CHEMWATCH

Bulletin Board

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CHEMICAL EFFECTS

Brownness of Organic Aerosol over the United States: Evidence for Seasonal Biomass Burning and Photobleaching Effects

2021-06-15

Light-absorptivity of organic aerosol may play an important role in visibility and climate forcing, but it has not been assessed as extensively as black carbon (BC) aerosol. Based on multiwavelength thermal/optical analysis and spectral mass balance, this study quantifies BC for the U.S. Interagency Monitoring of Protected Visual Environments (IMPROVE) network while developing a brownness index (γBr) for non-BC organic carbon (OC*) to illustrate the spatiotemporal trends of light-absorbing brown carbon (BrC) content. OC* light absorption efficiencies range from 0 to 3.1 m2 gC-1 at 405 nm, corresponding to the lowest and highest BrC content of 0 and 100%, respectively. BC, OC*, and γBr explain >97% of the variability of measured spectral light absorption (405-980 nm) across 158 IMPROVE sites. Network-average OC* light absorptions at 405 nm are 50 and 28% those for BC over rural and urban areas, respectively. Larger organic fractions of light absorption occur in winter, partially due to higher organic brownness. Winter γBr exhibits a dramatic regional/urban-rural contrast consistent with anthropogenic BrC emissions from residential wood combustion. The spatial differences diminish to uniformly low γBr in summer, suggesting effective BrC photobleaching over the midlatitudes. An empirical relationship between BC, ambient temperature, and γBr is established, which can facilitate the incorporation of organic aerosol absorptivity into climate and visibility models that currently assume either zero or static organic light absorption efficiencies.

Authors: Lung-Wen Antony Chen, Judith C Chow, Xiaoliang Wang, Junji Cao, Jingqiu Mao, John G Watson

Full Source: Environmental science & technology 2021 Jun 15. doi: 10.1021/acs.est.0c08706.

Light-absorptivity of organic aerosol may play an important role in visibility and climate forcing, but it has not been assessed as extensively as black carbon (BC) aerosol.

Acute and chronic toxicity of microcystin-LR and phenanthrene alone or in combination to the cladoceran (Daphnia magna)

2021-09-01

Hazardous substances, such as microcystin-LR (MC-LR) and phenanthrene (Phe) are ubiquitous co-contaminants in eutrophic freshwaters, which cause harms to aquatic organisms. However, the risks associated with the co-exposure of aquatic biota to these two chemicals in the environment have received little attention. In this study, the single and mixture toxic effects of MC-LR and Phe mixtures were investigated in Daphnia magna after acute and chronic exposure. Acute tests showed that the median effective concentrations (48 h) for MC-LR, Phe and their mixtures were 13.46, 0.57 and 8.84 mg/L, respectively. Mixture toxicity prediction results indicated that the independent action model was more applicable than the concentration addition model. Moreover, combination index method suggested that the mixture toxicity was concentration dependent. Synergism was elicited at low concentrations of MC-LR and Phe exposure (≤4.04 + 0.17 mg/L), whereas antagonistic or additive effects were induced at higher concentrations. The involved mechanism of antagonism was presumably attributable to the protective effects of detoxification genes activated by high concentrations of MC-LR in mixtures. Additionally, chronic results also showed that exposure to a MC-LR and Phe mixture at low concentrations (≤50 +2 μg/L) resulted in greater toxic effects on D. magna life history than either chemical acting alone. The significant inhibition on detoxification genes and increased accumulation of MC-LR could be accounted for their synergistic toxic effects on D. magna. Our findings revealed the exacerbated ecological hazard of MC-LR and Phe at environmental concentrations (≤50 +2 μg/L), and provided new insights to the potential toxic mechanisms of MC-LR and Phe in aquatic animals.

Authors: Xiang Wan, Chen Cheng, Yurong Gu, Xiubo Shu, Liqiang Xie, Yanyan Zhao

Full Source: Ecotoxicology and environmental safety 2021 Sep 1;220:112405. doi: 10.1016/j.ecoenv.2021.112405.

Variability in Toxicity of Plastic Leachates as a Function of Weathering and Polymer Type: A Screening Study with the Copepod Nitocra spinipes

2021-06

Abstract: The production and use of plastic over many decades has resulted in its accumulation in the world's oceans. Plastic debris poses a range of potential risks to the marine environment and its biota. Especially, the potential hazards of small plastic debris and chemicals associated with plastic have not been extensively studied. When buoyant plastic is exposed to ultraviolet radiation, it will slowly degrade and leach chemicals into surrounding waters. These leachates can include additives, sorbed organic pollutants, and degradation products of the plastic polymers. While most hazard assessments have focused on studying adverse effects due to the uptake of plastic, toxicity studies of the leachates of plastics

Abstract: The production and use of plastic over many decades has resulted in its accumulation in the world's oceans.

are less common. To begin to address this knowledge gap, we studied the acute toxicity of leachates from diverse plastics in the harpacticoid copepod Nitocra spinipes. Our results show that leachates caused a higher toxicity after plastic was exposed to ultraviolet light compared to leaching in darkness. We observed differences in toxicity for different polymer types: polyvinyl chloride and polypropylene resulted in the most toxic leachates, while polystyrene and poly[ethylene terephthalate] were least toxic. Furthermore, we observed increased toxicity of leachates from some plastics that had been weathered in the real marine environment compared to matching new materials. Our results indicate that both weathering condition and polymer type influence the toxicity of plastic leachates.

