

Bulletin Board

Contents

AUG. 07, 2020

[click on page numbers for links]

CHEMICAL EFFECTS

Impact of surface functionalization on the toxicity and antimicrobial effects of selenium nanoparticles considering different routes of entry.....	3
Effect Modelling Quantifies the Difference Between the Toxicity of Average Pesticide Concentrations and Time-variable Exposures from Water Quality Monitoring.....	3
Organic and conventional agriculture: Conventional rice farming causes biochemical changes in <i>Astyanax lacustris</i>	4

ENVIRONMENTAL RESEARCH

Chromium Pollution in European Water, Sources, Health Risk, and Remediation Strategies: An Overview.....	5
Emerging Pollutants - Part II: Treatment.....	6
Associations between acute exposure to ambient air pollution and length of stay for inpatients with ischemic heart disease: a multi-city analysis in central China.....	6

OCCUPATIONAL

Heavy metals and the skin: sensitization patterns in Lithuanian metalworkers.....	7
Polymorphism in GSTM1 and GSTT1 genes influence DNA damage in personnel occupationally exposed to volatile anaesthetics (VA), from Peshawar, Pakistan.....	8

PHARMACEUTICAL/TOXICOLOGY

Effect of prenatal exposure to per- and polyfluoroalkyl substances on childhood allergies and common infectious diseases in children up to age 7 years: The Hokkaido study on environment and children's health.....	9
Effect of lifetime antiepileptic drug treatment history on efficacy and tolerability of adjunctive brivaracetam in adults with focal seizures: Post-hoc analysis of a randomized, placebo-controlled trial.....	10

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Bulletin Board

Technical

AUG. 07, 2020

CHEMICAL EFFECTS

Impact of surface functionalization on the toxicity and antimicrobial effects of selenium nanoparticles considering different routes of entry

2020-07-29

Selenium nanoparticles (SeNPs) were first designed as nutritional supplements, but they are attractive also for use in diagnostic and therapeutic systems owing to their biocompatibility and protective effects. This study aimed to examine if different SeNPs stabilization strategies affect their (i) antimicrobial activity against bacteria *Escherichia coli* and *Staphylococcus aureus* and yeast *Saccharomyces cerevisiae* and (ii) toxicity to human cells of different biological barriers i.e., skin, oral and intestinal mucosa. For surface stabilization, polyvinylpyrrolidone (PVP), poly-L-lysine (PLL) and polyacrylic acid (PAA) were used rendering neutral, positively and negatively charged SeNPs, respectively. The SeNPs (primary size 180 nm) showed toxic effects in human cells in vitro and in bacteria *S. aureus*, but not in *E. coli* and yeast *S. cerevisiae*. Toxicity of SeNPs (24 h IC₅₀) ranged from 1.4 to >100 mg Se/L, depending on surface functionalization (PLL>PAA>PVP) and was not caused by ionic Se. At subtoxic concentrations, all SeNPs were taken up by all human cell types, induced oxidative stress response and demonstrated genotoxicity. As the safety profile of SeNPs was dependent not only on target cells [mammalian cells, bacteria, yeast] but also on surface functionalization, these aspects should be considered during development of novel SeNPs-based biomedical products.

Authors: Emerik Galić, Krunoslav Ilić, Sonja Hartl, Carolin Tetyczka, Kaja Kasemets, Imbi Kurvet, Mirta Milić, Rinea Barbir, Barbara Pem, Ina Erceg, Maja Dotuor Sikirić, Ivan Pavić, Eva Roblegg, Anne Kahru, Ivana Vinković Vrtek

Full Source: Food and chemical toxicology : an international journal published for the British Industrial Biological Research Association 2020 Jul 29;111621. doi: 10.1016/j.fct.2020.111621.

Effect Modelling Quantifies the Difference Between the Toxicity of Average Pesticide Concentrations and Time-variable Exposures from Water Quality Monitoring

2020-07-31

Synthetic chemicals are frequently detected in water bodies and their concentrations vary over time. Water monitoring programs typically

