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CHEMICAL EFFECTS

Spatial and seasonal controls on dissolved organic matter composition in shallow aquifers under the rapidly developing City of Patna, India

2023-08-09

The distribution and composition of dissolved organic matter (DOM) affects numerous (bio)geochemical processes in environmental matrices including groundwater. This study reports the spatial and seasonal controls on the distribution of groundwater DOM under the rapidly developing city of Patna, Bihar (India). Major DOM constituents were determined from river and groundwater samples taken in both pre- and post-monsoon seasons in 2019, using excitation-emission matrix (EEM) fluorescence spectroscopy. We compared aqueous fluorescent DOM (fDOM) composition to satellite-derived land use data across the field area, testing the hypothesis that the composition of groundwater DOM, and particularly the components associated with surface-derived ingress, may be controlled, in part, by land use. In the pre-monsoon season, the prominence of tryptophan-like components likely generated from recent biological activity overwhelmed the humic-like and tyrosine-like fluorescence signals. Evidence from fluorescence data suggest groundwater in the post-monsoon season is composed of predominantly i) plant-derived matter and ii) anthropogenically influenced DOM (e.g. tryptophan-like components). Organic tracers, as well as Eh and Cl⁻, suggest monsoonal events mobilise surface-derived material from the unsaturated zone, causing dissolved organic carbon (DOC) of more microbial nature to infiltrate to >100 m depth. A correlation between higher protein:humic-like fluorescence and lower vegetation index (NDVI), determined from satellite-based land use data, in the post-monsoon season, indicates the ingress of wastewater-derived OM in groundwater under the urban area. Attenuated protein:humic-like fluorescence in groundwater close to the river points towards the mixing of groundwater and river water. This ingress of surface-derived OM is plausibly exacerbated by intensive groundwater pumping under these areas. Our approach to link the composition of aqueous organics with land use could easily be adapted for similar hydrogeochemical settings

The distribution and composition of dissolved organic matter (DOM) affects numerous (bio)geochemical processes in environmental matrices including groundwater.

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to determine the factors controlling groundwater DOM composition in various contexts.

Authors: George J L Wilson, Chuanhe Lu, Dan J Lapworth, Arun Kumar, Ashok Ghosh, Wahid J Niasar, Stefan Krause, David A Polya, Daren C Goody, Laura A Richards

Full Source: The Science of the total environment 2023 Aug 9;166208. doi: 10.1016/j.scitotenv.2023.166208.

Full Source: The Science of the total environment 2023 Aug 9;166208. doi: 10.1016/j.scitotenv.2023.166208.

Determining the toxicity of organic compounds to the nematode *Caenorhabditis elegans* based on aqueous concentrations

2023-08-12

Caenorhabditis elegans is used for assessing the toxicity of chemicals in aqueous medium. However, chemicals can absorb to the bacterial food, which reduces the freely dissolved concentrations of the tested compounds. Thus, based on total or nominal concentrations, toxicity is underestimated, resulting in misleading assumptions on toxicity mechanisms or comparisons to other test organisms. As the verification of freely dissolved exposure concentrations (C_{free}) is challenging in small test systems, simple partitioning models might be a good option for estimating C_{free}. Therefore, *C. elegans* was exposed to seven differently acting organic chemicals with varying hydrophobicities, thus also different affinities to bind to the food of *C. elegans*. Measured concentrations of the dissolved aqueous and the bacterial-bound fraction allowed the calculation of binding constants (K_b). Experimental K_b were comparable to literature data of hydrophobic chemicals and correlated well with their hydrophobicity, expressed as log K_{OW}. The chronic toxicity of the various compounds on *C. elegans*' reproduction, based on their aqueous concentration, was weakly related to their log K_{OW}. Toxicity expressed based on chemical activity and comparisons with a baseline toxicity model, nevertheless, suggested a narcotic mode of action for most hydrophobic compounds (except methylisothiazolinone and trichlorocarbanilide). Although revealing a similar toxicity ranking than *Daphnia magna*, *C. elegans* was less sensitive, probably due to its ability to reduce its internal concentrations by means of its very impermeable cuticle or by efficient detoxification mechanisms. It could be shown that measured aqueous concentrations in the nematode test system corresponded well with freely dissolved concentrations that were modeled using simple mass-balance models from nominal concentrations.

