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Technical

CHEMWATCH

ENVIRONMENTAL RESEARCH

A strategy to reduce the dose of multichiral agricultural chemicals: The herbicidal activity of metolachlor against *Echinochloa crusgalli*

2019-09-23

Agricultural chemicals are normally used as mixtures of several isomers, e.g., enantiomers. In theory, in order to minimise the pesticides dose, it is desirable to use the most target-active isomer. Metolachlor is a typical multichiral herbicide belonging to amide herbicides. An asymmetric carbon atom and a chiral axis yield four stereoisomers. In this study, a novel laboratory method was developed to prepare the *S*-metolachlor and the four stereoisomers using high performance liquid chromatography. The separated isomers had a purity of >99%, with their absolute configurations assigned by electronic circular dichroism. The enantioseparation by ultra-performance convergence chromatography tandem mass spectrometry was also performed for the rapid and sensitive detection of metolachlor stereoisomers. The enantioselective herbicidal activity toward the target weed (*Echinochloa crusgalli*) was systematically assessed for the first time by measuring the morphology of the weed after treatment with rac-, *S*-metolachlor and the four stereoisomers, respectively. Among the commercial pesticides, *S*-metolachlor was more effective in weed inhibition than rac-metolachlor, and to the four stereoisomers, the herbicidal activities were ranked as: $SS > SR \quad RS > RR$, and the *RR*-isomer even had some stimulative effect to the weed growth at lower concentration (1 ppm). Thus, the authors concluded that in these cases, the chiral carbon feature played a major role in herbicidal activity rather than the chiral axis feature, and the higher bioactivity of the *S*-isomers was confirmed by more effective uptake and stronger interaction with target enzymes that were involved in the gibberellic acid biosynthesis. Although the *SS*-isomer shows the highest herbicidal activity, controlling the major chiral feature is still much easier and more economical than controlling two chiral features.

Authors: Zhao L, Gao Y, Xie J, Zhang Q, Guo F, Liu S, Liu W.

Full Source: Science of the Total Environment. 2019 Jul 2; 690:181-188. doi: 10.1016/j.scitotenv.2019.06.521. [Epub ahead of print]

High-throughput COPAS assay for screening of developmental and reproductive toxicity of nanoparticles using the nematode *Caenorhabditis elegans*

2019-09-23

With the rapid advancement and numerous applications of engineered nanomaterials (ENMs) in science and technology, their effects on animal health, environment and safety should be considered carefully. However, quick assessment of their effects on developmental and reproductive health and an understanding of how they cause such adverse toxic effects remain challenging, because of the fast-growing number of ENMs and the limitations of the different toxicity assays currently in use as well as lack of suitable animal model systems. In this study, the authors performed a high-throughput complex object parametric analyzer and sorter (COPAS) assay for assessing the developmental and reproductive toxicity of ENMs using *Caenorhabditis elegans* and provide descriptions of the data and their subsequent analysis. The results showed significant reproductive and developmental toxicity potential of different ENMs. We assessed the usefulness of this method in terms of error-free data, user-friendliness and results being consistent with those of visual, molecular and cellular studies. Moreover, the COPAS Biosort system could be used on a larger scale to screen thousands of chemicals, drugs, pharmaceuticals and ENMs. This study also indicates that the COPAS-based high-throughput screening system is highly reliable for the assessment of toxicity and health risks of ENMs.

Authors: Kim M, Jeong J, Kim H, Choi J.

Full Source: Journal of Applied Toxicology. 2019 Jul 9. doi: 10.1002/jat.3833. [Epub ahead of print]

Efficient adsorption of Pb(II) from aqueous solutions using aminopropyltriethoxysilane-modified magnetic attapulgite@chitosan (APTS-Fe₃O₄/APT@CS) composite hydrogel beads

2019-09-23

The performance of Fe₃O₄/attapulgite (APT) nanoparticles in Pb(II) adsorption from aqueous solutions could be improved by modifying the particles with aminopropyltriethoxysilane (APTS) and then combining with chitosan (CS) into beads. After preparing the APTS-Fe₃O₄/APT@CS beads, their surface morphology and crystal phases were analysed by Fourier-transform infrared spectroscopy, scanning electron microscopy, and X-ray diffraction. The magnetic properties of APTS-Fe₃O₄/APT@CS were

In this study, the authors performed a high-throughput complex object parametric analyzer and sorter (COPAS) assay for assessing the developmental and reproductive toxicity of ENMs using *Caenorhabditis elegans* and provide descriptions of the data and their subsequent analysis.

studied by a vibrating sample magnetometer, while their heat resistance and stability were characterised by thermal weight analysis. A recycling test and comparison of adsorption capacities were also carried out. The adsorption capacity of Fe₃O₄/APT was improved by the modification with APTS and CS. The adsorption process conforms to the pseudo-second-order kinetic and Langmuir adsorption isotherm models. The adsorption of Pb(II) reaches a maximum of 625.34 mg/g, which compares favourably with other reported adsorbents. The results show that APTS-Fe₃O₄/APT@CS is a promising hybrid adsorbent for effective removal of Pb(II) from water.

