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ENVIRONMENTAL RESEARCH

Sorptive Capacities of Nonpolymeric Plant Lipids for Hydrophobic Chemicals Determined by Passive Dosing

2019-03-25

Vegetation plays an important role in the partitioning, transport, and fate of semivolatile hydrophobic organic chemicals (HOCs) in the environment. Leaf/air partition ratios ($K_{leaf/air}$) of HOCs are highly variable for different plant species. The differences cannot be fully explained by the fraction of lipids in the leaves or the thickness of the cuticle. This study aimed to elucidate the importance of nonpolymeric lipids in determining $K_{leaf/air}$. The authors extracted organic matter from 7 plant species using solvents that do not extract the polymeric lipids cutin and cutan, to yield extractable organic matter (EOM). Passive dosing was used to determine the partition ratios of selected HOCs between the EOM of the leaves and the reference lipid, olive oil (KEOM/olive oil). In addition, the authors measured analogous partition ratios for three lipid standards. Proton nuclear magnetic resonance (NMR) spectroscopy was used to characterise the composition of lipids. Differences in KEOM/olive oil of two polychlorinated biphenyls and four chlorinated benzenes were below a factor of 2 in the plant species studied, indicating that the reported differences in $K_{leaf/air}$ are not caused by differences in the sorptive capacities of nonpolymeric lipids or that the EOM is not representative of all nonpolymeric leaf lipids.

Authors: Bolinius DJ, MacLeod M, Iadaresta F, Holmbäck J, Jahnke A.

Full Source: Environmental Science & Technology. 2019 Feb 5;53(3):1278-1286. doi: 10.1021/acs.est.8b05656. Epub 2019 Jan 25.

This study aimed to elucidate the importance of nonpolymeric lipids in determining $K_{leaf/air}$.

Anaerobic butanol production driven by oxygen-evolving photosynthesis using the heterocyst-forming multicellular cyanobacterium *Anabaena* sp. PCC 7120

2019-03-25

Cyanobacteria are oxygen-evolving photosynthetic bacteria. Established genetic manipulation methods and recently developed gene-regulation tools have enabled the photosynthetic conversion of carbon dioxide to biofuels and valuable chemicals in cyanobacteria, especially in unicellular cyanobacteria. However, the oxygen sensitivity of enzyme(s) introduced into cyanobacteria hampers productivity in some cases. *Anabaena* sp. PCC 7120 is a filamentous cyanobacterium consisting of a few hundred of vegetative cells, which perform oxygenic photosynthesis. Upon

nitrogen deprivation, heterocysts, which are specialised cells for nitrogen fixation, are differentiated from vegetative cells at semiregular intervals. The micro-oxic environment within heterocysts protects oxygen-labile nitrogenase from oxygen. This study aimed to repurpose the heterocyst as a host for the production of chemicals with oxygen-sensitive enzymes under photosynthetic conditions. Herein, *Anabaena* strains expressing enzymes of 1-butanol synthetic pathway from the anaerobe *Clostridium acetobutylicum* within heterocysts were created. A strain that expressed a highly oxygen-sensitive Bcd/EtfAB complex produced 1-butanol even under photosynthetic conditions. Furthermore, the 1-butanol production per heterocyst cell of a butanol-producing *Anabaena* strain was fivefold higher than that per cell of unicellular cyanobacterium with the same set of 1-butanol synthetic pathway genes. Thus, this study showed the usefulness of *Anabaena* heterocysts as a chassis for anaerobic production driven by oxygen-evolving photosynthesis.

Authors: Higo A, Ehira S.

Full Source: Applied Microbiology & Biotechnology. 2019 Jan 23. doi: 10.1007/s00253-019-09635-z. [Epub ahead of print]

Temporal change of the accumulation of persistent organic pollutants (POPs) and polycyclic aromatic hydrocarbons (PAHs) in lichens in Switzerland between 1995 and 2014.