Caenorhabditis elegans is used for assessing the toxicity of chemicals in aqueous medium.

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This offers the possibility to estimate freely dissolved concentrations of chemicals from nominal concentrations, making routine testing of chemicals and their comparison to other species more accurate.

Authors: Sebastian Höss, David Sanders, Roger van Egmond

Full Source: Environmental science and pollution research international 2023 Aug 12. doi: 10.1007/s11356-023-29193-2.

Role of Chemical Reduction and Formulation of Graphene Oxide on Its Cytotoxicity towards Human Epithelial Bronchial Cells

2023-07-27

Graphene-based materials may pose a potential risk for human health due to occupational exposure, mainly by inhalation. This study was carried out on bronchial epithelial 16HBE14o- cells to evaluate the role of chemical reduction and formulation of graphene oxide (GO) on its cytotoxic potential. To this end, the effects of GO were compared to its chemically reduced form (rGO) and its stable water dispersion (wdGO), by means of cell viability reduction, reactive oxygen species (ROS) generation, pro-inflammatory mediators release and genotoxicity. These materials induced a concentration-dependent cell viability reduction with the following potency rank: rGO > GO >> wdGO. After 24 h exposure, rGO reduced cell viability with an EC50 of 4.8 µg/mL (eight-fold lower than that of GO) and was the most potent material in inducing ROS generation, in contrast to wdGO. Cytokines release and genotoxicity (DNA damage and micronucleus induction) appeared low for all the materials, with wdGO showing the lowest effect, especially for the former. These results suggest a key role for GO reduction in increasing GO cytotoxic potential, probably due to material structure alterations resulting from the reduction process. In contrast, GO formulated in a stable dispersion seems to be the lowest cytotoxic material, presumably due to its lower cellular internalization and damaging capacity.

Authors: Marco Pelin, Clara Passerino, Adriana Rodríguez-Garraus, Michela Carlin, Silvio Sosa, Satu Suhonen, Gerard Vales, Beatriz Alonso, Amaia Zurutuza, Julia Catalán, Aurelia Tubaro

Full Source: Nanomaterials (Basel, Switzerland) 2023 Jul 27;13(15):2189. doi: 10.3390/nano13152189.

Graphene-based materials may pose a potential risk for human health due to occupational exposure, mainly by inhalation.

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ENVIRONMENTAL RESEARCH

Conversion of solid wastes and natural biomass for deciphering the valorization of biochar in pollution abatement: A review on the thermo-chemical processes

2023-08-10

This overview addresses the formation of solid trash and the various forms of waste from a variety of industries, which environmentalists have embraced. The paper investigates the negative effects on the environment caused by unsustainable management of municipal solid trash as well as the opportunities presented by the formal system. This examination looks at the origins of solid waste as well as the typical treatment methods. Pyrolysis methods, feedstock pyrolysis, and lignocellulosic biomass pyrolysis were highlighted. Explain in detail the various thermochemical processes that take place during the pyrolysis of biomass. Due to its carbon content, low cost, accessibility, ubiquitousness, renewable nature, and environmental friendliness, biomass waste is a unique biochar precursor. This study looks at the different types of biomass waste that are available for treating wastewater. This study discussed a wide variety of reactors. Adsorption is the standard method that is used the most frequently to remove hazardous organic, dye, and inorganic pollutants from wastewater. These pollutants cause damage to the environment and water supplies, thus it is important to remove them. Adsorption is both simple and inexpensive to utilize. Temperature-dependent conversions explain the kinetic theories of biomaterial biochemical degradation. This article presents a review that explains how pyrolytic breakdown char materials can be used to reduce pollution and improve environmental management.

Authors: Rishikesh Chormare, Pareshkumar G Moradeeya, Tarini Prasad Sahoo, Muthulingam Seenuvasan, Gurunathan Baskar, Hitesh T Saravaia, Madhava Anil Kumar

Full Source: Chemosphere 2023 Aug 10;339:139760. doi: 10.1016/j.chemosphere.2023.139760.