Authors: Berit Gewert, Matthew MacLeod, Magnus Breitholtz
Full Source: The Biological bulletin 2021 Jun;240(3):191-199. doi: 10.1086/714506.

Lung disorders induced by respirable organic chemicals

2021-01

Respirable organic chemicals were originally thought to cause allergic respiratory diseases, such as bronchial asthma and hypersensitivity pneumonitis, and believed not to cause lung disorders derived from inflammatory or fibrotic processes such as pulmonary fibrosis and interstitial pneumonitis. It has recently been reported, however, that exposure to organic chemicals can cause interstitial lung diseases. In this review, we discuss the clinical features of occupational asthma and hypersensitivity pneumonitis, as well as other lung disorders, including interstitial pneumonitis, caused by humidifier disinfectants in Korea and by a cross-linked acrylic acid-based polymer (CL-PAA) in Japan.

Authors: Yasuo Morimoto, Chinatsu Nishida, Taisuke Tomonaga, Hiroto Izumi, Kazuhiro Yatera, Kazuo Sakurai, Yangho Kim
Full Source: Journal of occupational health 2021 Jan;63(1):e12240. doi: 10.1002/1348-9585.12240.

ENVIRONMENTAL RESEARCH

A Deep Dive into the Complex Chemical Mixture and Toxicity of Tire Wear Particle Leachate in Fathead Minnow

2021-06-14

The ecological impact of tire wear particles in aquatic ecosystems is a growing environmental concern. In this study, we combined toxicity testing, using fathead minnow (Pimephales promelas) embryos, with non-target high-resolution liquid chromatography Orbitrap mass spectrometry to characterize the toxicity and chemical mixture of organic chemicals associated with tire particle (TP) leachates. We assessed: (a) exposure to TP leachates after leaching for 1-, 3- and 10-days, and (b) the effect of the presence and absence of small tire particulates in the leachates. We observed a decrease in embryonic heart rates, hatching success, and lengths, as well as an increase in the number of embryos with severe deformities and diminished eye and body pigmentation, upon exposure to the leachates. Overall, there was a pattern whereby we observed more toxicity in the 10-day leachates, and greater toxicity in unfiltered leachates. Redundancy analysis showed that several benzothiazoles and aryl-amines were correlated with the toxic effects observed in the embryos. These included benzothiazole, 2-aminobenzothiazole, 2-mercaptobenzothiazole, N,N′-diphenylguanidine, and N,N′-diphenylurea. However, many other chemicals characterized as unknowns are likely to also play a key role in the adverse effects observed. Our study provides insight into the types of chemicals likely to be important toxicological drivers in tire leachates, and improves our understanding on the ecotoxicological impacts of tire wear particles. This article is protected by copyright. All rights reserved.

Authors: Leah Chibwe, Joanne L Parrott, Kallie Shires, Hufsa Khan, Stacey Clarence, Christine Lavalle, Cheryl Sullivan, Anna O'Brien, Amila O De Silva, Derek C G Muir, Chelsea M Rochman
Full Source: Environmental toxicology and chemistry 2021 Jun 14. doi: 10.1002/etc.5140.

The COVID-19 incidence in Italian regions correlates with low temperature, mobility and PM10 pollution but lethality only with low temperature

2021-06-07

Background: The aim was to verify whether the density of particulate matter (PM10), the climate, and the mobility of people can influence the pandemic in the 19 regions and in the two autonomous Italian provinces as incidence rate and lethality.
Design and methods: The incidence rates per 100,000 inhabitants and the case fatality ratio (CFR) (dependent variables) in all Italian regions were calculated in January 2021 at John Hopkins University Coronavirus Center. The independent variables were: -Minimum average temperatures in the same month (January) of 2020, -Average pollution of PM10 in the air in each region in the last year available reported on a 0-10 scale to 0 = total absence of PM10 to 10 maximum pollutions. -Number of places in