Bulletin Board

Technical

AUG. 07, 2020

employ either a sequence of grab samples or continuous sampling, followed by chemical analysis. Continuous time-proportional sampling yields the time-weighted average concentration, which is taken as proxy for the real, time-variable exposure. However, we do not know how much the toxicity of the average concentration differs from the toxicity of the corresponding fluctuating exposure profile. Here, we use toxicokinetic-toxicodynamic models (invertebrates, fish) and population growth models (algae, duckweed) to calculate the margin of safety in moving time windows across measured aquatic concentration time series (seven pesticides) in five streams. A longer sampling period (14 d) for time-proportional sampling leads to more deviations from the real chemical stress than shorter sampling durations (3 d). The associated error is a factor of four or less in the margin of safety value towards underestimating and an error of factor nine towards overestimating chemical stress in the most toxic time windows. Under- and overestimations occur with approximate equal frequency and are very small compared to the overall variation, which ranged from 0.027 to 2.4×10¹⁰ (margin of safety values). We conclude that continuous, time-proportional sampling for a period of 3 d and 14 d for acute and chronic assessment, respectively, yields sufficiently accurate average concentrations to assess ecotoxicological effects. This article is protected by copyright. All rights reserved.

Authors: Roman Ashauer, Roland Kuhl, Elke Zimmer, Marion Junghans
Full Source: Environmental toxicology and chemistry 2020 Jul 31. doi: 10.1002/etc.4838.

Organic and conventional agriculture: Conventional rice farming causes biochemical changes in *Astyanax lacustris*

2020-07-09

World food production is directly related to human population growth. Chemicals are constantly applied to pest control in crops to increase productivity. Therefore, sustainable alternatives are needed to reduce environmental impacts. The biochemical responses in liver and muscle of *Astyanax lacustris* collected in different rice planting systems were analysed. Ten fish were collected in organic rice cultivation systems and conventional as well as water and sediment for pesticide analysis. In water from conventional system, bentazon (56.1 µg L⁻¹), fipronil (0.226 µg L⁻¹) and propoxur (0.141 µg L⁻¹) were found, while azoxystrobin and quinclorac were below the limit of quantification (LOQ). There were no pesticides in the sediment from the conventional system. In the water of the organic system, only propoxur (below the LOQ) was registered. Metalaxil (0.025

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Bulletin Board

Technical

AUG. 07, 2020

µg kg⁻¹) were verified in the sediment, while diphenconazole, dinoxifene and tebuconazole were below the LOQ. The presence of these pesticides in crops with an organic production system may be related to proximity to crops to conventional production systems. Besides this, the amount is very low as compared with conventional system. Muscle glycogen, protein and amino acid levels were higher in fish collected in organic ponds. Lactate and ammonia levels were higher in conventional cultures. Lipids and proteins had greater oxidative damage in both tissues in the conventional system. Although pesticides were detected in organic sediments, the parameters of metabolic and oxidative damage were probably related by exposure to higher concentrations of pesticide in the water or by the lower oxygen content of conventional systems. However, fish mortality was not observed during collections. Despite being an anthropic environment, areas of organic cultivation seem to present better conditions for the survival of *A. lacustris*.

Authors: Fabiane Borba Bergmann, Aline Monique Blank do Amaral, Matheus Vieira Volcan, Jossiele Wesz Leitemperger, Renato Zanella, Osmar Damian Prestes, Barbara Clasen, Demetrio Luis Guadagnin, Vania Lucia Loro

Full Source: The Science of the total environment 2020 Jul 9;744:140820. doi: 10.1016/j.scitotenv.2020.140820.

ENVIRONMENTAL RESEARCH

Chromium Pollution in European Water, Sources, Health Risk, and Remediation Strategies: An Overview

2020-07-28

Chromium is a potentially toxic metal occurring in water and groundwater as a result of natural and anthropogenic sources. Microbial interaction with mafic and ultramafic rocks together with geogenic processes release Cr (VI) in natural environment by chromite oxidation. Moreover, Cr (VI) pollution is largely related to several Cr (VI) industrial applications in the field of energy production, manufacturing of metals and chemicals, and subsequent waste and wastewater management. Chromium discharge in European Union (EU) waters is subjected to nationwide recommendations, which vary depending on the type of industry and receiving water body. Once in water, chromium mainly occurs in two oxidation states Cr (III) and Cr (VI) and related ion forms depending on pH values, redox potential, and presence of natural reducing agents. Public concerns with chromium are primarily related to hexavalent compounds owing to their toxic effects on humans, animals, plants, and microorganisms. Risks for human health

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Bulletin Board

Technical

AUG. 07, 2020

range from skin irritation to DNA damages and cancer development, depending on dose, exposure level, and duration. Remediation strategies commonly used for Cr (VI) removal include physico-chemical and biological methods. This work critically presents their advantages and disadvantages, suggesting a site-specific and accurate evaluation for choosing the best available recovering technology.