Authors: Liang XX, Ouyang XK, Wang S, Yang LY, Huang F, Ji C, Chen X.
Full Source: International Journal of Biology & Macromolecules. 2019 Jul 5; 137:741-750. doi: 10.1016/j.ijbiomac.2019.06.244. [Epub ahead of print]

Oestrogen Receptor-Mediated Transcriptional Activities of Spent Coffee Grounds and Spent Coffee Grounds Compost, and Their Phenolic Acid Constituents

2019-09-23

Spent coffee grounds (SCG) are the most abundant coffee by-product and are generally discarded as waste. The horticultural use of SCG and SCG compost (SCGC) has become popular due to a growing interest in environmentally friendly measures for waste disposal. Estrogen-like endocrine disrupting chemicals in the soil can be absorbed by plants and subsequently by humans who consume these plants. The objectives of this study are to determine the phytochemical profiles of extracts of SCG and SCGC and to evaluate the oestrogen-like activities of SCG, SCGC, and the major coffee phenolic acids, specifically, 5-O-caffeoylquinic acid (CQA), caffeic acid, and ferulic acid. Their inductive effects on estrogen receptor (ER)-mediated gene transcription have been examined in cultured cell lines. CQA was the most abundant phenolic acid in SCG and SCGC and was further examined for its ER-mediated estrogen-like activity using various assays. This is the first study to report the oestrogen-like signalling activities of coffee by-products and their major constituents.

Authors: An BH, Jeong H, Kim JH, Park S, Jeong JH, Kim MJ, Chang M.
Full Source: Journal of Agriculture & Food Chemistry. 2019 Aug 7;67(31):8649-8659. doi: 10.1021/acs.jafc.9b02452. Epub 2019 Jul 25.

The objectives of this study are to determine the phytochemical profiles of extracts of spent coffee grounds and spent coffee ground compost and to evaluate the oestrogen-like activities of SCG, SCGC, and the major coffee phenolic acids

Changes in fish sex ratio as a basis for regulating endocrine disruptors

2019-09-23

Fish sex ratio (SR) is an endpoint potentially indicating both endocrine activity and adversity, essential elements for identifying Endocrine Disrupting Chemicals (EDCs) as required by the EU regulations. Due to different protocols and methods in the literature studies, SR data vary greatly. This study analyses literature SR data and discusses important considerations for using SR data in the regulatory context for the hazard identification, classification, PBT (persistent, bioaccumulative and toxic) assessment, testing, and risk assessment. A total number of 106 studies were compiled for SR of zebrafish, medaka and fathead minnow exposed to 84 chemicals or mixtures. About 53% of literature studies determined SR by methods different from the standard histology method, leading to uncertainty of quantifying SR and differential sensitivity. SR was determined after depuration in 40 papers, which may lead to chemical-induced SR changes reversible to the control. SR was responsive to chemicals with EAS (oestrogen, androgen, steroidogenesis) activity and also to those with thyroid and progesterone activity. Besides, SR was influenced by non-chemical factors, e.g., inbreeding and temperature, leading to difficulty in data interpretation. The ECHA/EFSA/JRC Guidance suggests that SR and gonad histology data can be used for identifying EDCs. Due to reversibility, influence of confounding factors, and responsiveness to chemicals with endocrine activity other than EAS, this study suggests that SR/gonad histology should be combined with certain mode of action evidence for identifying EDCs. Important considerations for using SR data in the identification, classification, PBT assessment, testing, and risk assessment are discussed.

Authors: Dang Z, Kienzler A.

Full Source: Environment International. 2019 Sep; 130:104928. doi: 10.1016/j.envint.2019.104928. Epub 2019 Jul 2.

Chemical-microbial interactions can be categorised into two classes: Microbiome Modulation of Toxicity (MMT) and Toxicant Modulation of the Microbiome (TMM)

MEDICAL RESEARCH

The Role of the Human Microbiome in Chemical Toxicity

2019-09-23

There is overwhelming evidence that the microbiome must be considered when evaluating the toxicity of chemicals. Disruption of the normal microbial flora is a known effect of toxic exposure, and these disruptions may lead to human health effects. In addition, the biotransformation of

numerous compounds has been shown to be dependent on microbial enzymes, with the potential for different host health outcomes resulting from variations in the microbiome. Evidence suggests that such metabolism of environmental chemicals by enzymes from the host's microbiota can affect the toxicity of that chemical to the host. Chemical-microbial interactions can be categorised into two classes: Microbiome Modulation of Toxicity (MMT) and Toxicant Modulation of the Microbiome (TMM). MMT refers to transformation of a chemical by microbial enzymes or metabolites to modify the chemical in a way that makes it more or less toxic. TMM is a change in the microbiota that results from a chemical exposure. These changes span a large magnitude of effects and may vary from microbial gene regulation, to inhibition of a specific enzyme, to the death of the microbes. Certain microbiomes or microbiota may become associated with different health outcomes, such as resistance or susceptibility to exposure to certain toxic chemicals, the ability to recover following a chemical-induced injury, the presence of disease-associated phenotypes, and the effectiveness of immune responses. Future work in toxicology will require an understanding of how the microbiome interacts with toxicants to fully elucidate how a compound will affect a diverse, real-world population.

