Bulletin Board

MAY. 03, 2019

CHEMWATCH

Contents

(click on page numbers for links)

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

Contents

Technical

ENVIRONMENTAL RESEARCH

Safe chemical repellents to prevent the spread of invasive ants

2019-04-08

The red imported fire ant, Solenopsis invicta, is one of the most dangerous invasive species in the world. Fire ants can spread by hiding among plant material and soil that are transported from infested areas in vehicles and vessels. Therefore, efficient repellents may be used to prevent fire ants from infesting transported goods. Although some fire ant repellents have been identified, novel, cost-effective and environmentally friendly materials for fire ant control are still needed. Recent studies with other model insects have suggested readily available, non-toxic alternatives (e.g., anthranilates) to commercial repellents. In the present study, the authors measured the repellent effects of the food additives ethyl anthranilate and butyl anthranilate against nesting by fire ant workers, and the results demonstrated that extremely low concentrations of these compounds can prevent fire ant nesting in pots. The tested compounds remained active at concentrations < 100 µL/L, which is many times lower than the minimum active concentration of any other proposed compound, including the established insect repellent N,N-diethyl-3-methylbenzamide (DEET). These inexpensive chemicals are safely used by the food and cosmetics industries, and their high efficiency differentiates them as the most promising chemicals for use in preventing the spread of fire ants; thus, these chemicals should be evaluated for further potential applications.

Authors: Chen S, Chen H, Xu Y.

Full Source: Pest Management Science. 2019 Mar; 75(3):821-827. doi: 10.1002/ps.5184. Epub 2018 Oct 3.

In the present study, the authors measured the repellent effects of the food additives ethyl anthranilate and butyl anthranilate against nesting by fire ant workers

Oxygenic photosynthesis: history, status and perspective

2019-04-08

Cyanobacteria and plants carry out oxygenic photosynthesis. They use water to generate the atmospheric oxygen we breathe and carbon dioxide to produce the biomass serving as food, feed, fibre and fuel. This study scans the emergence of structural and mechanistic understanding of oxygen evolution over the past 50 years. It reviews speculative concepts and the stepped insight provided by novel experimental and theoretical techniques. Driven by sunlight photosystem II oxidises the catalyst of water oxidation, a hetero-metallic Mn4CaO5(H2O)4

cluster. Mn3Ca are arranged in cubanoid and one Mn dangles out. By accumulation of four oxidising equivalents before initiating dioxygen formation it matches the four-electron chemistry from water to dioxygen to the one-electron chemistry of the photo-sensitiser. Potentially harmful intermediates are thereby occluded in space and time. Kinetic signatures of the catalytic cluster and its partners in the photo-reaction centre have been resolved, in the frequency domain ranging from acoustic waves via infra-red to X-ray radiation, and in the time domain from nano- to milli-seconds. X-ray structures to a resolution of 1.9 Å are available. Even time resolved X-ray structures have been obtained by clocking the reaction cycle by flashes of light and diffraction with femtosecond X-ray pulses. The terminal reaction cascade from two molecules of water to dioxygen involves the transfer of four electrons, two protons, one dioxygen and one water. A rigorous mechanistic analysis is challenging because of the kinetic enslaving at millisecond duration of six partial reactions (4e-, 1H+, 1O2). For the time being a peroxide-intermediate in the reaction cascade to dioxygen has been in focus, both experimentally and by quantum chemistry. Homo sapiens has relied on burning the products of oxygenic photosynthesis, recent and fossil. Mankind's total energy consumption amounts to almost one-fourth of the global photosynthetic productivity. If the average power consumption equalled one of those nations with the highest consumption per capita it was four times greater and matched the total productivity. It is obvious that biomass should be harvested for food, feed, fibre and platform chemicals rather than for fuel.

Author: Junge W.

Full Source: Quarterly reviews of biophysics. 2019 Jan; 52:e1. doi: 10.1017/S0033583518000112.

The aim of this study was to explore the mechanisms of brain damage induced by the combined treatment of mice with 1,2-dichloroethane (1,2-DCE) and ethanol.

Toxic effects of combined treatment of 1,2-dichloroethane and ethanol on mouse brain and the related mechanisms

2019-04-08

The aim of this study was to explore the mechanisms of brain damage induced by the combined treatment of mice with 1,2-dichloroethane (1,2-DCE) and ethanol. Mice were divided into control group; 1,2-DCE-intoxicated group; ethanol-treated group; and low-, medium-, and high-dose combined treatment groups. Histological observations along with brain organ coefficients and water content were used to measure the brain damage directly and indirectly. The levels of nonprotein sulfhydryls, malondialdehyde (MDA), and superoxide dismutase activity were used as parameters to evaluate oxidative stress in the brain. Protein and messenger RNA (mRNA) levels of cytochrome P450 2E1 (CYP2E1), zonula

occludens-1 (occluding and zo-1), aquaporin-4 (AQP4), nuclear factor erythroid 2-related factor 2 (Nrf2), heme oxygenase (HO)-1, and the γ-glutamyl cysteine synthetase catalytic and modulatory subunits (γ-GCSc, GR, and γ-GCSm) in the brain were examined by Western blot analysis and quantitative polymerase chain reaction analysis, respectively. Effects of the combined treatment of 1,2-DCE and ethanol were evaluated by analysis of variance with a factorial design. The results suggested that combined exposure to ethanol and 1,2-DCE synergistically increased CYP2E1 protein and mRNA levels, accelerated the metabolism of ethanol and 1,2-DCE in the brain tissue, induced high production of reactive oxygen species (ROS), and increased MDA levels, thereby damaging the blood-brain barrier and causing obvious pathological changes in brain tissue. However, the increased level of ROS activated the Nrf2 signal transduction pathway, promoting the expression of HO-1 and glutathione-related antioxidant enzymes in the brain to protect the cells from oxidative damage.