Authors: Marina Tumolo, Valeria Ancona, Domenico De Paola, Daniela Losacco, Claudia Campanale, Carmine Massarelli, Vito Felice Uricchio
Full Source: International journal of environmental research and public health 2020 Jul 28;17(15):E5438. doi: 10.3390/ijerph17155438.

Emerging Pollutants - Part II: Treatment

2020-07-24

Emerging pollutants (EPs) refer to a class of pollutants, which are emerging in the environment or recently attracted attention. EPs mainly include pharmaceutical and personal care products (PPCPs), endocrine disrupting chemicals (EDCs), antibiotic resistance genes (ARGs), etc. EPs have potential threats to human health and ecological environment. In recent years, the continuous detections of EPs in surface and ground water have brought huge challenges to water treatment, and also made the treatment of EPs become an international research hotspot. This paper summarizes some research results on EPs treatment published in 2019. This paper may be helpful to understand the current situations and development trends of EP treatment technologies.

Authors: Bo Liu, Shen-Gen Zhang, Chein-Chi Chang

Full Source: Water environment research : a research publication of the Water Environment Federation 2020 Jul 24. doi: 10.1002/wer.1407.

Associations between acute exposure to ambient air pollution and length of stay for inpatients with ischemic heart disease: a multi-city analysis in central China

2020-08-01

Ambient air pollution (AAP) has been widely associated with increased morbidity of ischemic heart disease (IHD). However, no prior studies have investigated the effects of AAP exposure on the length of stay (LOS) due to IHD. Hospital data during 2015-2017 were obtained from hospital information system in five cities of Hubei province, China. We collected daily mean concentrations of air pollutants, including PM_{2.5}, PM₁₀, SO₂, NO₂, O₃, and CO, and meteorological data during the same time period. Poisson regression was applied to estimate the acute impacts of AAP on the LOS of IHD inpatients. A total of 42,114 inpatients with primary diagnosis of

Emerging pollutants (EPs) refer to a class of pollutants, which are emerging in the environment or recently attracted attention.

Bulletin Board

Technical

AUG. 07, 2020

IHD were included, 50.63% of which were chronic IHD inpatients. Annual average concentrations of PM_{2.5}, PM₁₀, SO₂, NO₂, O₃, and CO were 61.93 µg/m³, 95.47 µg/m³, 18.59 µg/m³, 35.87 µg/m³, 100.30 µg/m³, and 1.117 mg/m³, respectively. After adjusting for temperature, relative humidity, gender, age group, payment method, number of hospital beds, location of hospital, and surgery or not, exposures to PM_{2.5}, PM₁₀, SO₂, O₃, and CO were associated with increased LOS for all IHD patients in both single- and multi-pollutant models, and stronger associations were observed among chronic IHD patients. In addition, subgroup analyses demonstrated that males and the group aged 65+ years were more vulnerable to air pollution, and the adverse effects were also promoted by low temperature in cold season. This study provides the first investigation of the adverse effects of AAP on the LOS for IHD patients. In order to shorten the LOS of IHD, measures should be taken to strengthen the AAP management and protect the high-risk population.

Authors: Xuyan Wang, Yong Yu, Chuanhua Yu, Fang Shi, Yunquan Zhang
Full Source: Environmental science and pollution research international 2020 Aug 1. doi: 10.1007/s11356-020-10256-7.

OCCUPATIONAL

Heavy metals and the skin: sensitization patterns in Lithuanian metalworkers

2020-07-30

Background: Metalworkers are exposed to many sensitizing and irritant substances. There are no published data on contact allergy in this population in the Baltic countries. Objective: To detect skin symptoms related to occupational exposure and to describe the reactivity pattern to the European baseline series in workers from two metal plants in Lithuania.

Methods: In this cross-sectional study 185 metalworkers (154 production workers and 31 office staff) filled an interviewer-administered questionnaire. Patch testing was performed in 135 metalworkers and office staff, as a control group.

Results: Metalworkers younger than 40 years statistically significantly more often complained of skin symptoms especially on hands and face than older ones. Physician-diagnosed skin diseases were reported in 1.7% of cases. Metalworkers, working <20 years in the factory, more often had skin symptoms. Contact with chemicals at the workplace was suspected as main factors provoking skin symptoms. Metalworkers were sensitized mainly to cobalt chloride, and nickel was the most prevalent allergen

Background: Metalworkers are exposed to many sensitizing and irritant substances.