Anthropogenic pollutants induce enhancement of aerosol acidity at a mountainous background atmosphere in southern China

2023-08-09

Aerosol acidity plays a crucial role in atmospheric physicochemical processes, climate change and human health, particularly in the

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formation of secondary organic aerosols (SOA). However, understanding the characteristics and driving factors of aerosol acidity in background mountains has been limited. In this study, we conducted intensive field measurements in the Nanling mountains during the dry and wet seasons of 2018 to analyze aerosol pH characteristics and their driving factors using sensitivity tests. The mean aerosol pH in the background mountains was found to be 2.68 ± 0.55 , with values ranging from 0.38 to 4.44, significantly lower than predicted values in northern China. Sensitivity tests revealed that aerosol acidity in the background atmosphere was more responsive to dominant chemical species (T-NH₃ (= NH₄⁺ + NH₃) and SO₄²⁻) rather than relative humidity and temperature. Additionally, we observed that sulfate and ammonium, transported occasionally by dryer northern air masses, had a substantial impact on decreasing aerosol pH at the site. Similar to the southeastern United States, NH₄⁺/NH₃ also dominated the total buffer capacity of aerosol acidity in the Nanling mountains. The strong aerosol acidity in this area is expected to have adverse effects on regional air quality and climate by enhancing SOA formation and regulating the dry deposition of inorganic reactive nitrogen.

Authors: Gengchen Wu, Hao Wang, Chengliang Zhang, Daocheng Gong, Xiaoting Liu, Zoran Ristovski, Boguang Wang
Full Source: The Science of the total environment 2023 Aug 9;166192. doi: 10.1016/j.scitotenv.2023.166192.

Functional MOF-Based Materials for Environmental and Biomedical Applications: A Critical Review

2023-07-31

Over the last ten years, there has been a growing interest in metal-organic frameworks (MOFs), which are a unique category of porous materials that combine organic and inorganic components. MOFs have garnered significant attention due to their highly favorable characteristics, such as environmentally friendly nature, enhanced surface area and pore volume, hierarchical arrangements, and adjustable properties, as well as their versatile applications in fields such as chemical engineering, materials science, and the environmental and biomedical sectors. This article centers on examining the advancements in using MOFs for environmental remediation purposes. Additionally, it discusses the latest developments in employing MOFs as potential tools for disease diagnosis and drug delivery across various ailments, including cancer, diabetes, neurological disorders, and ocular diseases. Firstly, a concise overview of MOF evolution and the synthetic techniques employed for creating MOFs are provided,

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presenting their advantages and limitations. Subsequently, the challenges, potential avenues, and perspectives for future advancements in the utilization of MOFs in the respective application domains are addressed. Lastly, a comprehensive comparison of the materials presently employed in these applications is conducted.

Authors: Maria-Anna Gatou, Ioanna-Aglaiia Vagena, Nefeli Lagopati, Natassa Pippa, Maria Gazouli, Evangelia A Pavlatou
Full Source: Nanomaterials (Basel, Switzerland) 2023 Jul 31;13(15):2224. doi: 10.3390/nano13152224.

PHARMACEUTICAL/TOXICOLOGY

Presence of Perfluoroalkyl Substances in Landfill Adjacent Surface Waters in North Carolina

2023-08-04

Landfills pose an important public health risk, especially in historically disenfranchised communities that are disproportionately sited for landfills and in rural areas where private wells may be impacted. Landfills are major sources of perfluoroalkyl substances (PFAS) that migrate into the surrounding environment. This study characterized PFAS in surface waters adjacent to two landfills, one in Sampson County (SC) and one in Orange County (OC) in North Carolina. In addition to municipal solid waste and construction and demolition waste, the landfill in SC accepts industrial sludge from a chemical plant that produces proprietary PFAS. Over four months, 35 surface water samples were collected at upstream, landfill-adjacent, and downstream/downgradient sites. Thirty-four PFAS were analyzed using liquid chromatography with tandem mass spectroscopy. Of those, six novel and six legacy PFAS were detected. Legacy PFAS were detected in surface water near both landfills, with the highest concentrations adjacent to the landfill. Novel PFAS were only detected in surface water near the SC landfill and showed the highest concentrations adjacent to the landfill, indicating offsite migration of PFAS. These findings support the need for more comprehensive and frequent monitoring of groundwater and surface water wells near landfills and stricter regulation regarding the landfilling of industrial materials.