Authors: Zhang L, Jin YP.

Full Source: Journal of Biochemical and Molecular Toxicology. 2019 Jan 21:e22294. doi: 10.1002/jbt.22294. [Epub ahead of print]

Towards a harmonised method for the global reconnaissance of multi-class antimicrobials and other pharmaceuticals in wastewater and receiving surface waters

2019-04-08

Antimicrobial resistance is a worldwide problem that is both pressing and challenging due to the rate at which it is spreading, and the lack of understanding of the mechanisms that link human, animal and environmental sources contributing to its proliferation. One knowledge gap that requires immediate attention is the significance of antimicrobial residues and other pharmaceuticals that are being discharged from wastewater treatment plants (WWTPs) on the dissemination of antimicrobial resistance in the environment. In this study, the authors provide an approach to develop a harmonised analytical method for 8 classes of antimicrobials and other pharmaceuticals that can be used for global monitoring in wastewater and receiving waters. Analysis of these trace organic chemicals in the influent and effluent wastewater, and in the respective upstream and downstream receiving waters from different countries across the globe is not trivial. The authors demonstrated that sample preparation using solid-phase extraction (SPE) not only provides a convenient and cost-effective shipping of samples, but also adds stability to the analytes during international shipping. It is important

In this study, the authors provide an approach to develop a harmonised analytical method for 8 classes of antimicrobials and other pharmaceuticals that can be used for global monitoring in wastewater and receiving waters.

that SPE cartridges are maintained at cold temperature during shipment if the duration is longer than 7 days because a significant decrease in recoveries were observed after 7 days in the cartridges stored at room temperature, especially for sulfonamides and tetracyclines. To compensate for sample degradation during shipment, and matrix effects in liquid chromatography/mass spectrometry, the use of stable isotope labelled compounds should be employed when available and affordable. The importance of applying a defined tolerance for the ion ratios (Q/q) that have been optimised for wastewater and surface water is discussed. The tolerance range was set to be the mean Q/q of the analyte standard at various concentrations ±40% for the influent, and ±30% for the effluent, upstream, and downstream samples; for tetracyclines and quinolones, however, the tolerance range was ±80% in order to minimise false negative and false positive detection. The optimized procedures were employed to reveal differences in antimicrobial and pharmaceutical concentrations in influent, effluent, and surface water samples from Hong Kong, India, Philippines, Sweden, Switzerland, and United States. The antimicrobials with the highest concentrations in influent and effluent samples were ciprofloxacin (48,103 ng/L, Hong Kong WWTP 1) and clarithromycin (5178 ng/L, India WWTP 2), respectively. On the other hand, diclofenac (108,000 ng/L, Sweden WWTP 2), caffeine (67,000 ng/L, India WWTP 1), and acetaminophen (28,000 ng/L, India WWTP 1) were the highest detected pharmaceuticals in the receiving surface water samples. Hong Kong showed the highest total antimicrobial concentrations that included macrolides, quinolones, and sulfonamides with concentrations reaching 60,000 ng/L levels in the influent. Antidepressants were predominant in Sweden, Switzerland, and the United States.

Authors: Singh RR, Angeles LF, Butryn DM, Metch JW, Garner E, Vikesland PJ, Aga DS.

Full Source: Environment International. 2019 Mar; 124:361-369. doi: 10.1016/j.envint.2019.01.025. Epub 2019 Jan 17.

The ecotoxicological effects of microplastics on aquatic food web, from primary producer to human: A review

2019-04-08

The prevalence of microplastics in global waters raises the concern about their potential effects on aquatic biota. In aquatic environment, microplastics are almost ubiquitously present in all compartments from surface water to benthic sediment, making them accessible to a wide range of aquatic biota occupying different habitats. Exposure to microplastics may induce detrimental implications to the health of aquatic

This review describes the wide occurrence of microplastics ingestion by aquatic fauna and evaluates the eco-toxicological effects of microplastics as well as the associated chemicals on aquatic biota including phytoplankton and fauna from both freshwater and marine environments.

organisms. This review describes the wide occurrence of microplastics ingestion by aquatic fauna and evaluates the ecotoxicological effects of microplastics as well as the associated chemicals on aquatic biota including phytoplankton and fauna from both freshwater and marine environments. Trophic transfer of microplastics and associated contaminants along the aquatic food chain and potential impacts on human health are also discussed. Finally, this review emphasises the current knowledge gaps and gives recommendations for the future work.
Authors: Wang W, Gao H, Jin S, Li R, Na G.
Full Source: Ecotoxicology & Environmental Safety. 2019 May 30; 173:110-117. doi:10.1016/j.ecoenv.2019.01.113. Epub 2019 Feb 13.