2019-03-25

The aim of this study was to assess the temporal change of atmospheric deposition patterns of persistent organic pollutants (POPs) and polycyclic aromatic hydrocarbons (PAHs) in Switzerland between 1995 and 2014 by a passive biomonitoring with lichens. Lichen tissues sampled at 16 representative sites in the same season of 1995 and 2014 were analysed for a total of 94 individual and 27 sum parameters of POPs and PAHs by means of gas chromatography-mass spectrometry (GC/MS). The comparative analyses showed a decrease of 40 to 80% (medians) for most of the POPs and PAHs concentration in lichens at all site categories. Reduction in tissue concentration of the polychlorinated dibenzo-p-dioxins/furans (PCDD/PCDFs), such as the highly toxic 2,3,7,8-TetraCDD and the TEQ according to WHO (2005) were 66% and 73%, respectively. For the dioxin- and non-dioxin-like PCBs, a decrease of 67% and 58% was found. The average decrease of 30 organochlorine pesticides and insecticides (OCPs) was 65%, with a 94% decrease for lindane. For the 27 PAHs and for benzo(a)pyrene, an average decrease of 58% and 59% was found. Polybrominated diphenyl ethers (PBDE) showed reduced concentrations in lichens at rural and agglomeration sites, but an increase

The aim of this study was to assess the temporal change of atmospheric deposition patterns of persistent organic pollutants (POPs) and polycyclic aromatic hydrocarbons (PAHs) in Switzerland between 1995 and 2014 by a passive biomonitoring with lichens.

of contamination was observed at industrial and road traffic sites. The direct comparison of changes of POPs and PAHs concentrations in lichens and of emissions between 1995 and 2014 revealed consistent results. The results of this study highlight for the first time in biota the positive effect of emission regulation of POPs in Switzerland.

Authors: Herzig R, Lohmann N, Meier R.

Full Source: Environmental Science & Pollution Research International.

2019 Feb 14. doi: 10.1007/s11356-019-04236-9. [Epub ahead of print]

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

2019-03-25

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

Authors: Nurmi TMA, Kiljunen TK, Knuutinen JS.

Full Source: Environmental Science & Pollution Research International.

2018 Nov 5. doi: 10.1007/s11356-018-3485-x. [Epub ahead of print]

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

Macrolides induce severe cardiotoxicity and developmental toxicity in zebrafish embryos

2019-03-25

Macrolide antibiotics (MALs) are widely used for both human and animal health. Most MALs and their metabolites transfer into aquatic organisms and environment resulting in violent consequences. Previous studies show that MALs cause cardiotoxicity in humans and mammals. However, the potential risk of these chemicals in aquatic organisms remains unclear. In the present study, the researchers used zebrafish embryos as a model to evaluate the toxicity of MALs. Zebrafish embryos were exposed to four typical MALs including azithromycin (AZM), clarithromycin (CLR), tilmicosin (TMS) and tylosin (TYL) to study their cardiotoxicity. The heart rate of zebrafish embryos showed similar biphasic distribution in the presence of four MALs at 2 days post-fertilization (dpf). The heart rate increased significantly at low levels of MALs while decreased obviously at high levels. Subsequently, TMS was chosen to study its acute toxicity and developmental toxicity, which caused pericardial oedema and spinal curvature in zebrafish embryos at 4 dpf. Furthermore, we found that TMS triggered oxidative stress, with decreased SOD activities and increased MDA contents. Lastly, apoptosis was observed in zebrafish embryos under TMS treatment, with up-regulation of apoptosis associated genes such as p53, bcl 2, bax, caspase 3 and caspase 9, confirmed by increased protein expression based on Western blot analysis. Taken together, these data indicate that MALs can cause serious toxicity in the development of zebrafish. Great caution should be taken due to the huge consumption of MALs for food animal production and treatments with TMS for infections in aquaculture.

Authors: Yan Z, Huang X, Xie Y, Song M, Zhu K, Ding S.

Full Source: Science of the Total Environment. 2019 Feb 1; 649:1414-1421.

doi: 10.1016/j.scitotenv.2018.07.432. Epub 2018 Aug 21.