Authors: Aleah Walsh, Courtney G Woods
Full Source: International journal of environmental research and public health 2023 Aug 4;20(15):6524. doi: 10.3390/ijerph20156524.

Landfills pose an important public health risk, especially in historically disenfranchised communities that are disproportionately sited for landfills and in rural areas where private wells may be impacted.

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Prevalence and predictors of skin cancer screening among a sample of US volunteer firefighters

2023-08-12

Background: Firefighters have a higher risk of melanoma incidence and mortality compared to the general population. In the United States (US), the National Fire Protection Association recommends all firefighters receive annual skin cancer screening through visual skin examination by a clinician. However, there is limited information on skin cancer screening practices among volunteer firefighters who comprise two-thirds of the US fire service.

Methods: This cross-sectional study of 552 US volunteer firefighters estimated the prevalence of skin cancer screening and evaluated associations with their fire service experience, demographics, sun protection practices, and cancer risk perception.

Results: The prevalence of receiving skin cancer screening among volunteer firefighters was 26.1% (95% confidence interval [CI]: 22.4, 29.8). The odds of being screened for skin cancer, compared to not being screened, were twice as high for firefighters who used sunscreen (odds ratio [OR]: 2.35, 95% CI: 1.48, 3.73) and who perceived their skin likely to burn with prolonged sun exposure (OR: 1.81, 95% CI: 1.10, 3.00). Older age, some college education, and family history of skin cancer were also positively associated with skin cancer screening. A positive exposure-response relationship was observed between more monthly firefighting calls and receiving screening. Cancer risk perception was not associated with screening.

Conclusion: To our knowledge, this is the first large study to assess skin cancer screening among US volunteer firefighters. Our findings suggest gaps in skin cancer prevention efforts in the volunteer fire service. Additional assessment of skin cancer prevention practices within volunteer fire departments could help address these gaps.

Authors: Nimit N Shah, Michael B Steinberg, Alberto J Caban-Martinez, Elena Austin, Jefferey L Burgess, Brittany S Hollerbach, Derrick L Edwards, Taylor M Black, Kathleen Black, Kaleigh M Hinton, Brian S Kubiel, Judith M Graber

Full Source: American journal of industrial medicine 2023 Aug 12. doi: 10.1002/ajim.23524.

Background: Firefighters have a higher risk of melanoma incidence and mortality compared to the general population.

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OCCUPATIONAL

Expanding Behavioral and Occupational Health Research in Military Police

2023-08-12

Introduction: It is important to understand the behavioral and occupational health needs of military police personnel, a high-risk and understudied population.

Materials and methods: The incidence rates of behavioral and occupational conditions were examined from the years of 2005 to 2021 from the Defense Medical Epidemiology Database. Single-sample chi-square analyses were performed to analyze the differences in the incidence rates across demographic groups relative to population density. Results: There were moderate-to-large increases in sleep-related disorders and mood or stress-related disorders. There were also patterns of overrepresentation or underrepresentation in diagnoses of various conditions by sex, age group, marital status, race, service branch, and pay grade.

Conclusions: It is important to provide tailored resources and programming to employees in high-stress settings to help prevent or manage behavioral and occupational health conditions and reduce the stigma surrounding the utilization of such resources and programs.

Authors: Kristin A Horan, Michael A Schlenk, Tyler L Collette, Bianca C Channer, Israel Sanchez-Cardona, Brian A Moore

Full Source: Military medicine 2023 Aug 12;usad312. doi: 10.1093/milmed/usad312.

Introduction: It is important to understand the behavioral and occupational health needs of military police personnel, a high-risk and understudied population.