MEDICAL RESEARCH

Effects of cigarette smoke condensate on proliferation and pluripotency gene expression in mouse embryonic stem cells

2019-04-08

Embryonic stem cells (ESCs) are derived from the inner cell mass (ICM) of blastocysts. They can be used as valuable experimental models to test the effects of drugs, chemicals, and environmental contaminants such as cigarette smoke condensate (CSC) on preimplantation embryo development. The aim of this study was to evaluate the effect of CSC on ESCs derived from mice with different genetic backgrounds and maternal ages. The study groups consisted of mouse ESCs (mESCs) obtained from three sources: blastocysts developed from fertilized oocytes of two-month-old (2-C57) and six-month-old (6-C57) C57BL/6 inbred mice and those developed from fertilised oocytes of two-month-old (2-NMRI) NMRI outbred mice. The groups of mESCs were exposed to 0.04, 4, and 40 µg/mL CSC. After exposure, the authors measured cell viability by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide assay and real-time polymerase chain reaction for changes in expressions of Oct4, Sox2, Nanog, Ahr, Bax, Bcl2, TFAM, and POLG. The cell doubling time (DT) of these populations was also determined. It was observed that CSC changed proliferation and DT in the 2-C57 and 6-C57 cells. There was no change in 2-NMRI cells. Exposure to CSC caused changes in the gene expressions and induced apoptosis in all three cell lines. Based on the results of the study, it can be concluded that CSC has an effect on the viability, DT and gene expression patterns in mouse ESCs and its effects

The aim of this study was to evaluate the effect of cigarette smoke condensate on embryonic stem cells derived from mice with different genetic backgrounds and maternal ages.

vary based on the genetic background and maternal age of isolated mouse ESCs.
Authors: Assadollahi V, Mohammadi E, Fathi F, Hassanzadeh K, Erfan MBK, Soleimani F, Banafshi O, Yosefi F, Allahvaisi O.
Full Source: Journal of Cellular Biochemistry. 2019 Mar; 120(3):4071-4080. doi: 10.1002/jcb.27692. Epub 2018 Sep 30.

Bacterial regulation of macrophage bacterial recognition receptors in COPD are differentially modified by budesonide and fluticasone propionate

2019-04-08
Patients with COPD have an increased risk for community-acquired pneumonia, which is further increased by inhaled corticosteroids. The present study assessed the effects of the corticosteroids, budesonide and fluticasone propionate, on macrophage bacterial responses in COPD. Monocyte-derived macrophages (MDMs) generated from blood monocytes from 10 non-smoker controls (NoS), 20 smokers without COPD (Sm), and 40 subjects with moderate to severe COPD (21 ex-smokers (COPD-ES) and 19 current smokers (COPD-S)) were pre-treated with budesonide or fluticasone (10 nM-1 μM) and challenged with live non-typeable Haemophilus influenzae (NTHI) or Streptococcus pneumoniae (SP). Cell surface bacterial recognition receptor expression (flow cytometry) and cytokine release (bead array) were analysed. NTHI and SP reduced bacterial recognition receptor expression on MDMs from COPD and Sm, but not NoS (except TLR4). SR-AI and MARCO were reduced by both NTHI and SP, whereas other receptors by either NTHI or SP. Among COPD subjects, COPD-ES demonstrated a greater number of reductions as compared to COPD-S. NTHI reduced SR-AI, MARCO, CD11b, CD35 and CD206 in COPD-ES while only SR-AI and CD11b in COPD-S. SP reduced SRA-1, CD1d, TLR2 and TLR4 in both COPD-ES and COPD-S, and reduced MARCO and CD93 only in COPD-ES. All receptors reduced in COPD by NTHI and most by SP, were also reduced in Sm. Budesonide counteracted the receptor reductions induced by both NTHI (CD206 $p = 0.03$, MARCO $p = 0.08$) and SP (SR-AI $p = 0.02$) in COPD-ES. Fluticasone counteracted only SP-induced reductions in TLR2 ($p = 0.008$ COPD-ES and $p = 0.04$ COPD-S) and TLR4 ($p = 0.02$ COPD-ES). Cytokine release was equivalently reduced by both corticosteroids. Reduction in macrophage bacterial recognition receptors during bacterial exposure could provide a mechanism for the increased pneumonia risk in COPD. Differential effects of budesonide and fluticasone propionate on macrophage bacterial recognition receptor

The present study assessed the effects of the corticosteroids, budesonide and fluticasone propionate, on macrophage bacterial responses in COPD.

expression may contribute to the higher pneumonia incidence reported with fluticasone propionate.
Authors: Provost KA, Smith M, Miller-Larsson A, Gudleski GD, Sethi S.
Full Source: PLoS One. 2019 Jan 24;14(1):e0207675. doi: 10.1371/journal.pone.0207675. eCollection 2019.

