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CHEMICAL EFFECTS

Oxidation of antibiotics by ferrate(VI) in water: Evaluation of their removal efficiency and toxicity changes

2021-08

Antibiotics in water and wastewater have been determined extensively. The treatment of antibiotics in water needs evaluation of possible harmful effects on aquatic ecosystems and human health. This paper presents the toxicity evaluation of antibiotics after their treatment with ferrate (VI) (FeVIO_4^{2-} , Fe(VI)) in water. The antibiotics (sulfamethoxazole (SMX), erythromycin (ERY), ofloxacin (OFL), ciprofloxacin (CIP), tetracycline (TET), oxytetracycline (OXY), and trimethoprim (TMP)) were treated at pH 8.0 by applying two concentrations of Fe(VI) to have molar ratios of 5:1 and 10:1 ($[\text{Fe(VI)}]:[\text{antibiotic}]$). Under the studied conditions, incomplete removal of antibiotics was observed, suggesting that the treated solutions contained parent antibiotics and their transformation products. The toxicity of antibiotics without Fe(VI) treatment was tested against freshwater green alga *Raphidocelis subcapitata* and cyanobacterium *Synechococcus elongatus*, which were determined to be generally sensitive to antibiotics, with $\text{EC}_{50} < 1.0 \text{ mg/L}$. The toxicity of Fe(VI) treated solution was tested against *R. subcapitata*. Results found no toxicity for the treated solutions of OFL, CIP, and OXY. However, SMX, ERY, and TET remained toxic after Fe(VI) treatment (i.e., more than 75% growth inhibition of *R. subcapitata*). Results demonstrated that *R. subcapitata* may be applied to test the toxicity of antibiotics after oxidative treatments.

Authors: Pavla Kovalakova, Leslie Cizmas, Mingbao Feng, Thomas J McDonald, Blahoslav Marsalek, Virender K Sharma

Full Source: Chemosphere 2021 Aug;277:130365. doi: 10.1016/j.chemosphere.2021.130365.

Bone developmental toxicity of organophosphorus flame retardants TDCIPP and TPhP in marine medaka *Oryzias melastigma*

2021-08-06

The global phase-out has decreased the use of polybrominated diphenyl ethers (PBDEs), thereby, rapidly increasing the production and use of their important surrogates, organophosphorus flame retardants (OPFRs). Currently, OPFRs are often found at higher levels in the environments compared to PBDEs. Although the two typical OPFRs, tris (1,3-dichloroisopropyl) phosphate (TDCIPP) and triphenyl phosphate

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(TPhP), have been frequently detected in marine environments with significant concentrations, their toxicity to marine organisms remains unknown. We used *Oryzias melastigma* to investigate and compare their developmental toxicity in marine organisms through two-generational chronic exposure. The results showed that TDCIPP and TPhP exposure shortened the body length and length of the pectoral fin of *O. melastigma*. Both TDCIPP and TPhP deformed the pectoral fins in the 1st fry and caused spinal curvature in adult fish. Therefore, these two chemicals may pose potential risks to marine fish and marine ecosystems. Further studies suggested that although these two chemicals caused similar developmental bone toxicity, they had different modes of modulating the expression of bone developmental genes such as, *bmp4*, *bmp2* and *runx2*.
 Authors: Haizheng Hong, Yunchen Zhao, Lingming Huang, Daiyin Zhong, Dalin Shi
 Full Source: *Ecotoxicology and environmental safety* 2021 Aug 6;223:112605. doi: 10.1016/j.ecoenv.2021.112605.

Toxicokinetic Models for Bioconcentration of Organic Contaminants in Two Life Stages of White Sturgeon (*Acipenser transmontanus*)

2021-08-12

The white sturgeon (*Acipenser transmontanus*) is an endangered ancient fish species that is known to be particularly sensitive to certain environmental contaminants, partly because of the uptake and subsequent toxicity of lipophilic pollutants prone to bioconcentration as a result of their high lipid content. To better understand the bioconcentration of organic contaminants in this species, toxicokinetic (TK) models were developed for the embryo-larval and subadult life stages. The embryo-larval model was designed as a one-compartment model and validated using whole-body measurements of benzo[a]pyrene (B[a]P) metabolites from a waterborne exposure to B[a]P. A physiologically based TK (PBTK) model was used for the subadult model. The predictive power of the subadult model was validated with an experimental data set of four chemicals. Results showed that the TK models could accurately predict the bioconcentration of organic contaminants for both life stages of white sturgeon within 1 order of magnitude of measured values. These models provide a tool to better understand the impact of environmental

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contaminants on the health and the survival of endangered white sturgeon populations.