Does Decreased Diffusing Capacity of the Lungs for Carbon Monoxide Constitute a Risk of Decompression Sickness in Occupational Divers?

2023-08-03

Long-term alterations of pulmonary function (mainly decreased airway conductance and capacity of the lungs to diffuse carbon monoxide (DLCO)) have been described after hyperbaric exposures. However, whether these alterations convey a higher risk for divers' safety has never been investigated before. The purpose of the present pilot study was to assess whether decreased DLCO is associated with modifications of the physiological response to diving. In this case-control observational study, 15 "fit-to-dive" occupational divers were split into two groups according to their DLCO measurements compared to references values, either normal

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(control) or reduced (DLCO group). After a standardized 20 m/40 min dive in a sea water pool, the peak-flow, vascular gas emboli (VGE) grade, micro-circulatory reactivity, inflammatory biomarkers, thrombotic factors, and plasmatic aldosterone concentration were assessed at different times post-dive. Although VGE were recorded in all divers, no cases of decompression sickness (DCS) occurred. Compared to the control, the latency to VGE peak was increased in the DLCO group (60 vs. 30 min) along with a higher maximal VGE grade ($p < 0.0001$). P-selectin was higher in the DLCO group, both pre- and post-dive. The plasmatic aldosterone concentration was significantly decreased in the control group ($-30.4 \pm 24.6\%$) but not in the DLCO group. Apart from a state of hypocoagulability in all divers, other measured parameters remained unchanged. Our results suggest that divers with decreased DLCO might have a higher risk of DCS. Further studies are required to confirm these preliminary results.

Authors: Brice Loddé, Marie-Agnès Giroux-Metges, Hubert Galinat, Hèlène Kerspern, Richard Pougnet, Philippe Saliou, François Guerrero, Pierre Lafère
Full Source: International journal of environmental research and public health 2023 Aug 3;20(15):6516. doi: 10.3390/ijerph20156516.

Effects of postnatal exposure to phthalate, bisphenol a, triclosan, parabens, and per- and poly-fluoroalkyl substances on maternal postpartum depression and infant neurodevelopment: a korean mother-infant pair cohort study

2023-08-12

Exposure to endocrine-disrupting chemicals (EDCs) can promote infant neurodevelopmental impairment and maternal postpartum depression (PPD). However, the associations between lactation exposure to EDCs, maternal PPD, and infant neurodevelopment are unclear. Hence, we investigated these relationships in infants aged 36-42 months. We recruited 221 Korean mothers and analyzed 29 EDCs. The Edinburgh Postnatal Depression Scale (EPDS) was used to assess maternal PPD. Bayley scales of infant development; the Swanson, Nolan, and Pelham rating scale (SNAP); and the Child Behavior Checklist (CBCL) were used to assess neurodevelopment in infants exposed to the top 30% of EDC over three years. Multiple regression analyses were adjusted for maternal age, pre-pregnancy body mass index, education, income, employment, residence, and infant age and sex. The rates of infants with clinically abnormal diagnoses on neurologic developmental tests (Bayley, SNAP, and CBCL scales) ranged from 7.7 to 38.5% in this study, with the motor and

Exposure to endocrine-disrupting chemicals (EDCs) can promote infant neurodevelopmental impairment and maternal postpartum depression (PPD).

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hyperactivity/impulsivity areas scoring the highest among 65 boys and girls. Mono-2-ethylhexyl phthalate (MEHP) and mono-isononyl phthalate (MiNP) levels in breast milk significantly correlated with infant inattention and hyperactivity. Perfluorononanoic acid (PFNA) and perfluorooctyl sulfonate (PFOS) levels correlated significantly with motor development of BSID-III and total CBCL score which mean infant might have lower developmental status. EDC concentrations in breast milk were not associated with maternal PPD. Overall, lactational exposure to EDCs during the postpartum period can exert a negative effect on maternal PPD and infant neurodevelopment.

Authors: Ju Hee Kim, Nalae Moon, Eunsun Ji, Hyo-Bang Moon

Full Source: Environmental science and pollution research international 2023 Aug 12. doi: 10.1007/s11356-023-29292-0.