Benzene metabolite hydroquinone promotes DNA homologous recombination repair via the NF-κB pathway

2019-04-08
Benzene, a widespread environmental pollutant, induces DNA double-strand breaks (DSBs) and DNA repair, which may further lead to oncogenic mutations, chromosomal rearrangements and leukemogenesis. However, the molecular mechanisms underlying benzene-induced DNA repair and carcinogenesis remain unclear. The human osteosarcoma cell line (U2OS/DR-GFP), which carries a GFP-based homologous recombination (HR) repair reporter, was treated with hydroquinone, one of the major benzene metabolites, to identify the potential effects of benzene on DSB HR repair. RNA-sequencing was further employed to identify the potential key pathway that contributed to benzene-initiated HR repair. We found that treatment with hydroquinone induced a significant increase in HR. NF-κB pathway, which plays a critical role in carcinogenesis in multiple tumours, was significantly activated in cells recovered from hydroquinone treatment. Furthermore, the upregulation of NF-κB by hydroquinone was also found in human hematopoietic stem and progenitor cells. Notably, the inhibition of NF-κB activity by small molecule inhibitors (QNZ and JSH-23) significantly reduced the frequency of hydroquinone-initiated HR (-1.36- and -1.77-fold, respectively, $P < 0.01$). The results demonstrate an important role of NF-κB activity in promoting HR repair induced by hydroquinone. These finding shed light on the underlying mechanisms involved in benzene-induced genomic instability and leukemogenesis and may contribute to the larger exploration of the influence of other environmental pollutants on carcinogenesis.
Authors: Yang X, Lu Y, He F, Hou F, Xing C, Xu P, Wang QF.
Full Source: Carcinogenesis. 2019 Feb 16. pii: bgy157. doi: 10.1093/carcin/bgy157. [Epub ahead of print]

In this study, Caenorhabditis elegans was used for in vivo toxicity assessment to detect the reproductive toxicity of CdTe QDs.

Technical

Exposure to MPA-capped CdTe quantum dots causes reproductive toxicity effects by affecting oogenesis in nematode Caenorhabditis elegans

2019-04-08

Quantum dots (QDs), considered as a type of excellent semiconductor nanomaterial, are widely employed and have a number of important applications. However, QDs have the potential to produce adverse effects and toxicity with the underlying molecular mechanisms not well understood. In this study, Caenorhabditis elegans was used for in vivo toxicity assessment to detect the reproductive toxicity of CdTe QDs. The authors found that exposure to CdTe QDs particles (≥ 50 mg/L) resulted in a defect in reproductive capacity, dysfunctional proliferation and differentiation, as well as an imbalance in oogenesis by reducing the number of cells in pachytene and diakinesis. Further, we identified a SPO-11 and PCH-2 mediated toxic mechanism and a GLP-1/Notch mediated protective mechanism in response to CdTe QDs particles (≥ 50 mg/L). Taken together, these results demonstrate the potential adverse impact of CdTe QDs (≥ 50 mg/L) exposure on oogenesis and provide valuable data and guidelines for evaluation of QD biocompatibility.

Authors: Qu M, Qiu Y, Lv R, Yue Y, Liu R, Yang F, Wang D, Li Y.

Full Source: Ecotoxicology & Environmental Safety. 2019 May 30; 173:54-62. doi: 10.1016/j.ecoenv.2019.02.018. Epub 2019 Feb 12.

Effects of norfloxacin exposure on neurodevelopment of zebrafish (Danio rerio) embryos

2019-04-08

In view of the wide application of fluoroquinolones (FQs), a group of broad-spectrum synthetic antibacterial agents, and their large ingress into the environment, the toxic effects on non-target organisms caused by FQs have received great attention. In this study, the authors used zebrafish embryo as a model, measured the general toxic effects of norfloxacin, a commonly used FQs, and investigated the effects of norfloxacin on the neurodevelopment of zebrafish embryos. The data showed that norfloxacin significantly inhibited the hatching rate of zebrafish embryos, and increased the mortality and malformation rate of the embryos. To discuss the developmental neurotoxicity of norfloxacin, the expression of several stem cell and neuron lineage markers in the zebrafish embryos were measured. It was found that norfloxacin exposure inhibited the expression of GFAP (glial cell marker), and enhanced the expression of Sox 2 (stem cell marker) and Eno2 (mature neuron marker).

In this study, the authors used zebrafish embryo as a model, measured the general toxic effects of norfloxacin, a commonly used FQs, and investigated the effects of norfloxacin on the neurodevelopment of zebrafish embryos.