In the present study, the researchers used zebrafish embryos as a model to evaluate the toxicity of macrolide antibiotics

Cytological Effects of Bleaching Agent (Quneex) on Plant Cells and Plant DNA

2019-03-25

There have been a number of reported drawbacks and efficacy issues regarding the use of bleaching agents in the plant industry. This study was conducted to determine the cytological effects of the bleaching agent (Quneex) on the plant cells and plant DNA using the *Allium cepa* assay. In the study, sixteen root meristems of *A. cepa* were subjected to different concentrations of the bleaching agent (0.1, 0.2, 0.3, 0.4 and 0.5%)

with different periods of time (6, 12 and 24 h). Recovery was done for 6, 12 and 24 h after exposure. The mitotic index significantly decreased with time and also decreased with increase in the concentration of the bleaching agent. Abnormal chromosomal changes reflecting mutagenesis including stickiness, laggards, bridges, C-metaphase, star-metaphase, binucleation, polyploidy, disturbance and multinucleation were observed in the different concentrations and periods of time. After recovery, a slow increase in the mitotic index was observed. All treatments with or without recovery for 12 and 24 h resulted in reduction in the amount of DNA. Bleaching agents similar to Quneex containing sodium hypochlorite have mutagenic properties that can be potentially hazardous to the environment and also to humans. Thus, there is a need to regulate the use and disposal of such chemicals into the environment particularly to the sewers, to prevent contamination of potable water, plant and biodiverse aquatic animals.

Author: I Algwaiz H.

Full Source: Pakistan Journal of Biological Sciences. 2018 Jan; 21(5):205-214. doi: 10.3923/pjbs.2018.205.214.

MEDICAL RESEARCH

Arsenic induces gender difference of estrogen receptor in AECII cells from ICR foetal mice

2019-03-25

Arsenic is a confirmed human lung carcinogen with oestrogenic activity. There are gender differences in the incidence of lung cancer. Oestrogen receptors (ER) play an important role in the process of the development of lung cancer. In order to understand the gender difference effects of ER during carcinogenesis of lung induced by arsenic, the effects of arsenic and oestrogen receptor antagonist (ICI182780) on expression levels of oestrogen receptor beta (ER β), extracellular regulated protein kinase (ERK1/2) and nuclear factor κ B (NF- κ B/P65) in type II alveolar epithelial cells (AECII) from different sex ICR foetal mice lung were detected. Results showed that arsenic increased the expression levels of mRNA and protein of ER β , ERK1/2 and NF- κ B/P65, and ICI182780 inhibited the increase. Furthermore, there remains a gender difference in these changes. The authors concluded, the observations strongly suggested that oestrogen receptor and its mediated signal pathway molecules might have critical

In order to understand the gender difference effects of ER during carcinogenesis of lung induced by arsenic, the effects of arsenic and oestrogen receptor antagonist (ICI182780) on expression levels of oestrogen receptor beta (ER β), extracellular regulated protein kinase (ERK1/2) and nuclear factor κ B (NF- κ B/P65) in type II alveolar epithelial cells (AECII) from different sex ICR foetal mice lung were detected.

roles of the gender difference of incidence of lung cancer in arsenic induced.

Authors: Che W, Yang M, Cheng Y, Wu M, Lan Y, Zhang H.

Full Source: Toxicology In Vitro. 2019 Jan 23; 56:133-140. doi: 10.1016/j.tiv.2019.01.014. [Epub ahead of print]

28 days follow up of patch-test reactions to p-phenylenediamine and p-phenylenediamine dihydrochloride: a multicentre study on behalf of EECDRG