Bulletin Board

Technical

AUG. 07, 2020

among the office staff. Conclusion: Younger metalworkers more often had skin symptoms suspected of being work-related compared to older ones. Sensitization to cobalt was more prevalent in the metalworkers than in controls. This article is protected by copyright. All rights reserved.
Authors: Linauskiene Kotryna, Isaksson Marlène, Malinauskiene Laura
Full Source: Contact dermatitis 2020 Jul 30. doi: 10.1111/cod.13681.

Polymorphism in GSTM1 and GSTT1 genes influence DNA damage in personnel occupationally exposed to volatile anaesthetics (VA), from Peshawar, Pakistan

2020-07-27

Objectives: The objective of this study was to assess the influence of antioxidant gene GSTM1 and GSTT1 on DNA damage in personnel occupationally exposed to volatile anaesthetics (VA).

Methods: The study groups were composed of 50 exposed subjects (anaesthesia workers) and 49 controls. Blood samples were collected from both subjects. DNA damage was analysed through the comet assay technique. Biomarker genes GSTM1 and GSTT1 were inspected through PCR technique for polymorphism.

Results: The comet assay technique showed that the Total Comet Score (TCS) in exposed subjects was significantly higher ($p=0.0001$) than the control. Age and smoking had significant effects on TCS in the study groups ($p<0.05$). Duration of occupational exposure had significant positive correlation ($r=0.755$, $p<0.001$) with DNA damage. The null polymorphism in GSTM1 and GSTT1 gene showed a significant effect ($p<0.001$ and $p<0.000$) on the DNA damage.

Conclusions: The polymorphism in GSTM1 and GSTT1 gene significantly damage DNA in personnel occupationally exposed to VA.

Authors: Muhammad Khisroon, Maleeha Humayun, Ajmal Khan, Javeed Farooqi, Humayun, Jamal Khan

Objectives: The objective of this study was to assess the influence of antioxidant gene GSTM1 and GSTT1 on DNA damage in personnel occupationally exposed to volatile anaesthetics (VA).

Bulletin Board

Technical

AUG. 07, 2020

PHARMACEUTICAL/TOXICOLOGY

Effect of prenatal exposure to per- and polyfluoroalkyl substances on childhood allergies and common infectious diseases in children up to age 7 years: The Hokkaido study on environment and children's health

2020-07-24

Per- and polyfluoroalkyl substances (PFAS) are widely used bio-accumulative chemicals in many industrial and household products. Experimental studies reported that exposure to PFAS results in immunotoxicity. We have previously reported that prenatal exposure to PFAS decreased the risk of allergies, while it increased the risk of infectious diseases at ages 2 and 4 years. However, it remains unclear whether the adverse effects of PFAS on allergies and infectious diseases continue until a reliable age of diagnosing allergies. This study aimed at investigating the effects of prenatal exposure to PFAS on the prevalence of allergies and infectious diseases in children up to age 7, from the Hokkaido Study. Among mother-child pairs enrolled in the Hokkaido study and followed up until the age of 7 years, 2689 participants with maternal PFAS, 1st trimester of pregnancy and 7-year-old questionnaire survey data were included in this study. Eleven PFAS in the 3rd-trimester plasma were measured using ultra-performance liquid chromatography coupled to triple quadrupole tandem mass spectrometry. Wheeze, rhino-conjunctivitis, and eczema were defined using the International Study of Asthma and Allergies on Childhood (ISAAC) questionnaire. History childhood infectious diseases diagnosed by a doctor was assessed by a mother-reported questionnaire at child's age 7. The relative risk of childhood allergies was calculated by generalized estimating equation models. The odds ratio of an episode of infectious diseases was calculated by logistic regression analysis, adjusted for potential confounders. The prevalence of various allergies and infectious diseases was: wheeze, 11.9%; rhino-conjunctivitis, 11.3%; eczema, 21.0%; chickenpox, 61.5%; otitis media, 55.7%; pneumonia, 30.6%; and respiratory syncytial virus infection, 16.8%. Prenatal exposure to perfluorooctanoic acid, perfluorodecanoic acid (PFDA), and perfluoroundecanoic acid (PFUnDA) was inversely associated with rhino-conjunctivitis, while that for perfluorooctanoate (PFOA), perfluorooctane sulfonate, PFUnDA, perfluorododecanoic acid (PFDoDA), and perfluorotridecanoic acid was inversely associated with eczema. For infectious diseases, PFDA and PFDoDA were associated with increased risk of pneumonia and PFOA was associated with increased