Authors: Chelsea Grimard, Annika Mangold-Döring, Hattan Alharbi, Lynn Weber, Natacha Hogan, Paul D Jones, John P Giesy, Markus Hecker, Markus Brinkmann
 Full Source: *Environmental science & technology* 2021 Aug 12. doi: 10.1021/acs.est.0c06867.

ENVIRONMENTAL RESEARCH

Phenomics Approach to Investigate Behavioral Toxicity of Environmental or Occupational Toxicants in Adult Zebrafish (*Danio rerio*)

2021-08

Over the last few years, environmental pollution, especially water pollution, has become a serious issue worldwide. Thus, methods that can help us understand the impact and effects of these pollutants, especially on aquatic animals, are needed. Behavioral assessment has emerged as a crucial tool in toxicology and pharmacology because many studies have shown, in multiple animal models, that various pharmacological compounds can alter behavior, with many of the findings being translatable to humans. Moreover, behavior study can also be used as a suitable indicator in the ecotoxicological risk assessment of pollutants. Several model organisms, especially rodent models, have been extensively employed for behavior studies. However, assessments using this model are generally time consuming, expensive, and require extensive facilities for housing experimental animals. Moreover, behavioral studies typically use different measurements and assessment tools, making comparisons difficult. In addition, even though behavioral phenomics has the potential to comprehensively illustrate the toxicities of chemicals, there is only a limited number of studies focusing on animal behavior using such a global approach. Here, we describe a phenomics approach that can be used to investigate the impact of pollutants using zebrafish. The approach consists of several behavioral tests, including response to a novel environment, mirror-reflection image, predator fish, and conspecifics, after exposure to a test chemical. Phenotype fingerprinting, a method for summarizing individual phenotypes based on the results of the behavioral tests, is then conducted to reduce data complexity and display the pattern of each compound on behavioral phenotypes in zebrafish. This approach may be useful to researchers studying the potential adverse effects of different

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pollutants. © 2021 Wiley Periodicals LLC. Basic Protocol 1: Novel tank test
Basic Protocol 2: Shoaling test Basic Protocol 3: Aggression test (mirror
biting test) Basic Protocol 4: Social interaction test Basic Protocol 5: Fear
response test Basic Protocol 6: PCA and heatmap clustering.

Authors: Gilbert Audira, Yu-Heng Lai, Jong-Chin Huang, Kelvin H-C Chen,
Chung-Der Hsiao

Full Source: Current protocols 2021 Aug;1(8):e223. doi: 10.1002/cpz1.223.

Polyvinyl chloride in consumer and environmental plastics, with a particular focus on metal-based additives

2021-08-09

Polyvinyl chloride (PVC) is one of the most widely used thermoplastics but is also a material of concern because of the generation and release of harmful chemicals during its life cycle. Amongst the chemicals added to PVC are metal-based stabilisers and Sb-based halogenated flame retardant synergists. However, very little quantitative information exists on these additives, and in particular in PVC lost to the environment. In this study, the distribution of PVC amongst consumer plastics in societal circulation and plastics retrieved from marine and lacustrine beaches and agricultural soils are compared, along with the presence and concentrations of Ba, Cd, Pb, Sb, Sn and Zn as proxies for common metal-based additives and determined by X-ray fluorescence spectrometry. About 10% of consumer plastics and 2% of environmental plastics were constructed of PVC, with the discrepancy attributed to the long service lives and managed disposal of PVC used in the construction sector and the propensity of the plastic to sink in aquatic systems and evade detection. Metal-based additives, defined as having a metal concentration >1000 mg kg⁻¹, were present in about 75% of consumer and environmental PVC, with Ba and Pb most abundant and Cd and Zn least abundant in both types of sample, and median concentrations statistically different only for Ba. Metals also appeared to be present as contaminants (defined as concentrations <1000 mg kg⁻¹) arising from manufacturing or recycling. Metals in PVC are believed to pose little risk when the material is in use, but experimental evidence in the literature suggests that significant mobilisation and exposure may occur from PVC microplastics when ingested by wildlife.

Authors: Andrew Turner, Montserrat Filella

Full Source: Environmental science. Processes & impacts 2021 Aug 9. doi: 10.1039/d1em00213a.