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hotels occupied per inhabitants in 2020. Linear regression and Multiple Regression Analysis were carried out.
Results: The spread of the COVID-19 in the Italian regions seems to be related to pollution of PM10, the number of beds occupied in hotels (as an index of mobility and temperature (indirect correlation). On the contrary, the CFR correlates inversely with temperature but not with pollution. Measuring the concomitant effect of two independent variables by means of Multiple Regression Analysis, temperature and pollution show a synergistic effect on COVID-19 incidence.
Conclusions: The study seems to confirm the literature on the influence of temperature on the lethality of COVID-19 but adds the new results of an inverse relationship between the spread of the virus and low temperature in regions between the Mediterranean area (which includes southern Italy and Sicily and Sardinia islands) and the cold European temperate zone which includes the northern regions under the Alps. A new date also concerns the summation effect of the risk between cold weather and PM10 air pollution was found. Due to several methodic weakness the study has an exploratory than conclusive relevance.
Authors: Mauro Giovanni Carta, Luigi Minerba, Roberto Demontis, Germano Orrù, Ferdinando Romano, Alessandra Scano, Angelo Restivo, Stefano Del Giacco, Simona Deidda, Davide Firnu, Marcello Campagna, Federico Meloni, Giulia Cossu, Federica Sancassiani, Luchino Chessa, Goce Kalcev, Roberto Littera, Luigi Zorcolo, Cesar Ivan Aviles-Gonzale, Paolo Usai
Full Source: Journal of public health research 2021 Jun 7. doi: 10.4081/jphr.2021.2303.

Peracetic Acid-Ruthenium(III) Oxidation Process for the Degradation of Micropollutants in Water

2021-06-15

This paper presents an advanced oxidation process (AOP) of peracetic acid (PAA) and ruthenium(III) (Ru(III)) to oxidize micropollutants in water.

This paper presents an advanced oxidation process (AOP) of peracetic acid (PAA) and ruthenium(III) (Ru(III)) to oxidize micropollutants in water.

Studies of PAA-Ru(III) oxidation of sulfamethoxazole (SMX), a sulfonamide antibiotic, in 0.5-20.0 mM phosphate solution at different pH values (5.0-9.0) showed an optimum pH of 7.0 with a complete transformation of SMX in 2.0 min. At pH 7.0, other metal ions (i.e., Fe(II), Fe(III), Mn(II), Mn(III), Co(II), Cu(II), and Ni(II)) in 10 mM phosphate could activate PAA to oxidize SMX only up to 20%. The PAA-Ru(III) oxidation process was also unaffected by the presence of chloride and carbonate ions in solution. Electron paramagnetic resonance (EPR) measurements and quenching experiments showed the dominant involvement of the acetyl(per)oxyl radicals (i.e., CH3C(O)O• and CH3C(O)OO•) for degrading SMX in the PAA-Ru(III) oxidation process. The transformation pathways of SMX by PAA-Ru(III) were proposed based on the identified intermediates. Tests with other pharmaceuticals demonstrated that the PAA-Ru(III) oxidation system could remove efficiently a wide range of pharmaceuticals (9 compounds) in the presence of phosphate ions in 2.0 min at neutral pH. The knowledge gained herein on the effective role of Ru(III) to activate PAA to oxidize micropollutants may aid in developing Ru(III)-containing catalysts for PAA-based AOPs.
Authors: Ruobai Li, Kyriakos Manoli, Juhee Kim, Mingbao Feng, Ching-Hua Huang, Virender K Sharma
Full Source: Environmental science & technology 2021 Jun 15. doi: 10.1021/acs.est.0c06676.

OCCUPATIONAL

A high docosahexaenoic acid diet alters lung inflammation and recovery following repetitive exposure to aqueous organic dust extracts: Role of DHA in repetitive organic dust exposure

2021-06-11

Agricultural workers, especially those who work in swine confinement facilities, are at increased risk for developing pulmonary diseases including asthma, chronic obstructive pulmonary disease, and chronic bronchitis due to exposures to fumes, vapors, and organic dust.

Agricultural workers, especially those who work in swine confinement facilities, are at increased risk for developing pulmonary diseases including asthma, chronic obstructive pulmonary disease, and chronic bronchitis due to exposures to fumes, vapors, and organic dust. Repetitive exposure to agricultural dust leads to unresolved inflammation, a common underlying mechanism that worsens lung disease. Besides occupational exposure to dusts, diet also significantly contributes to inflammation and disease progression. Since DHA (docosahexaenoic acid), a polyunsaturated omega-3 fatty acid and its bioactive metabolites have key roles in inflammation resolution, we rationalized that individuals chronically exposed to organic dusts can benefit from dietary modifications. Here, we evaluated the role of DHA in modifying airway inflammation in a murine model of repetitive exposure to an aqueous extract of agricultural dust (3-week exposure to swine confinement dust extract, HDE) and after a one-week resolution/recovery period. We found that mice fed a high DHA diet had significantly increased bronchoalveolar lavage fluid (BALF) levels of DHA-derived resolvins and lower TNFα along with altered plasma levels of endocannabinoids and related lipid mediators. Following the one-week recovery we identified significantly reduced BALF cellularity and cytokine/chemokine release along with increased BALF amphiregulin