Authors: Koontz JM, Dancy BCR, Horton CL, Stallings JD, DiVito VT, Lewis JA.

Full Source: International Journal of Toxicology. 2019 Jul/Aug;38(4):251-264. doi: 10.1177/1091581819849833. Epub 2019 Jun 20.

DNA methylation changes involved in the tumour increase in F2 males born to gestationally arsenite-exposed F1 male mice

2019-09-23

Previously, we have found that arsenite exposure of only F0 females during their pregnancy increases hepatic tumours in the F2 males in C3H mice. In the current study, the authors investigated the association of DNA methylation with the hepatic tumour increase in the F2 males of the arsenite group. Reduced-representation bisulfite sequencing analysis newly identified that DNA methylation levels of regions around the transcriptional start sites of Tmem54 and Cd74 were decreased and the expression of these genes were significantly increased in the hepatic tumours of F2 males of the arsenite group. The associations between DNA methylation in these regions and gene expression changes were confirmed by treatment of murine hepatoma cell lines and hepatic stellate cell line with 5-aza-2'-deoxycytidine. Overexpression of Cd74 in Hepa1c1c7

Multigenerational adverse effects from the environment such as nutrition and chemicals are among important concerns in environmental health issues.

cells increased Trib3 expression and suppressed the expression of tumour suppressor genes Id3 and Atoh8. Human database analysis using the Cancer Genome Atlas indicated that TMEM54, CD74, and TRIB3 were significantly increased and that ATOH8 was decreased in hepatocellular carcinoma. The data also showed that high expression of TMEM54 and TRIB3 and low expression of ATOH8 were associated with poor survival. These results suggested that an increase in Tmem54 and Cd74 expression via DNA methylation reduction was involved in the tumour increase in the F2 male offspring by gestational arsenite exposure of F0 females. This study also suggested that genes downstream of Cd74 were involved in tumorigenesis.

Authors: Okamura K, Nakabayashi K, Kawai T, Suzuki T, Sano T, Hata K, Nohara K.

Full Source: Cancer Science. 2019 Aug;110(8):2629-2642. doi: 10.1111/cas.14104. Epub 2019 Jul 25.

Quantitative identification of and exposure to synthetic phenolic antioxidants, including butylated hydroxytoluene, in urine

2019-09-23

Synthetic phenolic antioxidants (SPAs) such as 2,6-di-tert-butyl-4-hydroxytoluene (butylated hydroxytoluene, BHT), are used in a wide variety of consumer products, including certain foodstuffs (e.g. fats and oils) and cosmetics. Although BHT is considered generally safe as a food preservative when used at approved concentrations, there is debate whether BHT exposure is linked to cancer, asthma, and behavioural issues in children. Little is known with regard to human exposure to SPAs and the methods to measure these chemicals in urine. In this study, six SPAs and the metabolites were analysed in 145 urine samples collected from four Asian countries (China, India, Japan, and Saudi Arabia) and the United States. BHT was found in 88% of the urine samples at median and maximum concentrations of 1.26 and 15 ng/mL, respectively. BHT metabolites and butylated hydroxyanisole (BHA) were found in 39% to 89% of the urine samples at a concentration range of <LOQ-46 ng/mL. 3,5-Di-tert-butyl-4-hydroxybenzoic acid (BHT-COOH), the major metabolite of BHT, is suggested as a potential urinary biomarker of exposure to BHT. The estimated median daily intakes (EDIs) of BHT, calculated from urinary concentrations, in children and adults were 0.38-56.6 and 0.21-31.3 µg/kg

In this study, six synthetic phenolic antioxidants and the metabolites were analysed in 145 urine samples collected from four Asian countries (China, India, Japan, and Saudi Arabia) and the United States.

bw/day, respectively. BHT levels were high in urine samples from Japan, India, and the United States.

Authors: Wang W, Kannan K.

Full Source: Environment International. 2019 Jul; 128:24-29. doi: 10.1016/j.envint.2019.04.028. Epub 2019 Apr 25.