2019-03-25

It is discussed if routinely patch testing p-phenylenediamine (PPD) 1.0 % petrolatum is safe due to the risk of patch test sensitisation. Late appearing patch test reactions may reflect patch test sensitisation, but may also be due to a low degree of pre-existing sensitisation. The aim of this study was to follow the positive patch test reactions to PPD and its salt PPD-dihydrochloride (PPD-DHC) to characterise reaction patterns concerning time and dose in PPD-sensitised individuals. Volunteers with previous reactions to PPD 1.0% were included and patch tested with PPD and PPD-DHC in equimolar dilution series. Seven follow-up visits during 28 days followed. Twenty-six volunteers completed the study of which 23/26 (88%) reacted to PPD 1.0%, whereas 69% reacted to 0.32%. Altogether, 42% and 27% reacted to the corresponding equimolar concentrations of PPD-DHC. After day 7 no new reactions were observed to any concentration tested, neither of PPD nor of PPD-DHC. The authors concluded that no late appearing reactions were observed to PPD or PPD-DHC at any dose. There is a risk of missing contact allergy when the dose was decreased.

Authors: Young E, Andersen KE, Bruze M, Giménez-Arnau A, Ross-Hansen K, Johansen JD, Madsen JT, Zimerson E, Svedman C.

Full Source: Contact Dermatitis. 2019 Jan 26. doi: 10.1111/cod.13235. [Epub ahead of print]

An ultrasensitive sensor based on quantitatively modified upconversion particles for trace bisphenol A detection

2019-03-25

Bisphenol A (BPA) is one of the endocrine-disrupting chemicals which might cause reproductive and endocrine system diseases, and poses a serious threat to the ecosystem and human health. In this study, the authors report an ultrasensitive sensor for trace BPA detection employing fluorescence resonance energy transfer (FRET) between modified

The aim of this study was to follow the positive patch test reactions to PPD and its salt PPD-dihydrochloride (PPD-DHC) to characterise reaction patterns concerning time and dose in PPD-sensitised individuals.

upconversion nanoparticles (UCNPs) and tetramethylrhodamine. To circumvent the problems of low luminous efficiency of FRET and low sensitivity of sensor, the upconversion nanoparticles with very strong fluorescence efficiency were prepared and quantitatively modified. Results showed that the concentrations of amino groups and streptavidin were 43 nmol/mg and 6.12 µg/mg on the surface of the UCNPs, respectively. Under the optimal detection conditions, the peak intensity of UCNPs at 547 nm was linear with the logarithm of the BPA concentration with the detection limit of 0.05 ng/mL. Without complicated pre-processing, the recoveries were in general between 91.0 and 115.0% in tap water, river water, and disposable paper cup water. Therefore, the proposed sensor is suitable for effective sensing of trace BPA in water samples.

Authors: Li Q, Bai J, Ren S, Wang J, Gao Y, Li S, Peng Y, Ning B, Gao Z.

Full Source: Analytical and Bioanalytical Chemistry. 2018 Nov 3. doi: 10.1007/s00216-018-1425-8. [Epub ahead of print]

The Impact of Nutrition and Environmental Epigenetics on Human Health and Disease

2019-03-25

Environmental epigenetics describes how environmental factors affect cellular epigenetics and, hence, human health. Epigenetic marks alter the spatial conformation of chromatin to regulate gene expression. Environmental factors with epigenetic effects include behaviours, nutrition, and chemicals and industrial pollutants. Epigenetic mechanisms are also implicated during development in utero and at the cellular level, so environmental exposures may harm the foetus by impairing the epigenome of the developing organism to modify disease risk later in life. By contrast, bioactive food components may trigger protective epigenetic modifications throughout life, with early life nutrition being particularly important. Beyond their genetics, the overall health status of an individual may be regarded as an integration of many environmental signals starting at gestation and acting through epigenetic modifications. This review explores how the environment affects the epigenome in health and disease, with a particular focus on cancer. Understanding the molecular effects of behaviour, nutrients, and pollutants might be relevant for developing preventative strategies and personalised health programs. Furthermore, by restoring cellular differentiation, epigenetic drugs

This review explores how the environment affects the epigenome in health and disease, with a particular focus on cancer.

could represent a potential strategy for the treatment of many diseases including cancer.

Author: Tiffon C.

Full Source: International Journal of Molecular Science. 2018 Nov 1;19(11). pii: E3425. doi: 10.3390/ijms19113425.