By measuring the level of active Caspase 3 and the expression ratio of Bax to Bcl2, the authors discovered that norfloxacin induced obvious cell apoptosis in the brain of zebrafish embryos. To explore the mechanism of the developmental neurotoxic effects of norfloxacin, MK-801, a non-competitive NMDA receptors antagonist, was applied to block the actions of NMDA receptors. The results indicated that MK-801 could rescue the upregulated cell apoptosis and disrupted balance of neuro-glial differentiation induced by norfloxacin in the brain of zebrafish embryos. The authors concluded that the results suggest that the activation of NMDA receptors mediates the developmental neurotoxicity of norfloxacin.
Authors: Xi J, Liu J, He S, Shen W, Wei C, Li K, Zhang Y, Yue J, Yang Z.
Full Source: Neurotoxicology. 2019 Feb 12; 72:85-94. doi: 10.1016/j.neuro.2019.02.007. [Epub ahead of print]

OCCUPATIONAL RESEARCH

Lifestyle and occupational factors affecting exposure to BTEX in municipal solid waste composting facility workers

2019-04-08

Composting facilities workers are potentially exposed to different volatile organic compounds (VOCs). This study aims to investigate the potential exposure to benzene, toluene, ethylbenzene and xylenes (BTEX) compounds among workers of composting facilities by measuring un-metabolised BTEX in urine and to investigate the effect that several lifestyle factors (i.e. smoking and residential traffic), using personal protective equipment, and religious practices such as Ramadan fasting can have on the urinary BTEX concentrations. The authors assessed concentrations of BTEX in the urine of a composting facility workers. Samples were collected in May 2018. Overall, 25 workers chosen as the exposed group and 20 inhabitants living close to the composting facility as a control group. The urine samples were collected from studied subjects. Identification and quantification of un-metabolized BTEX was performed using a headspace gas chromatography-mass spectrometry (GC-MS). Detailed information of participants was gathered by a comprehensive questionnaire. The geometric mean levels of urinary benzene, toluene, ethylbenzene, m-p xylene, and o-xylene in the exposed subjects were 1.27, 2.12, 0.54, 1.22 and 1.51 μg/L, respectively; 1.4 to 3.7-time higher than values in control group ($p < 0.05$). Post-shift levels were significantly higher than pre-shift for all chemicals ($p < 0.05$). Smoking habits, exposure to environmental tobacco smoke, and Ramadan fasting predicted urinary BTEX levels. Personal protective equipment

This study aims to investigate the potential exposure to benzene, toluene, ethylbenzene and xylenes (BTEX) compounds among workers of composting facilities by measuring un-metabolised BTEX in urine

which included a simple N95 mask did not protected workers from BTEX emissions. Composting facilities represent a significant source BTEX emissions and exposure for staff. More effective protective strategies are required to minimize exposure and related occupational hazards.
Authors: Rafiee A, Delgado-Saborit JM, Sly PD, Amiri H, Hoseini M.
Full Source: Science of the Total Environment. 2019 Mar 15; 656:540-546. doi: 10.1016/j.scitotenv.2018.11.398. Epub 2018 Nov 27.

Para-tertiary butyl catechol (PTBC), an industrial antioxidant induces human platelet apoptosis

2019-04-08
The catecholic derivative para-tertiary butyl catechol (PTBC) is a conventional antioxidant and polymerisation inhibitor, which exhibits melanocytotoxic effects and contact dermatitis often leading to occupational leucoderma or vitiligo. Although numerous industrial workers will be in constant exposure to PTBC and its chances of getting entry into blood are most expected, its effect on blood components is still undisclosed. As platelets play a prominent role in dermatitis, inflammation, and immunity, in this study, the authors have evaluated the effect of PTBC on human platelets in vitro. Exposure of platelets to PTBC showed increased reactive oxygen species (ROS), intracellular calcium, cardiolipin oxidation, mitochondrial permeability transition pore (MPTP) formation, activation of caspases, phosphatidylserine (PS) externalisation and decreased mitochondrial membrane potential. In addition, there was a significant decrease in cellular glutathione level, increased γ-glutamyltransferase (GGT) activity and cell death. These findings demonstrate that PTBC could induce toxic effects on blood components, which is often ignored field of research. Since dermal exposure of humans to toxic chemicals covers an important issue in various industries, there is a need of such work to understand and update the long-term toxicities induced by PTBC usage in industrial sectors and public domain.
Authors: Vishalakshi GJ, NaveenKumar SK, Hemshekhar M, Mahendra M, Kemparaju K, Girish KS.
Full Source: Environmental Toxicology. 2019 Mar; 34(3):262-270. doi: 10.1002/tox.22681. Epub 2018 Nov 21.

In this study, the authors have evaluated the effect of PTBC on human platelets in vitro.

Technical

Epidemiology of work-related burn injuries presenting to burn centres in Australia and New Zealand

2019-04-08

Burn injuries to workers can have a devastating impact, however knowledge of the epidemiology of work-related burn injuries in Australia and New Zealand is limited. In the present study, the authors described epidemiological characteristics of work-related burn injuries in Australia and New Zealand, and compared these with non-work-related burns. Adult burn injury data, 2009-2016, were extracted from the Burns Registry of Australia and New Zealand. Descriptive statistics were used to describe demographic, injury, management and outcome characteristics. Differences between work-related and non-work-related injuries were assessed using Chi-square and Wilcoxon rank-sum tests. Of 10,574 adult patients treated in burn centres in Australia and New Zealand, 2009-2016, 17% had work-related burns. Most work-related cases were male (85%), less than 35 years old (53%), and had sustained flame (33%), scald (30%) or chemicals (17%) burns. Proportions of chemical, scald and electrical burns were greater for work-related than for non-work-related burns, with this being most marked for chemical and electrical burns (17% vs. 3% and 7% vs. 1%, respectively). Almost one in five cases of working-aged people admitted to Australian and New Zealand burns centres was work-related. Through identification of vulnerable groups, this study informs policy and strategies to minimise occupational burn risk.