Polyvinyl chloride (PVC) is one of the most widely used thermoplastics but is also a material of concern because of the generation and release of harmful chemicals during its life cycle.

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Sex reversal and ontogeny under climate change and chemical pollution: are there interactions between the effects of elevated temperature and a xenoestrogen on early development in agile frogs?

2021-09-15

Anthropogenic environmental change poses a special threat to species in which genetic sex determination can be overwritten by the thermal and chemical environment. Endocrine disrupting chemicals as well as extreme temperatures can induce sex reversal in such species, with potentially wide-ranging consequences for fitness, demography, population viability and evolution. Despite accumulating evidence suggesting that chemical and thermal effects may interact in ecological contexts, little is known about their combined effects on sex reversal. Here we assessed the simultaneous effects of high temperature (female-to-male sex-reversing agent) and 17 α -ethinylestradiol (EE2), a widespread xenoestrogen (male-to-female sex-reversing agent), on sexual development and fitness-related traits in agile frogs (*Rana dalmatina*). We exposed tadpoles to a six-days heat wave (30 °C) and/or an ecologically relevant concentration of EE2 (30 ng/L) in one of three consecutive larval periods, and diagnosed sex reversals two months after metamorphosis using species-specific markers for genetic sexing. We found that high temperature induced female-to-male sex reversal, decreased survival, delayed metamorphosis, decreased body mass at metamorphosis, and increased the proportion of animals that had no fat bodies, while EE2 had no effect on these traits. Simultaneous exposure to heat and EE2 had non-additive effects on juvenile body mass, which were dependent on treatment timing and further complicated by a negative effect of sex reversal on body mass. These results show that environmentally relevant exposure to EE2 does not diminish the female-to-male sex-reversing effects of high temperature. Instead, our findings on growth suggest that climate change and chemical pollution may have complex consequences for individual fitness and population persistence in species with environment-sensitive sex determination.

Authors: Zsanett Mikó, Edina Nemesházi, Nikolett Ujhegyi, Viktória Verebélyi, János Ujszegi, Andrea Kásler, Réka Bertalan, Nóra Vili, Zoltán Gál, Orsolya I Hoffmann, Attila Hettyey, Veronika Bókony

Full Source: Environmental pollution (Barking, Essex : 1987) 2021 Sep 15;285:117464. doi: 10.1016/j.envpol.2021.117464.

Anthropogenic environmental change poses a special threat to species in which genetic sex determination can be overwritten by the thermal and chemical environment.

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HYGIENIC ASSESSMENT OF WORKPLACE ENVIRONMENTAL AIR POLLUTION OF TBILISI CITY MUNICIPAL TRANSPORT AND THEIR SERVICES

2021-06

The study aim was to observe the working conditions of individuals working on municipal transport, check the levels of dust and toxicity, and review from the hygienic point of view. The levels of dust and chemical pollutants in the working environment of Tbilisi municipal transport workers were examined. Methods used in hygienic practice were applied to analyze air samples. test in total was conducted to measure the concentration of dust in the air and samples were collected with air analyzers. The toxicity levels in the surrounding environment of the municipal motor vehicle drivers, as well as technicians (welders, electricians, turners, tinsmiths, electric arc welding). It was established that the toxicity of the air in the municipal transports and technical service establishments fluctuates between certain levels. The highest dust levels were found in the working zone of the driver, with dust levels twice accepted levels. Working conditions at this specific zone were identified as 3.1 class. Workplaces in different service stations were also classified in the same group, with dust levels 1.6 times higher than normal. In total 5 workplaces were given level 3.1 classification. Only the workplace of a tinsmith was classified as a level 2 acceptable hazard. The concentration of dust and toxic chemicals in the environment of municipal transport employees is lower than acceptable levels, but long-time exposure to these agents affects the health of individuals and may cause subclinical health effects, even if the disease does not fully manifest. These effects should be taken into consideration when planning regular medical examinations and rejuvenating procedures for the employees.

Authors: S Japharidze, I Kvachadze, Mar Tsimakuridze, M Tsimakuridze, M Arabidze

Full Source: Georgian medical news 2021 Jun;(315):181-185.

OCCUPATIONAL

A longitudinal study of working hours and chronic kidney disease in healthy workers: The Kangbuk Samsung Health Study

2021-01

Objectives: Long working hours are linked to an increased risk of exposure to work safety hazards that threaten the health of workers. To date, only a

The study aim was to observe the working conditions of individuals working on municipal transport, check the levels of dust and toxicity, and review from the hygienic point of view.