DNA modifications that do not cause gene mutations confer the potential for mutagenicity by combined treatment with food chemicals

2019-09-23

Cell proliferation plays a key role in fixing mutations induced by DNA damage. In the present study, the authors clarified whether this phenomenon occurred after combined treatment with chemicals in food. The effects of antibiotic flumequine (FL), a residue of veterinary medicinal products in foodstuffs, on mutagenicity in the liver were examined in mice treated with estragole (ES), a natural food flavouring compound. Gpt delta mice were orally administered 10 or 100 mg/kg/day ES and simultaneously fed a diet containing 0.4% FL for 4 weeks. Proliferating cell nuclear antigen-positive cells and cell cycle-related genes were additively increased in the livers of combined treatment groups as compared with high-dose ES or FL groups. Mutant frequencies (MFs) in gpt after cotreatment with low-dose ES and FL were significantly increased, although treatment with ES alone increased MFs only in the high-dose group. Sult1a1 mRNA levels were unchanged after FL treatment. Liquid chromatography with tandem-mass spectrometry analysis showed that FL did not affect the amount of ES-specific DNA adducts in the livers, indicating that FL treatment did not influence metabolic pathways of ES. Thus, enhancement of the mutagenic potential of a chemical by chemical-induced cell proliferation may occur as a result of the combined effects of chemicals in food.

Authors: Ishii Y, Yokoo Y, Kijima A, Takasu S, Ogawa K, Umemura T.

Full Source: Food Chemistry & Toxicology. 2019 Jul; 129:144-152. doi: 10.1016/j.fct.2019.04.011. Epub 2019 Apr 25.

Development of low molecular weight heparin by H₂O₂/ascorbic acid with ultrasonic power and its anti-metastasis property

2019-09-23

Low molecular weight heparins (LMWHs) are currently used as an anticoagulant agent since unfractionated heparin (UFH) can cause

Cell proliferation plays a key role in fixing mutations induced by DNA damage. In the present study, the authors clarified whether this phenomenon occurred after combined treatment with chemicals in food.

serious adverse drug reactions. LMWHs are commercially prepared using different methods such as nitrous acid cleavage and β -elimination under strong reaction conditions or with harsh chemicals, which may cause the saccharide units within the polysaccharide backbone to be decomposed and noticeably modified. This study demonstrates an effective method for depolymerizing heparin via the production of large amounts of free radicals from H₂O₂/ascorbic acid and ultrasonic power; this results in highly pure products because ascorbic acid can decompose during the reaction, which is different from the previously reported H₂O₂/Cu²⁺ method. The reaction conditions-including concentration of ascorbic acid, reaction temperature and intensity of ultrasonic power-were investigated and optimized. The authors found that the degradation behaviour of heparin in this combined physicochemical process conformed to first-order reaction kinetics. The chemical composition and structures of different LMWHs were analysed. The results showed the primary structure and sulfate esters were well preserved after the depolymerization, the major repeat units are (1-4)-linked glucosamine and iduronic acid. The further in vitro assays indicated that the LMWHs produced by H₂O₂/ascorbic acid with ultrasonic power have an anti-metastatic effect in A549 cells, which suggested the LMWHs rapidly prepared in this physicochemical way have a potential for anti-tumour metastatic function.

Authors: Shen X, Liu Z, Li J, Wu D, Zhu M, Yan L, Mao G, Ye X, Linhardt RJ, Chen S.

Full Source: International Journal of Biology & Macromolecules. 2019 Jul 15; 133:101-109. doi: 10.1016/j.ijbiomac.2019.04.019. Epub 2019 Apr 4.

OCCUPATIONAL RESEARCH

Meta-analysis of chromosomal aberrations as a biomarker of exposure in healthcare workers occupationally exposed to antineoplastic drugs

2019-09-23

Many antineoplastic drugs used to treat cancer, particularly alkylating agents and topoisomerase inhibitors, are known to induce genetic damage in patients. Elevated levels of chromosomal aberrations, micronuclei, and DNA damage have been documented in cancer patients. Elevations in these same biomarkers of genetic damage have been reported in numerous studies of healthcare workers, such as nurses and pharmacists, who routinely handle these drugs, but results vary across studies. To obtain an overall assessment of the exposure effect, the

The authors performed a meta-analysis on data obtained from peer-reviewed publications reporting chromosomal aberration levels in healthcare workers exposed to antineoplastic drugs.

authors performed a meta-analysis on data obtained from peer-reviewed publications reporting chromosomal aberration levels in healthcare workers exposed to antineoplastic drugs. A literature search identified 39 studies reporting on occupational exposure to antineoplastic drugs and measurement of chromosomal aberrations in healthcare workers. After applying strict inclusion criteria for data quality and presentation, data from 17 studies included in 16 publications underwent meta-analysis using Hedges' bias-corrected g and a random-effects model. Results showed the level of chromosomal aberrations in healthcare workers exposed to antineoplastic drugs was significantly higher than in controls. The standardised mean differences (difference of means divided by within sd) from all studies were pooled, yielding a value 1.006 (unitless) with $p < 0.001$. Thus, in addition to the documented genotoxic effects of antineoplastic drugs in cancer patients, this meta-analysis confirmed a significant association between occupational exposure to antineoplastics during the course of a normal work day and increases in chromosomal aberrations in healthcare workers. Based on the studies reviewed, the authors were unable to accurately assess whether appropriate use of protective measures might reduce the incidence of genetic damage in healthcare workers. However, given the potential for increased cancer risk linked to increases in chromosomal aberrations, the results of this study support the need to limit occupational exposure of healthcare workers to antineoplastic drugs as much as possible.