Authors: McInnes JA, Cleland H, Tracy LM, Darton A, Wood FM, Perrett T, Gabbe BJ.

Full Source: Burns. 2019 Mar;45(2):484-493. doi: 10.1016/j.burns.2018.09.011. Epub 2018 Sep 28.

This study aimed to identify the chemical constituents of photoresist (PR) products and their by-products and to compare these constituents with material safety data sheets (MSDSs) and analytical results.

Evaluation of Hazardous Chemicals with Material Safety Data Sheet and By-products of a Photoresist Used in the Semiconductor-Manufacturing Industry

2019-04-08

The photolithography process in the semiconductor industry uses various chemicals with little information on their constitution. This study aimed to identify the chemical constituents of photoresist (PR) products and their by-products and to compare these constituents with material safety data sheets (MSDSs) and analytical results. A total of 51 PRs with 48 MSDSs were collected. Analysis consisted of two parts: First, the constituents of the chemical products were identified and analysed using MSDS data; second, for verification of the by-products of PR, volatile organic

compounds were analysed. The chemical constituents were categorised according to hazards. Forty-five of 48 products contained trade secrets in amounts ranging from 1 to 65%. A total of 238 ingredients with multiple counting (35 ingredients without multiple counting) were identified in the MSDS data, and 48.7% of ingredients were labelled as trade secrets under the Korea Occupational Safety and Health Act. The concordance rate between the MSDS data and the analytical result was 41.7%. The by-product analysis identified 129 chemicals classified according to Chemical Abstracts Service No., with 17 chemicals that are carcinogenic, mutagenic, and reprotoxic substances. Formaldehyde was found to be released from 12 of 21 products that use novolak resin. The authors confirmed that several PRs contain carcinogens, and some were not specified in the toxicological information in the MSDS. Hazardous chemicals, including benzene and formaldehyde, are released from PRs products as by-products. Therefore, it is necessary to establish a systematic management system for chemical compounds and the working environment.

Authors: Jang M, Yoon C, Park J, Kwon O.
Full Source: Safety & Health at Work. 2019 Mar;10(1):114-121. doi: 10.1016/j.shaw.2018.08.001. Epub 2018 Aug 18.

Association of occupational exposures with cardiovascular disease among US Hispanics/Latinos

2019-04-08

Cardiovascular disease (CVD) is a leading cause of mortality and morbidity in the USA. The role of occupational exposures to chemicals in the development of CVD has rarely been studied even though many agents possess cardiotoxic properties. The authors therefore evaluated associations of self-reported exposures to organic solvents, metals and pesticides in relation to CVD prevalence among diverse Hispanic/Latino workers. Cross-sectional data from 7404 employed individuals, aged 18-74 years, enrolled in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) were analysed. Participants from four US cities provided questionnaire data and underwent clinical examinations, including ECGs. CVD was defined as the presence of at least one of the following: coronary heart disease, atrial fibrillation, heart failure or cerebrovascular disease. Prevalence ratios reflecting the relationship between each occupational exposure and CVD as well as CVD subtypes were calculated using Poisson regression models. Hispanic/Latino workers reported exposures to organic solvents (6.5%), metals (8.5%) and pesticides (4.7%) at their current jobs. Overall, 6.1% of participants had some form of CVD, with coronary heart disease as the most common (4.3%) followed by cerebrovascular disease

(1.0%), heart failure (0.8%) and atrial fibrillation (0.7%). For individuals who reported working with pesticides, the prevalence ratios for any CVD were 2.18 (95% CI 1.34 to 3.55), coronary heart disease 2.20 (95% CI 1.31 to 3.71), cerebrovascular disease 1.38 (95% CI 0.62 3.03), heart failure 0.91 (95% CI 0.23 to 3.54) and atrial fibrillation 5.92 (95% CI 1.89 to 18.61) after adjustment for sociodemographic, acculturation, lifestyle and occupational characteristics. Metal exposures were associated with an almost fourfold (3.78, 95% CI 1.24 to 11.46) greater prevalence of atrial fibrillation. Null associations were observed for organic solvent exposures. The authors concluded that the results suggest that working with metals and pesticides could be risk factors for CVD among Hispanic/Latino workers. Further work is needed to evaluate these relationships prospectively.

Authors: Bulka CM, Daviglus ML, Persky VW, Durazo-Arvizu RA, Lash JP, Elfassy T, Lee DJ, Ramos AR, Tarraf W, Argos M.
Full Source: Heart. 2019 Mar; 105(6):439-448. doi: 10.1136/heartjnl-2018-313463. Epub 2018 Dec 11.

