Minimal histopathological effects at 2000 mg/m<sup>3</sup> included nasal epithelium goblet cell hyperplasia and olfactory epithelium degeneration. A concurrent micronucleus test was negative for evidence of genotoxicity. All HEFA fuels were negative for mutagenicity (Ames test). Sensory irritation (RD<sub>50</sub>) values were determined to be 9578 mg/m<sup>3</sup> for HEFA-C and greater than 10,000 mg/m<sup>3</sup> for HEFA-T and HEFA-F in male Swiss-Webster mice. Overall, HEFA jet fuel was less toxic than JP-8. Occupational exposure levels of 200 mg/m<sup>3</sup> for vapor and 5 mg/m<sup>3</sup> for aerosol are recommended for HEFA-based jet fuels.

Authors: Sterner TR, Wong BA, Mumy KL, James RA, Reboulet J, Dodd DE, Streibich RC, Mattie DR

Full Source: Journal of toxicology and environmental health, Part A. 2020 Mar 20:1-22. doi: 10.1080/15287394.2020.1738970. [Epub ahead of print]

Hydroprocessed esters and fatty acids (HEFA) renewable jet fuel is certified for use in commercial and USAF aircraft.



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### Association between short-term exposure to ambient air pollutants and the risk of tuberculosis outpatient visits: A time-series study in Hefei, China

2020-03-03

#### BACKGROUND:

The current evidence has presented mixed results between air pollutants exposure and the progression of tuberculosis (TB). The purpose of this study was to explore the association between short-term exposure to air pollutants and the risk of TB outpatient visits in Hefei, China.

#### METHODS:

Time-series analysis was used to assess the effect of short-term exposure to ambient air pollutants on the risk of TB outpatient visits. A Poisson generalized linear regression model combined with a distributed lag non-linear model (DLNM) was applied to explore the association. The effects of different gender (male, female), age ( $\leq 65$  years old,  $> 65$  years old) and season (cold season, warm season) on the risk of TB were investigated by stratified analysis. Sensitivity analyses were conducted to test the robustness of our findings.

#### RESULTS:

A total of 22,749 active TB cases were identified from November 1, 2013 to December 31, 2018 in Hefei. The overall exposure-response curve showed that the concentration of particulate matter with aerodynamic diameter less than  $2.5 \mu\text{m}$  ( $\text{PM}_{2.5}$ ) and nitrogen dioxide ( $\text{NO}_2$ ) exposure were positively correlated with the risk of TB outpatient visits, while ozone ( $\text{O}_3$ ) and sulfur dioxide ( $\text{SO}_2$ ) exposure were negatively correlated with the risk of TB outpatient visits. The maximum lag-specific and cumulative relative risk (RR) of TB outpatient visits were 1.057 [95%CI: 1.002-1.115, lag 3 day] and 1.559 (95%CI: 1.057-2.300, lag 13 days) for each  $10 \mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{2.5}$ ; 1.026 (95% CI: 1.008-1.044, lag 0 day) and 1.559 (95%CI: 1.057-2.300, lag 07 days) for each  $10 \mu\text{g}/\text{m}^3$  increase in  $\text{NO}_2$ ; 0.866 (95% CI: 0.801-0.935, lag 5 day) and 0.852 (95%CI: 1.01-1.11, lag 0-14 days) for each  $10 \mu\text{g}/\text{m}^3$  increase in  $\text{SO}_2$  in the single-pollutant model. There was only a negative association between  $\text{O}_3$  exposure and the cumulative risk of TB outpatient visits (RR = 0.960, 95%CI: 0.936-0.984, lag 07 days). Stratified analyses showed that the effects of  $\text{SO}_2$  and  $\text{O}_3$  exposure were different between warm and cold seasons. The effect of  $\text{NO}_2$  exposure remained statistically significant in male, younger, and cold season subgroups. Besides, elderly people are more susceptible to  $\text{PM}_{2.5}$  exposure.

#### CONCLUSION:

Hydroprocessed esters and fatty acids (HEFA) renewable jet fuel is certified for use in commercial and USAF aircraft.

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This study suggests that exposure to  $PM_{2.5}$ ,  $NO_2$ ,  $SO_2$ , and  $O_3$  are associated with the risk of TB outpatient visits. Seasonal variation may have a greater impact on the risk of TB outpatient visits compared with gender and age.

Authors: Huang K, Ding K, Yang XJ, Hu CY, Jiang W, Hua XG, Lui J, Cao JY, Zhang T, Kan XH, Zhang XJ

Full Source: Environmental Research. 2020 Mar 3;184:109343. doi: 10.1016/j.envres.2020.109343. [Epub ahead of print]