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Bulletin Board

Technical

AUG. 07, 2020

risk of RSV infection among children not having any siblings (only-one-child). Our results corroborate the hypothesis on immunosuppressive and immunomodulating effects of PFAS on allergies and infectious diseases in children. These effects observed previously at 2 and 4 years continued until the age of 7 years. However, additional studies assessing inflammatory biomarkers along with ISAAC questionnaires, doctor-diagnosed allergies, and longer follow-ups are necessary to better assess the effects of exposure to chemicals on human immune outcomes.

Authors: Yu Ait Bamai, Houman Goudarzi, Atsuko Araki, Emiko Okada, Ikuko Kashino, Chihiro Miyashita, Reiko Kishi

Full Source: Environment international 2020 Jul 24;143:105979. doi: 10.1016/j.envint.2020.105979.

Effect of lifetime antiepileptic drug treatment history on efficacy and tolerability of adjunctive brivaracetam in adults with focal seizures: Post-hoc analysis of a randomized, placebo-controlled trial

2020-05-25

Objective: To evaluate the efficacy and tolerability of adjunctive brivaracetam (BRV) in adults with focal seizures by the number of lifetime (previous and concomitant) antiepileptic drugs (AEDs).
Methods: Post-hoc analysis of data from NO1358 (NCT01261325), a randomized, double-blind, placebo (PBO)-controlled Phase III trial evaluating BRV 100 and 200 mg/day in patients ≥ 16 years of age with uncontrolled focal seizures. Efficacy and tolerability outcomes were assessed for the 12-week Treatment Period in subgroups of patients with 1-2, 3-4, 5-6, or ≥ 7 lifetime AEDs.

Results: 764 patients received at least one dose of trial medication (BRV: 503; PBO: 261; Safety Set), of whom 14.3% had 1-2, 20.8% had 3-4, 21.3% had 5-6, and 43.6% had ≥ 7 lifetime AEDs. In all lifetime AED subgroups, $>85\%$ of patients completed the trial. Patients with a higher number of lifetime AEDs had a younger age at epilepsy onset, longer epilepsy duration, and higher baseline seizure frequency. In patients on BRV, 50% responder rates were 49.3%, 44.4%, 47.2% and 27.4% in patients with 1-2 (n = 75), 3-4 (n = 99), 5-6 (n = 108) and ≥ 7 (n = 219) lifetime AEDs; 75% responder rates were 36.0%, 21.2%, 22.2% and 12.3%. In patients on PBO, 50% responder rates were 35.3%, 25.9%, 20.4% and 15.9% in patients with 1-2 (n = 34), 3-4 (n = 58), 5-6 (n = 54) and ≥ 7 (n = 113) lifetime AEDs; 75% responder rates were 26.5%, 6.9%, 3.7% and 4.4%. The Kaplan-Meier estimated probability of patients achieving a sustained 50% or 75% response from the first day of

Objective: To evaluate the efficacy and tolerability of adjunctive brivaracetam (BRV) in adults with focal seizures by the number of lifetime (previous and concomitant) antiepileptic drugs (AEDs).

Bulletin Board

Technical

AUG. 07, 2020

treatment was generally higher in patients with a lower number of lifetime AEDs (both in patients on BRV and PBO). In patients on adjunctive BRV, the incidence of drug related treatment-emergent adverse events (TEAEs) was 34.7%, 26.0%, 44.4% and 47.7% in patients with 1-2 (n = 75), 3-4 (n = 100), 5-6 (n = 108) and ≥ 7 (n = 220) lifetime AEDs; the incidence of discontinuations due to TEAEs was 1.3%, 3.0%, 8.3% and 10.5%.

Conclusions: This post-hoc analysis suggests a numerically higher response to adjunctive BRV in patients with fewer lifetime AEDs. The lowest response was observed in patients with ≥ 7 lifetime AEDs, although these patients could also benefit from adjunctive BRV treatment. Patients with fewer lifetime AEDs had lower discontinuation of BRV due to TEAEs.

Authors: Pavel Klein, Richard McLachlan, Kathy Foris, Xavier Nondonfaz, Sami Elmoufti, Svetlana Dimova, Christian Brandt

Full Source: Epilepsy research 2020 May 25;167:106369. doi: 10.1016/j.eplesyres.2020.106369.