PUBLIC HEALTH RESEARCH

The Role of Early Life Food Sensitization in Adolescent Lung Function: Results from 2 Birth Cohort Studies

2019-04-08

It is unclear whether early life food sensitisation (as opposed to aeroallergen sensitisation) is associated with subsequent poor lung function. In this study, the authors investigated the associations between food sensitisation in the first 2 years of life and lung function at 12 to 18 years and whether these observed associations are mediated through aeroallergen sensitisation or asthma. The authors used data from a high-risk cohort (Melbourne Atopy Cohort Study [MACS]) and a population-based "Influence of life-style-related factors on the development of the Immune System and Allergies in East and West Germany plus the influence of traffic emissions and genetics" (LISAplus) cohort. Food sensitisation was assessed at 6, 12, and 24 months in MACS and 24 months in LISAplus. Lung function was evaluated by spirometry at 12 and 18 years in MACS and 15 years in LISAplus. Linear regression models were used to estimate the association with sensitization (food and/or aeroallergen) while adjusting for potential confounders. Sensitisation to food without aeroallergen at 6 months was associated with reduced forced expiratory volume in 1 second (FEV1) at both 12 years (-153 mL; 95% confidence interval [CI] = -256 mL, -51 mL) and 18 years (-206 mL; 95% CI = -347 mL, -65 mL) in MACS. Similar

In this study, the authors investigated the associations between food sensitisation in the first 2 years of life and lung function at 12 to 18 years

results were observed for sensitisation measured at 12 months but not at 24 months. Early-life asthma (but not aeroallergen sensitisation) partially mediated these associations. Both cohorts showed that only aeroallergen sensitization at 24 months but not food sensitisation was associated with lower adolescent lung function. This study showed that food sensitisation at 6 and 12 months was associated with reduced FEV1 in adolescence. These finding that this link is not completely mediated by either subsequent asthma or aeroallergen sensitisation is novel and suggests that early food sensitisation itself can be used to identify high-risk groups for poor lung health.

Authors: Alduraywish S, Luzak A, Lodge C, Aldakheel F, Erbas B, Allen K, Matheson M, Gurrin L, Heinrich J, Lehmann I, von Berg A, Standl M, Abramson M, Schulz H, Lowe A, Dharmage SC.

Full Source: Journal of Allergy and Clinical Immunology. 2019 Feb 11. pii: S2213-2198(19)30158-8. doi: 10.1016/j.jaip.2019.01.050. [Epub ahead of print]

Potential harms from legalisation of recreational cannabis use in Canada.

2019-04-08

With the recent legalisation of recreational cannabis use in Canada, questions remain concerning optimal regulation to minimise harms and ensure public health and safety. Patterns of use are subject to change following legalisation, and it is important to consider the potential adverse effects that this may have on public health. Important areas of consideration are methods of consumption (e.g., vaping, edibles) and product proliferation; acute and long-term health and behavioural effects (including impaired driving); and use in vulnerable groups, such as children and youth, pregnant women, individuals with mental illness, individuals with low socio-economic status, and Indigenous populations. To support harm reduction measures and evidence-based policy, there is a need to anticipate the potential ramifications that legalisation of recreational cannabis use may have on public health in Canada.

With the recent legalisation of recreational cannabis use in Canada, questions remain concerning optimal regulation to minimise harms and ensure public health and safety.

Authors: Windle SB, Wade K, Filion KB, Kimmelman J, Thombs BD, Eisenberg MJ.

Full Source: Canadian Journal of Public Health. 2019 Apr;110(2):222-226. doi: 10.17269/s41997-018-00173-1. Epub 2019 Feb 13.

Technical

Elucidating Conserved Transcriptional Networks Underlying Pesticide Exposure and Parkinson's Disease: A Focus on Chemicals of Epidemiological Relevance

2019-04-08

While a number of genetic mutations are associated with Parkinson's disease (PD), it is also widely acknowledged that the environment plays a significant role in the aetiology of neurodegenerative diseases. Epidemiological evidence suggests that occupational exposure to pesticides (e.g., dieldrin, paraquat, rotenone, maneb, and ziram) is associated with a higher risk of developing PD in susceptible populations. Within dopaminergic neurons, environmental chemicals can have an array of adverse effects resulting in cell death, such as aberrant redox cycling and oxidative damage, mitochondrial dysfunction, unfolded protein response, ubiquitin-proteome system dysfunction, neuroinflammation, and metabolic disruption. More recently, our understanding of how pesticides affect cells of the central nervous system has been strengthened by computational biology. New insight has been gained about transcriptional and proteomic networks, and the metabolic pathways perturbed by pesticides. These networks and cell signalling pathways constitute potential therapeutic targets for intervention to slow or mitigate neurodegenerative diseases. Here we review the epidemiological evidence that supports a role for specific pesticides in the aetiology of PD and identify molecular profiles amongst these pesticides that may contribute to the disease. Using the Comparative Toxicogenomics Database, these transcripts were compared to those regulated by the PD-associated neurotoxicant MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine). While many transcripts are already established as those related to PD (alpha-synuclein, caspases, leucine rich repeat kinase 2, and parkin2), lesser studied targets have emerged as "pesticide/PD-associated transcripts" [e.g., phosphatidylinositol glycan anchor biosynthesis class C (Pigc), allograft inflammatory factor 1 (Aif1), TIMP metallopeptidase inhibitor 3, and DNA damage inducible transcript 4]. The authors also compared pesticide-regulated genes to a recent meta-analysis of genome-wide association studies in PD which revealed new genetic mutant alleles; the pesticides under review regulated the expression of many of these genes (e.g., ELOVL fatty acid elongase 7, ATPase H+ transporting V0 subunit a1, and bridging integrator 3). The significance is that these proteins may contribute to pesticide-related increases in PD risk. This review collates information on transcriptome