Amyloid beta-positive subjects exhibit longitudinal network-specific reductions in spontaneous brain activity

2019-03-25

Amyloid beta ($A\beta$) deposition and cognitive decline are key features of Alzheimer's disease. The relationship between $A\beta$ status and changes in neuronal function over time, however, remains unclear. This study evaluated the effect of baseline $A\beta$ status on reference region spontaneous brain activity (SBA-rr) using resting-state functional magnetic resonance imaging and fluorodeoxyglucose positron emission tomography in patients with mild cognitive impairment. Patients (N= 62, [43 $A\beta$ -positive]) from the Alzheimer's Disease Neuroimaging Initiative were divided into $A\beta$ -positive and $A\beta$ -negative groups via prespecified cerebrospinal fluid $A\beta_{42}$ or 18F-florbetapir positron emission tomography standardised uptake value ratio cut-offs measured at baseline. The authors analysed interaction of biomarker-confirmed $A\beta$ status with SBA-rr change over a 2-year period using mixed-effects modelling. SBA-rr differences between $A\beta$ -positive and $A\beta$ -negative subjects increased significantly over time within subsystems of the default and visual networks. Changes exhibit an interaction with memory performance over time but were independent of glucose metabolism. Results reinforce the value of resting-state functional magnetic resonance imaging in evaluating Alzheimer's disease progression and suggest spontaneous neuronal activity changes are concomitant with cognitive decline.

Authors: Avants BB, Hutchison RM, Mikulskis A, Salinas-Valenzuela C, Hargreaves R, Beaver J, Chiao P; Alzheimer's Disease Neuroimaging Initiative.

Full Source: Neurobiological Aging. 2018 Oct 11;74: 191-201. doi: 10.1016/j.neurobiolaging.2018.10.002. [Epub ahead of print]

This study evaluated the effect of baseline $A\beta$ status on reference region spontaneous brain activity (SBA-rr) using resting-state functional magnetic resonance imaging and fluorodeoxyglucose positron emission tomography in patients with mild cognitive impairment.

OCCUPATIONAL RESEARCH

Aluminium in the lungs of Ontario hardrock miners

2019-03-25

The objective of this study was to determine the concentration of aluminium in the autopsied lungs of eight hardrock miners. These miners had inhaled McIntyre Powder (a mixture of aluminium and aluminium oxide) as a prophylaxis against silicosis. The study involved chemical analysis of lungs, where each whole lung was divided horizontally into three sections and analysed by atomic absorption spectrophotometer equipped with a graphite furnace. The grand mean level of aluminium was found to be 476.4 µg/g of dry tissue, which is similar in the range reported for occupationally exposed groups. The effect of smoking was also examined and found to be unrelated. This study provides an estimate of retained aluminium in the lungs of Ontario hardrock miners as a result of occupational exposure to hardrock mining environment and inhalation of McIntyre Powder.

Author: Verma DK.

Full Source: Archives in Environmental & Occupational Health. 2019 Feb 11:1-4. doi: 10.1080/19338244.2019.1574703. [Epub ahead of print]

A hybrid expert approach for retrospective assessment of occupational exposures in a population-based case-control study of cancer

2019-03-25

While the expert-based occupational exposure assessment approach has been considered the reference method for retrospective population-based studies, its implementation in large study samples has become prohibitive. To facilitate its application and improve upon it the authors developed, in the context of a Montreal population-based study of prostate cancer (PROtEuS), a hybrid approach combining job-exposure profiles (JEPs) summarising expert evaluations from previous studies and expert review. The aim was to describe the hybrid expert method and its impacts on the exposures assigned in PROtEuS compared to those from a previous study coded using the traditional expert method. Applying the hybrid approach, experts evaluated semi-quantitative levels of confidence, concentration and frequency of exposure to 313 agents for 16,065 jobs held by 4005 subjects in PROtEuS. These assessments were compared to those from a different set of jobs coded in an earlier study of lung cancer, conducted on the same study base, for 90 blue-collar occupations and 203 agents.

The objective of this study was to determine the concentration of aluminium in the autopsied lungs of eight hardrock miners.