Authors: Roussel C, Witt KL, Shaw PB, Connor TH.

Full Source: Mutation Research. 2019 Jul - Sep; 781:207-217. doi: 10.1016/j.mrrev.2017.08.002. Epub 2017 Aug 24.

The aim of this investigation was to evaluate the presence of epithelial squamous metaplasia and dysplasia in ethmoidal nasal polyposis

Epithelial Squamous Metaplasia and Dysplasia in Inflammatory Nasal Polyps: An Observational Study

2019-09-23

Nasal polyposis (NP) is characterised by polypoid outgrowths of chronically inflamed respiratory mucosa. The presence of squamous metaplasia and dysplasia on the mucosal surface of nasal polyps (NPs) represents different manifestations of epithelial atypia. The aim of this investigation was to evaluate the presence of epithelial squamous metaplasia and dysplasia in ethmoidal NPs. This retrospective analysis of prospectively collected data involved 212 patients with NP undergoing endoscopic ethmoidectomy. To evaluate possible aetiological factors for epithelial atypia, the patients in whom we histopathologically detected the presence of epithelial atypia were compared with patients with "normal" NPs in accordance with the following characteristics as found in

the patients' medical records: gender, age, main symptoms, preoperative extent of sinus disease on computed tomography, atopic status, aspirin sensitivity, cigarette smoking, and occupational exposure to different noxious factors. Epithelial atypia was detected histopathologically in 44 (20.7%) NP patients, whereas features of "true" dysplasia were found in only 1 (0.5%) patient. The presence of atypia was more frequent in males than in females ($P = .008$). The association with aspirin-exacerbated respiratory disease and with long-term occupational exposure to different noxious chemicals, especially in workers exposed to salts of heavy metals, was more frequent in NP patients with epithelial atypia than in patients without atypia ($P = .023$; $P = .006$, respectively). Our results suggest epithelial atypia in NPs are associated with aspirin sensitivity and occupational exposure to different noxious chemicals. Although extremely rare, epithelial dysplasia may occasionally be noted in NPs, a fact potentially useful for both rhinologists and pathologists.

Authors: Perić A, Stoiljkov M, Đokić D, Đurđević BV.

Full Source: Ear Nose Throat Journal. 2019 Jul 16:145561319862207. doi: 10.1177/0145561319862207. [Epub ahead of print]

Urinary parabens in adults from South China: Implications for human exposure and health risks

2019-09-23

Parabens are a kind of preservatives widely used in cosmetic and personal care products and ubiquitously detected in the environment. However, little is known on human exposure to these chemicals. This study investigated the urinary parabens in adults from South China to evaluate the cumulative risk of paraben exposure. A total of 562 urine samples were collected from adult workers for the determination of methyl paraben (MeP), ethyl paraben (EtP), propyl paraben (PrP), butyl paraben, and benzyl parabens. High detection frequencies ($\geq 98\%$) were observed for MeP, EtP, and PrP with median concentrations of 8.88, 5.11, and 1.44 $\mu\text{g/L}$, respectively. Urinary parabens were 4.5-46.2-fold higher in urine of females than those in males. Urinary MeP was associated with alcohol drinking and a history of tumour, while urinary PrP was negatively associated with education levels of the subjects. There were not significant associations between urinary concentrations of parabens and body mass index, which indicated that obesity was not associated with paraben exposure. Also, parabens did not correlate with human dietary habits. Although the total estimated daily intake (TEDI) of the major compound MeP and EtP in adult workers was lower than the acceptable daily intake (ADI), the TEDI of PrP

This study investigated the urinary parabens in adults from South China to evaluate the cumulative risk of paraben exposure.

exceed the ADI for a very few subjects, especially for females and low-educated ones, suggesting potential health risks.

Authors: Yu Y, Li W, Lu S, Wu S, Wang F, Tse LA, Kang L, Ma S.

Full Source: *Ecotoxicology & Environmental Safety*. 2019 Oct 30;

182:109419. doi: 10.1016/j.ecoenv.2019.109419. Epub 2019 Jul 10.