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few cross-sectional studies regarding the relationship between working characteristics, such as over-workload and chronic kidney disease (CKD) have been reported. Therefore, in this longitudinal study, we aimed to examine the direct relationship between long working hours and the incidence of CKD.

Methods: We included 97 856 participants without CKD in the Kangbuk Samsung Health Study. Using a self-report questionnaire, we evaluated weekly working hours, which were categorized into 35-40, 41-52, and >52 hours. CKD was defined as estimated glomerular filtration rate <60 mL/min/1.73 m². Hazard ratios (HRs) and 95% confidence intervals (CIs) for incident CKD were estimated using Cox proportional hazards regression analyses with weekly working 35-40 hours as the reference.

Results: During a median follow-up of 4.0 years, 185 participants developed incident CKD (incidence density, 4.83 per 104 person-years). Multivariable-adjusted HRs (95% CI) of incident CKD for weekly working >52 hours compared with working 35-40 hours were 1.99 (1.22-3.25). In subgroup analyses, the significant association between working >52 hours and incident CKD was consistently observed in groups of age ≥40 years, men, and obesity with no interaction.

Conclusions: Our large-scale cohort study of young- to middle-aged men and women demonstrated a significant association between long working hours and an increased risk of incident CKD.

Authors: Yesung Lee, Eunhye Seo, Eunchan Mun, Woncheol Lee

Full Source: Journal of occupational health 2021 Jan;63(1):e12266. doi: 10.1002/1348-9585.12266.

[Occupational diseases of the airways and the lungs]

2021-08-13

The attributable proportion of occupation-related influences on airway and lung diseases is 10-30%. In patients with obstructive airway diseases it is extremely important to sufficiently document findings during the period of activities burdening the airway as compared to periods off work. Chronic obstructive pulmonary disease (COPD) can have a work-related (partial) cause even in smokers. Regarding occupational infectious diseases, the main cause up to 2019 was tuberculosis but the corona pandemic has led to coronavirus disease 2019 (COVID-19) being the most frequent occupational disease. For the occupational medical assessment

The attributable proportion of occupation-related influences on airway and lung diseases is 10-30%.

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of interstitial and malignant pulmonary diseases, checklists can be helpful to support the medical history.

Authors: Dennis Nowak, Uta Ochmann, Ullrich G Mueller-Lisse

Full Source: Der Internist 2021 Aug 13;1-12. doi: 10.1007/s00108-021-01109-7.

PHARMACEUTICAL/TOXICOLOGY

A PBPK model describing the pharmacokinetics of γ -HBCD exposure in mice

2021-08-11

The brominated flame retardant, hexabromocyclododecane (HBCD), is added-but not bound-to consumer products and is eventually found in the environment and human tissues. Commercial-grade HBCD mixtures contain three major stereoisomers, alpha (α), beta (β), and gamma (γ), that are typically at a ratio of 12%:6%:82%, respectively. Although HBCD is widely used, the toxicological effects from its exposure in humans are not clearly understood. Using a physiologically based pharmacokinetic (PBPK) model could help improve our understanding of the toxicity of HBCD. The aim of this work was to develop a PBPK model, consisting of five permeability limited compartments (i.e., brain, liver, adipose tissue, blood, and rest of the body), to evaluate the pharmacokinetics of γ -HBCD in C57BL/6 mice. Physiological parameters related to body size, organ weights, and blood flow were taken from the literature. All partition coefficients were calculated based on the log Kow. The elimination in urine and feces was optimized to reflect the percent dose eliminated, as published in the literature. Compared with data from the literature for brain, liver, blood, and adipose tissue, the model simulations accurately described the mouse data set within 1.5-fold of the data points. Also, two examples showing the utility of the PBPK model supplement the information regarding the internal dose that caused the health effects observed during these studies. Although this version of the PBPK model expressly describes γ -HBCD, more efforts are needed to clarify and improve the model to discriminate between the α , β , and γ stereoisomers.

Authors: Claude Emond, Michael J DeVito, Linda S Birnbaum

Full Source: Toxicology and applied pharmacology 2021 Aug 11;115678. doi: 10.1016/j.taap.2021.115678.

The brominated flame retardant, hexabromocyclododecane (HBCD), is added-but not bound-to consumer products and is eventually found in the environment and human tissues.