Endpoints evaluated included differences in the number of exposures and in the distribution of ratings across jobs, and the within-occupation variability in exposure. Compared to jobs from the lung cancer study, jobs in PROtEuS had on average 0.3 more exposures. PROtEuS exposures were more often assigned definite confidence ratings, but concentration and frequency levels tended to be lower. The within-occupation variability in ratings assigned to jobs were lower in PROtEuS jobs for all metrics. This was particularly evident for concentration, although considerable variability remained with over 40% of occupation/agent cells in PROtEuS exposed at different levels. The hybrid approach reduced coding time by half, compared to the traditional expert assessment. The new hybrid expert approach improved on efficiency and transparency, and resulted in greater confidence in assessments, compared to the traditional expert method applied in an earlier study involving a similar set of jobs. Assigned ratings were more homogeneous with the hybrid approach, possibly reflecting clearer guidelines for coding, greater coherence between experts and/or reliance on summaries of past assessments. Nevertheless, significant within-occupation variability remained with the hybrid approach, suggesting that experts took into account job-specific factors in their assessments.

Authors: Sauvé JF, Lavoué J, Nadon L, Lakhani R, Senhaji Rhazi M, Bourbonnais R, Richard H, Parent MÉ.

Full Source: Environmental Health. 2019 Feb 15;18(1):14. doi: 10.1186/s12940-019-0451-0.

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

2019-03-25

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

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

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There was a significant positive linear association between urinary Mn and GnRH and LH, while the linear association between urinary Mn and TSTO was negative. Sperm progressive motility and total motility decreased significantly in the Mn-exposed group. There was a significantly negative linear association between urinary Mn and sperm progressive motility and total motility. In conclusion, occupational Mn exposure was inversely associated with reproductive health of male workers, resulting in the abnormality of hormones secretion and decrease of sperm motility.

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

Full Source: Toxicology & Industrial Health. 2018 Nov 22:748233718810109.

doi: 10.1177/0748233718810109. [Epub ahead of print]

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

2019-03-25

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

The authors monitored physicians who were exposed to inhalational anaesthetics during their first year of a medical residency program to evaluate the possible early damage events.

physicians should undergo additional biomonitoring at the beginning of their careers to determine possible toxic effects on their cells and genetic material, and further investigations are warranted to determine whether a longer exposure to inhalational anaesthetics results in mitochondrial depolarization, apoptosis and DNA breaks.

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

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

Surgical smoke: still an underestimated health hazard in the operating theatre

2019-03-25

Smoke generated from electrocautery dissection contains irritating and/or carcinogenic components. The aim of this study was to investigate the effectiveness of a mobile smoke evacuation system (SES) in protecting surgical personnel from these hazardous fumes. Standardised cuts with an electrocautery device were performed on fresh porcine tissue, and the generated surgical fume was analysed with and without the additional use of a mobile SES using a real-time proton-transfer-reaction time-of-flight mass spectrometer. Furthermore, 2 different surgical masks were tested to investigate their filter capacity. Several toxic and/or carcinogenic volatile organic compounds including 1,3-butadiene, benzene and furfural were found in concentrations clearly above the limits that were set by the National Institute of Occupational Safety and Health: 1,3-butadiene at 19.06 ± 1.54 ppb (limit: 5 ppb), benzene at 6.21 ± 1.33 ppb (limit: 0.5 ppb) and furfural at 14.34 ± 2.97 ppb (limit: 2 ppb). Although the mobile SES was able to reduce these substances to a certain degree, butadiene and benzene still remained above the permissible exposure limits with concentrations of 14.21 ± 0.07 and 1.16 ± 0.05 , respectively. Both surgical masks were unable to reduce the 'inhaled' concentrations of volatile organic compounds. Although the SES reduced the concentrations of most of the detected volatile organic compounds to a certain amount, especially the carcinogenic substances, butadiene and benzene remained high above exposure limits. According to the abovementioned significant data, further investigation on this topic is imperative, especially when considering that surgical masks were absolutely ineffective in protecting

The aim of this study was to investigate the effectiveness of a mobile smoke evacuation system (SES) in protecting surgical personnel from these hazardous fumes.

individuals from the toxic smoke and that the cautery was only used for 10s in this experiment.