Characterising Occupational Health Risks and Chemical Exposures Among Asian Nail Salon Workers on the East Coast of the United States

2019-09-23

The products used in nail care services contain toxic chemicals. This study aimed to characterise occupational health risk factors and chemical exposures among Asian nail salon workers on the East Coast of the U.S. for informing the development of more effective, culturally appropriate interventions. The authors conducted a community-based participatory research (CBPR) study to characterise occupational health risks. A face-to-face, self-reported survey was performed, and personal exposure to volatile organic compounds (VOCs) was evaluated. Three VOCs, acetone, methyl methacrylate (MMA), and toluene, were measured using 3M 3500 organic vapor monitors. Data on 112 workers with 100 personal chemical exposure measurements from 25 nail salons was collected. Self-reported health problems that emerged or worsened after participants started working in the nail salon industry included headaches (8%); light-headedness (9.8%); and irritation to the nose, eyes, throat, and skin (21.2%). Approximately 70% of participants reported that they had been pregnant, 11.7% of whom had at least one miscarriage. The mean concentrations of acetone, MMA, and toluene were 18.51 parts per million (ppm), 39.45 ppm, and 0.09 ppm, respectively. Mean concentrations of acetone and MMA measured from salons in New York City were significantly lower than those measured in Philadelphia and southern New Jersey. CBPR proved to be as an efficient approach for recruiting hard-to-reach Asian immigrant nail salon workers. Adverse health symptoms and problems associated with providing nail salon services were identified in these workers. Further studies are needed to better understand the long-term health effects of chronic chemical exposures in nail salon environments.

Authors: Ma GX, Wei Z, Husni R, Do P, Zhou K, Rhee J, Tan Y, Navder K, Yeh MC.

Full Source: *Journal of Community Health*. 2019 Jul 11. doi: 10.1007/s10900-019-00702-0. [Epub ahead of print]

This study aimed to characterise occupational health risk factors and chemical exposures among Asian nail salon workers on the East Coast of the U.S.

Priority: safe working conditions

2019-09-23

The drawing up of a new regulation of the Minister of Family, Labour and Social Policy regarding the maximum admissible concentrations and intensities of agents harmful to health in the working environment resulted from the obligatory implementation into national law the provisions of Commission Directive (EU) 2017/164 of 31 January 2017 establishing a fourth list of indicative occupational exposure limit values pursuant to Council Directive 98/24/EC, and amending Commission Directives 91/322/EEC, 2000/39/EC and 2009/161/EU, the provisions of which Member States had to introduce by 21 August 2018, and partly Directive 2017/2398/EU of the European Parliament and of the Council of 12 December 2017 amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work. The Regulation takes into account 13 applications submitted in the years 2014-2017 by the Interdepartmental Commission for Maximum Admissible Concentrations and Intensities for Agents Harmful to Health in the Working Environment to the minister competent for labour issues. The Commission was appointed by way of the regulation of the Prime Minister of 15 December 2008 (Journal of Laws 2015, item 1772, as amended), and its tasks include submitting to the minister competent for labour issues applications regarding the value of the maximum admissible concentrations and intensities for agents harmful to health in the working environment.

2019;70(4):497-509.

Author: Skowroń J.

Full Source: *Medycyna Pracy*. 2019 Jul 16;70(4):497-509. doi: 10.13075/mp.5893.00832. Epub 2019 Jun 11.

The Threshold of Toxicological Concern (TTC) concept integrates data on exposure, chemical structure, toxicity and metabolism to identify a safe exposure threshold value for chemicals with insufficient toxicity data for risk assessment.

PUBLIC HEALTH RESEARCH

Testing the thresholds of toxicological concern values using a new database for food-related substances

2019-09-23

The Threshold of Toxicological Concern (TTC) concept integrates data on exposure, chemical structure, toxicity and metabolism to identify a safe exposure threshold value for chemicals with insufficient toxicity data for risk assessment. The TTC values were originally derived from a non-cancer dataset of 613 compounds with a potentially small domain of applicability. There is interest to test whether the TTC values are applicable to a broader

range of substances, particularly relevant to food safety using EFSA's new OpenFoodTox database. After exclusion of genotoxic compounds, organophosphates or carbamates or those belonging to the TTC exclusion categories, the remaining 329 substances in the EFSA OpenFoodTox database were categorised under the Cramer decision tree, into low (Class I), moderate (II), or high (III) toxicity profile. For Cramer Classes I and III the threshold values were 1000 µg/person per day (90% confidence interval: 187-2190) and 87 µg/person per day (90% confidence interval: 60-153), respectively, compared to the corresponding original threshold values of 1800 and 90 µg/person per day. This confirms the applicability of the TTC values to substances relevant to food safety. Cramer Class II was excluded from our analysis because of containing too few compounds. Comparison with the Globally Harmonised System of classification confirmed that the Cramer classification scheme in the TTC approach is conservative for substances relevant to food safety.

Authors: Reilly L, Serafimova R, Partosch F, Gundert-Remy U, Cortiñas Abrahantes J, Dorne JMC, Kass GEN.