and resolvins in DHA diet-fed versus control diet-fed mice challenged with HDE. We further report observations on the effects of repetitive HDE exposure on lung Ym1+ and Arg-1+ macrophages. Overall, our findings support a protective role for DHA and identify DHA-derived resolvins and endocannabinoids among the potential mediators of DHA in altering airway inflammation in chronic agricultural dust exposure.
Authors: Arzu Ulu, Abigail Burr, Art J Heires, Jacqueline Pavlik, Tricia Larsen, Pedro A Perez, Carissa Bravo, Nicholas V DiPatrizio, Michelle Baack, Debra J Romberger, Tara M Nordgren
Full Source: The Journal of nutritional biochemistry 2021 Jun 11;108797. doi: 10.1016/j.jnutbio.2021.108797.

Upper extremity musculoskeletal disorders and work exposures among railroad maintenance-of-way workers

2021-06-14
Background: Our objective was to examine occupational risk factors for musculoskeletal disorders of the shoulders, elbows, wrists, and hands among railroad maintenance-of-way (MOW) workers. Little systematic research on musculoskeletal disorders has been conducted in this occupational group. Methods: In total, 3995 active members of the Brotherhood of Maintenance of Way Employes Division (BMWED) completed a standardized survey focusing on disorders caused by hand-transmitted vibration. We computed adjusted prevalence ratios (aPRs) using Poisson regression for shoulder, elbow, carpal tunnel syndrome, and vibration white finger musculoskeletal symptoms by work exposures, adjusted for age, region, race/ethnicity, smoking, potential second job, and spare time vehicle vibration exposure, and other work exposures. Results: Among active male BMWED members, we found associations between >5.2 years (vs. 0.0-0.7 years) duration of full-time equivalent power tool use and shoulder pain (aPR = 2.01; 95% confidence interval [CI], 1.43-2.85), elbow pain (aPR = 2.88; 95% CI, 1.86-4.46), vibration white finger symptoms (aPR = 2.49; 95% CI, 1.06-5.85), hand/wrist pain (aPR = 2.40; 95% CI, 1.74-3.32), finger numbness or tingling (aPR = 1.86; 95% CI, 1.38-2.50) and self-reported carpal tunnel syndrome diagnosis (aPR = 2.16; 95% CI, 1.24-3.77). Associations were not consistent across outcomes for the duration of non-powered hand tool use and "repeated lifting, pushing, pulling, or bending." Positive gradients were observed for most outcomes. Conclusions: Hand-arm vibration and some other biomechanical exposures were associated with shoulder, elbow, wrist, hand, and finger

Background: Our objective was to examine occupational risk factors for musculoskeletal disorders of the shoulders, elbows, wrists, and hands among railroad maintenance-of-way (MOW) workers.

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symptoms. Prevention programs should address occupational risk factors for upper extremity musculoskeletal disorders among MOW workers.
Authors: Paul Landsbergis, Eckardt Johanning, Marco Stillo, Rahul Jain, Michelle Davis
Full Source: American journal of industrial medicine 2021 Jun 14. doi: 10.1002/ajim.23259.

PHARAMACEUTICAL/TOXICOLOGY

Dietary N-nitroso compounds intake and bladder cancer risk: A systematic review and meta-analysis

2021-06-10
Bladder cancer is the most common cancer of the urinary tract. While tobacco smoking is responsible for more than half of the bladder cancer cases, occupational exposures is also an established risk factor of bladder cancer. Strong evidence of carcinogenicity of N-nitroso compounds (NOCs) have been provided in animal and human studies, but the target organ of occurring cancer in human including bladder cancer is still obscure. A wide range of NOCs sources surrounded us like diet, drinking water, cigarette smoking, workplace, and indoor air population. We conducted a meta-analysis to elucidate the association between NOCs in drinking water and food source and bladder cancer risk. Ten articles were included after removing the duplicates and irrelevant articles. The majority studies of our meta-analysis was done on women, maybe because of cigarette smoking as a main risk factor among men which is more common among men than women. Although the number of articles was limited our meta-analysis showed no significant association between dietary intakes of NOCs and bladder cancer risk (OR = 0.96, 95% CI = 0.88, 1.05; I2 = 50%, P-value = 0.007), neither subgrouping of NOCS type and source of NOCs nor dose of nitrate and nitrite intake indicated any associations.
Authors: Monireh Sadat SeyyedSalehi, Elham Mohebbi, Bahareh Sasanfar, Fatemeh Toorang, Kazem Zendehdel
Full Source: Nitric oxide : biology and chemistry 2021 Jun 10;115:1-7. doi: 10.1016/j.niox.2021.06.003.

Bladder cancer is the most common cancer of the urinary tract.