Authors: Kocher GJ, Sesia SB, Lopez-Hilfiker F, Schmid RA.

Full Source: European Association for Cardio-Thoracic Surgery. 2018 Nov 2.

doi: 10.1093/ejcts/ezy356. [Epub ahead of print]

PUBLIC HEALTH RESEARCH

Predictors of residential mobility and its impact on air pollution exposure among children diagnosed with early childhood leukaemia

2019-03-25

Epidemiology studies relying on one address to assign exposures over time share common methodological limitations in failing to account for mobility that may introduce potential exposure misclassification. Using Texas birth certificate and cancer registry data, the authors identified predictors of residential mobility among mothers of children diagnosed with early childhood leukaemia in Texas from 1995 to 2011. U.S. Environmental Protection Agency (EPA) National Air Toxics Assessment data was used to estimate residential levels of benzene and 1,3-butadiene based on addresses at birth and diagnosis and applied mixed-effects ordinal logistic regression models to evaluate differences in exposure classification between the two time periods. In total, 55% of children moved from time of birth to diagnosis, although they generally did not move far (median distance moved was 8 km). Predictors of mobility, at delivery, included younger age, being unmarried and living in neighbourhoods with high benzene levels, and, at diagnosis, increasing child's age and living in neighbourhoods with low poverty rates. It was observed that the odds of being assigned to a higher exposure quartile at diagnosis relative to the time of birth decreased by 31% for 1,3-butadiene (OR=0.69, 95% CI 0.59-0.82) and by 12% for benzene (OR=0.88, 95% CI 0.75, 1.05).

Authors: Tee Lewis PG, Chen TY, Chan W, Symanski E.

Full Source: Journal of Exposure Science & Environmental Epidemiology.

2019 Feb 15. doi: 10.1038/s41370-019-0126-5. [Epub ahead of print]

Epidemiology studies relying on one address to assign exposures over time share common methodological limitations in failing to account for mobility that may introduce potential exposure misclassification.

A State-of-the-Science Review of Mercury Biomarkers in Human Populations Worldwide between 2000 and 2018

2019-03-25

The Minamata Convention on Mercury provided a mandate for action against global mercury pollution. However, the knowledge of mercury exposures is limited because there are many regions and subpopulations with little or no data. This study aimed to increase worldwide understanding of human exposures to mercury by collecting, collating, and analysing mercury concentrations in biomarker samples reported in the published scientific literature. A systematic search of the peer-reviewed scientific literature was performed using three databases. A priori search strategy, eligibility criteria, and data extraction steps were used to identify relevant studies. 424,858 mercury biomarker measurements were collected from 335,991 individuals represented in 312 articles from 75 countries. General background populations with insignificant exposures have blood, hair, and urine mercury levels. The authors identified four populations of concern: a) Arctic populations who consume fish and marine mammals; b) tropical riverine communities (especially Amazonian) who consume fish and, in some cases, may be exposed to mining; c) coastal and/or small-island communities who substantially depend on seafood; and d) individuals who either work or reside among artisanal and small-scale gold mining sites. This review suggests that all populations worldwide are exposed to some amount of mercury and that there is great variability in exposures within and across countries and regions. There remain many geographic regions and subpopulations with limited data, thus hindering evidence-based decision making. This type of information is critical in helping understand exposures, particularly in light of certain stipulations in the Minamata Convention on Mercury. <https://doi.org/10.1289/EHP3904>.

Authors: Basu N, Horvat M, Evers DC, Zastenskaya I, Weihe P, Tempowski J. Full Source: Environmental Health Perspectives. 2018 Oct;126(10):106001. doi: 10.1289/EHP3904.