Full Source: Toxicology Letters. 2019 Jul 17; 314:117-123. doi: 10.1016/j.toxlet.2019.07.019. [Epub ahead of print]

Deep learning driven QSAR model for environmental toxicology: Effects of endocrine disrupting chemicals on human health

2019-09-23

Over 80,000 endocrine-disrupting chemicals (EDCs) are considered emerging contaminants (ECs), which are of great concern due to their effects on human health. Quantitative structure-activity relationship (QSAR) models are a promising alternative to in vitro methods to predict the toxicological effects of chemicals on human health. In this study, the authors assessed a deep-learning based QSAR (DL-QSAR) model to predict the qualitative and the quantitative effects of EDCs on the human endocrine system, and especially sex-hormone binding globulin (SHBG) and oestrogen receptor (ER). Statistical analyses of the qualitative responses indicated that the accuracies of all three DL-QSAR methods were above 90%, and greater than the other statistical and machine learning models, indicating excellent classification performance. The quantitative analyses, as assessed using deep-neural-network-based QSAR (DNN-QSAR), resulted in a coefficient of determination (R²) of 0.80 and predictive square correlation coefficient (Q²) of 0.86, which implied satisfactory goodness of fit and predictive ability. Thus, DNN was able to transform sparse molecular descriptors into higher dimensional

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spaces, and was superior for assessment qualitative responses. Moreover, DNN-QSAR demonstrated excellent performance in the discipline of computational chemistry by handling multicollinearity and overfitting problems.

Heo S, Safder U, Yoo C.

Full Source: Environmental Pollution. 2019 Jul 6; 253:29-38. doi: 10.1016/j.envpol.2019.06.081. [Epub ahead of print]

Consumer exposure and risk assessment to selected chemicals of mould stain remover use in Korea

2019-09-23

Mould stain remover (MSR) is used to clean mould and mildew spots from surfaces and contains a variety of chemical substances. In this study, the authors estimated the inhalation and dermal exposures associated with the use of trigger spray MSRs, and performed screening-level risk assessments for the use of this type of product in Korea. Inhalation and dermal exposures were estimated using exposure algorithms based on exposure factors obtained from a nationwide survey of 10,000 participants and chemical analyses of the four most popular trigger spray MSRs. The hazard quotients (HQs) for noncancer risk and excess cancer risk (ECR) were calculated for each chemical. The mean inhalation exposure estimates for formaldehyde, benzene, chloroform, and carbon tetrachloride were 6.9×10^{-7} , 1.7×10^{-7} , 5.4×10^{-6} , and 2.7×10^{-5} mg/kg/day, respectively. Dermal exposures of the chemicals were 5.7-6.5 times higher than inhalation exposures. The HQs for total exposure were all below 1, which indicated little noncancer risk from the use of MSRs. The safe ECR value of 1×10^{-6} , was exceeded in one subject for inhalation exposure of benzene and four subjects for dermal exposure of formaldehyde, while 19.8% for dermal exposure of benzene were above this value. Therefore, use of trigger spray MSRs in Korea should require more detailed exposure and risk assessment, especially for benzene.

Authors: Park JY, Lim M, Lee K, Ji K, Yang W, Shin HS, Lim H, Lee H, An J.

Full Source: Journal of Exposure Science & Environmental Epidemiology. 2019 Jul 12. doi: 10.1038/s41370-019-0155-0. [Epub ahead of print]

In this study, the authors estimated the inhalation and dermal exposures associated with the use of trigger spray MSRs, and performed screening-level risk assessments for the use of this type of product in Korea.

Biocide resistance and transmission of *Clostridium difficile* spores spiked onto clinical surfaces from an American healthcare facility

2019-09-23

Clostridium difficile is the primary cause of antibiotic-associated diarrhoea globally. In unfavourable environments the organism produces highly resistant spores which can survive microbicidal insult. In previous research, the authors determined the ability of *C. difficile* spores to adhere to clinical surfaces; finding that spores had marked different hydrophobic properties and adherence ability. Investigation into the effect of the microbicide sodium dichloroisocyanurate on *C. difficile* spore transmission revealed that sub-lethal concentrations increased spore adherence without reducing viability. The present study examined the ability of spores to transmit across clinical surfaces and their response to an in-use disinfection concentration of 1,000-ppm of chlorine-releasing agent sodium dichloroisocyanurate. In an effort to understand if these surfaces contribute to nosocomial spore transmission, surgical isolation gowns, hospital-grade stainless steel and floor vinyl were spiked with 1×10^6 spores/ml of two types of *C. difficile* spore preparations: crude spores and purified spores. The hydrophobicity of each spore type versus clinical surface was examined via plate transfer assay and scanning electron microscopy. The experiment was repeated and spiked clinical surfaces were exposed to 1,000-ppm sodium dichloroisocyanurate at the recommended 10-min contact time. Results revealed that the hydrophobicity and structure of clinical surfaces can influence spore transmission and that outer spore surface structures may play a part in spore adhesion. Spores remained viable on clinical surfaces after microbicide exposure at the recommended disinfection concentration demonstrating ineffectual sporicidal action. This study showed that *C. difficile* spores can transmit and survive between varying clinical surfaces despite appropriate use of microbicides. *Clostridium difficile* is a healthcare-acquired organism and the causative agent of antibiotic-associated diarrhoea. Its spores are implicated in faecal to oral transmission from contaminated surfaces in the healthcare environment due to their adherent nature. Contaminated surfaces are cleaned using high-strength chemicals to remove and kill the spores; however, despite appropriate infection control measures, there is still high incidence of *C. difficile* infection in patients in the US. This research examined the effect of a high-strength biocide on spores of *C. difficile* which had been spiked onto a range of clinically relevant surfaces including isolation gowns, stainless steel and floor vinyl. This study found that *C. difficile*

spores were able to survive exposure to appropriate concentrations of biocide; highlighting the need to examine the effectiveness of infection control measures to prevent spore transmission, and consideration of the prevalence of biocide resistance when decontaminating healthcare surfaces.