In the present study, the authors evaluated the use of eleven organo-phosphate and two carbamate insecticides in association with NHL in the North American Pooled Project

responses to PD-associated pesticides to develop a mechanistic framework for quantifying PD risk with exposures.
Authors: Cao F, Souders Ii CL, Perez-Rodriguez V, Martyniuk CJ.
Full Source: Frontiers in Genetics. 2019 Jan 25; 9:701. doi: 10.3389/fgene.2018.00701. eCollection 2018.

Non-Hodgkin lymphoma risk and organophosphate and carbamate insecticide use in the north American pooled project

2019-04-08

Organophosphates and carbamates have been among the most commonly used insecticides, with both agricultural and residential uses. Previous studies have suggested associations of non-Hodgkin lymphoma (NHL) with some of these chemicals; however, many studies have been limited in their ability to evaluate associations with lymphoma subtypes. In the present study, the authors evaluated the use of eleven organophosphate and two carbamate insecticides in association with NHL in the North American Pooled Project, which includes data from case-control studies in the United States and Canada (1690 cases/5131 controls). Unconditional logistic regression adjusting for potential confounders was used, including use of other pesticides, to estimate odds ratios (OR) and 95% confidence intervals (CI) for associations between these chemicals and NHL overall, and NHL subtypes, i.e., follicular (FL), diffuse large B-cell (DLBCL), small lymphocytic lymphoma (SLL) and others. Ever use of malathion was associated with increased risk of NHL overall (OR = 1.43; 95% CI: 1.14-1.81) compared with never users. Categories using tertiles of duration (<4 yrs., 4-12 yrs., and >12 yrs) also showed a significant exposure-response for increasing years of use of malathion and risk of NHL (OR<4vsUnex = 1.33 (0.88, 2.03), OR4-12vsUnex = 1.42 (1.02, 1.96), OR>12vsUnex = 1.55 (1.05, 2.28, p-trend < 0.01)). In addition, malathion use was statistically significantly associated with FL (OR = 1.58; 95% CI: 1.11-2.27) and DLBCL (OR = 1.61; 95% CI: 1.16-2.22) while there were no apparent associations with SLL or other subtypes, the p-value for heterogeneity across subtypes, however, was not significant. These results support previous studies suggesting an association between insecticide

The authors review approaches for characterising "peak" exposures in epidemiologic studies and methods for incorporating peak exposure metrics in dose-response assessments that contribute to risk assessment.

use and NHL overall, and provide new information on associations with NHL subtypes.
Authors: Koutros S, Harris SA, Spinelli JJ, Blair A, McLaughlin JR, Zahm SH, Kim S, Albert PS, Kachuri L, Pahwa M, Cantor KP, Weisenburger DD, Pahwa P, Pardo LA, Dosman JA, Demers PA, Beane Freeman LE.
Full Source: Environment International. 2019 Mar 27; 127:199-205. doi: 10.1016/j.envint.2019.03.018. [Epub ahead of print]

Peak Exposures in Epidemiologic Studies and Cancer Risks: Considerations for Regulatory Risk Assessment

2019-04-08
The authors review approaches for characterising "peak" exposures in epidemiologic studies and methods for incorporating peak exposure metrics in dose-response assessments that contribute to risk assessment. The focus was on potential etiologic relations between environmental chemical exposures and cancer risks. The epidemiologic literature on environmental chemicals classified as carcinogens in which cancer risks were described in relation to "peak" exposures were searched. These articles were evaluated to identify some of the challenges associated with defining and describing cancer risks in relation to peak exposures. We found that definitions of peak exposure varied considerably across studies. Of nine chemical agents included in our review of peak exposure, six had epidemiologic data used by the U.S. Environmental Protection Agency (US EPA) in dose-response assessments to derive inhalation unit risk values. These were benzene, formaldehyde, styrene, trichloroethylene, acrylonitrile, and ethylene oxide. All derived unit risks relied on cumulative exposure for dose-response estimation and none, to our knowledge, considered peak exposure metrics. This is not surprising, given the historical linear no-threshold default model (generally based on cumulative exposure) used in regulatory risk assessments. With newly proposed US EPA rule language, fuller consideration of alternative exposure and dose-response metrics will be supported. "Peak" exposure has not been consistently defined and rarely has been evaluated in epidemiologic studies of cancer risks. The authors recommend developing uniform definitions of "peak" exposure to facilitate fuller evaluation of dose response for environmental chemicals and cancer risks, especially where mechanistic understanding indicates that the dose response is unlikely linear and that short-term high-intensity exposures increase risk.
Authors: Checkoway H, Lees PSJ, Dell LD, Gentry PR, Mundt KA.
Full Source: Risk Analysis. 2019 Mar 29. doi: 10.1111/risa.13294. [Epub ahead of print]