Evaluation of 2-thiothiazolidine-4-carboxylic Acid, a Common Metabolite of Isothiocyanates as a Potential Biomarker of Cruciferous Vegetable Intake

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Cruciferous vegetable consumption is associated with favourable health outcomes. Bioactive compounds arising in these, especially isothiocyanates, exert effects that contribute to prevention of disease,

Cruciferous vegetable consumption is associated with favourable health outcomes.

in large part through attenuation of inflammation and oxidative stress. However, much about isothiocyanate metabolites and their role as biomarkers of crucifer intake remain unknown. The authors tested the utility and limitations of 2-thiothiazolidine-4-carboxylic acid (TTCA) as a urinary biomarker of broccoli beverage intake in a randomised crossover clinical trial where 50 participants consumed either a glucoraphanin-rich (GRR) or sulforaphane-rich (SFR) beverage. Compared to run-in and wash-out periods, the authors observed significantly higher urinary TTCA after broccoli beverage consumption. Measurements also showed that TTCA was present in beverage powders and in all tested cruciferous vegetables. GRR resulted in excretion of 87% of the ingested TTCA while SFR resulted in excretion of 176%. Elevated urinary TTCA was observed in rats administered 100µmol/kg SFN. Unlike SFN, TTCA did not activate Nrf2-mediated cytoprotective signalling. Collectively, TTCA appears to be common isothiocyanate-derived metabolite that has the capacity to be utilised as a biomarker of cruciferous vegetables which would be beneficial for objective and quantitative tracking of intake in studies.

Authors: Palliyaguru DL, Salvatore SR, Schopfer FJ, Cheng X, Zhou J, Kensler TW, Wendell SG.

Full Source: Molecular Nutrition & Food Research. 2018 Nov 8: e1801029. doi: 10.1002/mnfr.201801029. [Epub ahead of print]

Organophosphate flame-retardant metabolite concentrations and pregnancy loss among women conceiving with assisted reproductive technology

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In the present study, the authors evaluated whether urinary concentrations of organophosphate flame retardant (PFR) metabolites are associated with pregnancy loss among women conceiving with assisted reproductive technology (ART). The study was a prospective preconception cohort of subfertile women. At the Academic hospital fertility centre in Boston, Massachusetts. A total of 155 women conceiving 179 pregnancies with ART. Mean exposure to each of five PFR metabolites was estimated by averaging the specific-gravity adjusted natural log concentrations from two urine samples collected during the ART cycle of conception. Adjusted risk ratios (RRs) and 95% confidence intervals (CIs) for biochemical and total pregnancy loss (all losses <20 weeks' gestation) by quartiles of PFR metabolite concentrations were estimated using a repeated measures log-binomial model, accounting for multiple pregnancies per woman. Of the 179 pregnancies, 31% ended in pregnancy loss (12% in biochemical loss). Among the three metabolites with high

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detection frequency [bis(1,3-dichloro-2-propyl) phosphate (BDCIPP), diphenyl phosphate (DPHP), and isopropylphenyl phenyl phosphate (ip-PPP)], an increased risk of biochemical loss was observed for women with DPHP concentrations in the fourth vs. first quartile (RR 1.64; 95% CI 0.61-4.39). Also found was an elevated risk of biochemical pregnancy loss among women in the highest quartile of the molar sum of urinary PFR metabolites compared with the lowest (RR 1.89; 95% CI 0.64-5.58). Urinary concentrations of ip-PPP and BDCIPP were not associated with either outcome. Among subfertile women, urinary DPHP metabolite concentrations measured during the ART cycle of conception may be associated with early pregnancy loss. Although this study is uniquely designed to investigate early markers of pregnancy success and maintenance, the small sample size likely contributed to imprecision. Given their increasing use as replacement chemicals for traditional flame retardants, exposure to PFRs may increase, and more studies will be needed to investigate their potential to impact pregnancy and reproduction.

Authors: Messerlian C, Williams PL, Mínguez-Alarcón L, Carignan CC, Ford JB, Butt CM, Meeker JD, Stapleton HM, Souter I, Hauser R; EARTH Study Team.

Full Source: *Fertility & Sterility*. 2018 Nov;110(6):1137-1144.e1. doi: 10.1016/j.fertnstert.2018.06.045.