Authors: Dyer C, Hutt LP, Burky R, Joshi LT.

Full Source: Applied Environmental Microbiology. 2019 Jul 12. pii: AEM.01090-19. doi: 10.1128/AEM.01090-19. [Epub ahead of print]

Prevalence of, and factors associated with health supplement use in Dubai, United Arab Emirates: a population-based cross-sectional study

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Health supplement (HS) products that are available in the Emirate of Dubai (United Arab Emirates; UAE) contain chemicals that may adversely affect human health. This study aimed to investigate the prevalence of, and factors associated with HS consumption, knowledge, related adverse events, and reporting practices of adverse events amongst the general population in Dubai, UAE. A cross-sectional household telephone survey using a computer-assisted questionnaire was conducted amongst a random representative sample (n = 1203) of the Dubai population that assessed HS use and knowledge. Dependent variables were supplement use and reports of adverse events while independent variables included socio-demographic factors, knowledge, attitudes, and practice. Logistic regression analysis was performed to identify factors independently associated with HS use. Among the 1203 participants in this study, 455 (37.8%) reported ever using HS. Amongst ever-users, reasons for use were to improve health (66.1%), for bodybuilding (9.9%), disease prevention (6.8%), and weight management (5.3%). The majority of users purchased their HS from pharmacies (88.4%) or were prescribed HS (46.6%). Vitamins were the most commonly used HS (87.9%) followed by minerals (10.5%) and sports nutrition products (10.5%). Only 2.9% of users experienced an adverse event associated with HS use which all resolved when the HS was discontinued. Only three of those affected reported the incident. Multivariate logistic regression analysis revealed that HS use was independently associated with female gender (adjusted odds ratio [AOR]; 3.26, 95% confidence interval [CI]: 2.26-4.70), higher income (AOR 2.41, 95% CI: 1.20-4.83), being a past-smoker (AOR 2.39, 95% CI: 1.27-4.48), having an allergy (AOR 1.75, 95% CI: 1.14-2.66), more frequent doctor visits (AOR 1.86, 95% CI: 1.02-3.39), taking prescribed medications (AOR 1.47, 95% CI: 1.04-2.06), and knowledge about HS (AOR 3.91, 95% CI: 2.26-6.76).

This study aimed to investigate the prevalence of, and factors associated with health supplement consumption, knowledge, related adverse events, and reporting practices of adverse events amongst the general population in Dubai, UAE.

CONCLUSIONS: Our study provides the first population-based estimates of HS use and HS-related adverse events in the Gulf region. Adverse events associated with HS are infrequent and this may be due to the well-developed regulatory framework in Dubai and the high level of knowledge amongst consumers who mainly consume vitamins and minerals on the advice of pharmacists or healthcare professionals.

Authors: Abdulla NM, Aziz F, Blair I, Grivna M, Adam B, Loney T.

Full Source: BMC Complementary and Alternative Medicine. 2019 Jul 12;19(1):172. doi: 10.1186/s12906-019-2593-6.

Understanding mixed environmental exposures using metabolomics via a hierarchical community network model in a cohort of California women in 1960's

2019-09-23

Even though the majority of population studies in environmental health focus on a single factor, environmental exposure in the real world is a mixture of many chemicals. The concept of "exposome" leads to an intellectual framework of measuring many exposures in humans, and the emerging metabolomics technology offers a means to read out both the biological activity and environmental impact in the same dataset. How to integrate exposome and metabolome in data analysis is still challenging. Here, we employ a hierarchical community network to investigate the global associations between the metabolome and mixed exposures including DDTs, PFASs and PCBs, in a women cohort with sera collected in California in the 1960s. Strikingly, this analysis revealed that the metabolite communities associated with the exposures were non-specific and shared among exposures. This suggests that a small number of metabolic phenotypes may account for the response to a large class of environmental chemicals.

Authors: Li S, Cirillo P, Hu X, Tran V, Krigbaum N, Yu S, Jones DP, Cohn B.

Full Source: Reproductive Toxicology. 2019 Jul 9. pii: S0890-6238(18)30603-8. doi: 10.1016/j.reprotox.2019.06.013. [Epub ahead of print]

Even though the majority of population studies in environmental health focus on a single factor, environmental exposure in the real world is a mixture of many chemicals.