CHEMWATCH

# Bulletin Board

## Contents

SEP. 15, 2023

(click on page numbers for links)



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## CHEMICAL EFFECTS

### Surfactants in water and wastewater (greywater): Environmental toxicity and treatment options

2023-09-07

Surfactant, an emerging pollutant present in greywater, raises the toxicity levels in the water body. Soap, detergent, and personal care items add surfactant to greywater. Due to excessive washing and cleaning procedures brought on by the COVID-19 pandemic, the release of surfactants in greywater has also increased. Considering the environmental toxicity and problems it creates during the treatment, it's essential to remove surfactants from the wastewater. This review intends to explain and address the environmental toxicity of the surfactant released via greywater and current techniques for surfactant removal from wastewater. Various physical, chemical, and biological methods are reported. Modern adsorbents such as hydrophilic silica nanoparticles, chitosan, fly ash, and iron oxide remove surfactants by adsorption. Membrane filtration effectively removes surfactants but is not cost-effective. Coagulants (chemical and natural coagulants) neutralize surfactant charges and help remove them as bigger particles. Electrocoagulation/electroflotation causes surfactants to coagulate and float. Microorganisms break down surfactants in microbial fuel cells to generate power. Surfactants are removed by natural processes and plants in constructed wetlands where traditional aerobic and anaerobic approaches use microbes to break down surfactants. Constructed wetlands, natural coagulation-flocculation, and microbial fuel cells are environmentally beneficial methods to remove surfactants from wastewater.

Authors: Gyanaranjan Jena, Kasturi Dutta, Achlesh Daverey
Full Source: Chemosphere 2023 Sep 7;140082. doi: 10.1016/j.chemosphere.2023.140082.

Surfactant, an emerging pollutant present in greywater, raises the toxicity levels in the water body.

### Chitosan-Based Electrochemical Sensors for Pharmaceuticals and Clinical Applications

2023-08-25

Chitosan (CTS), a biocompatible and multifunctional material derived from chitin, has caught researchers' attention in electrochemical detection due to its unique properties. This review paper provides a comprehensive overview of the recent progress and applications of CTS-based electrochemical sensors in the analysis of pharmaceutical products



CHEMWATCH
Bulletin Board
Technical
SEP. 15, 2023

and other types of samples, with a particular focus on the detection of medicinal substances. The review covers studies and developments from 2003 to 2023, highlighting the remarkable properties of CTS, such as biocompatibility, chemical versatility, and large surface area, that make it an excellent candidate for sensor modification. Combining CTS with various nanomaterials significantly enhances the detection capabilities of electrochemical sensors. Various types of CTS-based sensors are analyzed, including those utilizing carbon nanomaterials, metallic nanoparticles, conducting polymers, and molecularly imprinted CTS. These sensors exhibit excellent sensitivity, selectivity, and stability, enabling the precise and reliable detection of medications. The manufacturing strategies used for the preparation of CTS-based sensors are described, the underlying detection mechanisms are elucidated, and the integration of CTS sensors with transducer systems is highlighted. The prospects of CTS-based electrochemical sensors are promising, with opportunities for miniaturization, simultaneous detection, and real-time monitoring applications.

Authors: Alexandra Virginia Bounegru, Iulian Bounegru
Full Source: Polymers 2023 Aug 25;15(17):3539. doi: 10.3390/polym15173539.

## ENVIRONMENTAL RESEARCH

### Catalytic Activity of Rare Earth Elements (REEs) in Advanced Oxidation Processes of Wastewater Pollutants: A Review

2023-08-22

In recent years, sewage treatment plants did not effectively remove emerging water pollutants, leaving potential threats to human health and the environment. Advanced oxidation processes (AOPs) have emerged as a promising technology for the treatment of contaminated wastewater, and the addition of catalysts such as heavy metals has been shown to enhance their effectiveness. This review focuses on the use of rare earth elements (REEs) as catalysts in the AOP process for the degradation of organic pollutants. Cerium and La are the most studied REEs, and their mechanism of action is based on the oxygen vacancies and REE ion concentration in the catalysts. Metal oxide surfaces improve the decomposition of hydrogen peroxide to form hydroxide species, which degrade the organics. The review discusses the targets of AOPs, including pharmaceuticals, dyes, and other molecules such as alkaloids, herbicides, and phenols. The current state-of-the-art advances of REEs-based AOPs, including Fenton-like oxidation and photocatalytic oxidation,

In recent years, sewage treatment plants did not effectively remove emerging water pollutants, leaving potential threats to human health and the environment.

are also discussed, with an emphasis on their catalytic performance and mechanism. Additionally, factors affecting water chemistry, such as pH, temperature, dissolved oxygen, inorganic species, and natural organic matter, are analyzed. REEs have great potential for enhancing the removal of dangerous organics from aqueous solutions, and further research is needed to explore the photoFenton-like activity of REEs and their ideal implementation for wastewater treatment.
Authors: Lorenzo Saviano, Antonios Apostolos Brouziotis, Edith Guadalupe Padilla Suarez, Antonietta Siciliano, Marisa Spampinato, Marco Guida, Marco Trifuoggi, Donatella Del Bianco, Maurizio Carotenuto, Vincenzo Romano Spica, Giusy Lofrano, Giovanni Libralato
Full Source: Molecules (Basel, Switzerland) 2023 Aug 22;28(17):6185. doi: 10.3390/molecules28176185.

## Exposome and unhealthy aging: environmental drivers from air pollution to occupational exposures

2023-09-09

The aging population worldwide is facing a significant increase in age-related non-communicable diseases, including cardiovascular and brain pathologies. This comprehensive review paper delves into the impact of the exposome, which encompasses the totality of environmental exposures, on unhealthy aging. It explores how environmental factors contribute to the acceleration of aging processes, increase biological age, and facilitate the development and progression of a wide range of age-associated diseases. The impact of environmental factors on cognitive health and the development of chronic age-related diseases affecting the cardiovascular system and central nervous system is discussed, with a specific focus on Alzheimer's disease, Parkinson's disease, stroke, small vessel disease, and vascular cognitive impairment (VCI). Aging is a major risk factor for these diseases. Their pathogenesis involves cellular and molecular mechanisms of aging such as increased oxidative stress, impaired mitochondrial function, DNA damage, and inflammation and is influenced by environmental factors. Environmental toxicants, including ambient particulate matter, pesticides, heavy metals, and organic solvents, have been identified as significant contributors to cardiovascular and brain aging disorders. These toxicants can inflict both macro- and microvascular damage and many of them can also cross the blood-brain barrier, inducing neurotoxic effects, neuroinflammation, and neuronal dysfunction. In conclusion, environmental factors play a critical role in modulating cardiovascular and brain aging. A deeper understanding of how environmental toxicants exacerbate aging processes and contribute to the pathogenesis of neurodegenerative diseases, VCI, and dementia is crucial for the development of preventive strategies and interventions to promote cardiovascular, cerebrovascular, and brain health. By mitigating exposure to harmful environmental factors and promoting healthy aging, we can strive to reduce the burden of age-related cardiovascular and brain pathologies in the aging population.
Authors: Tamas Pandics, David Major, Vince Fazekas-Pongor, Zsofia Szarvas, Anna Peterfi, Peter Mukli, Rafal Gulej, Anna Ungvari, Monika Fekete, Anna Tompa, Stefano Tarantini, Andriy Yabluchanskiy, Shannon Conley, Anna Csiszar, Adam G Tabak, Zoltan Benyo, Roza Adany, Zoltan Ungvari
Full Source: GeroScience 2023 Sep 9. doi: 10.1007/s11357-023-00913-3.

The aging population worldwide is facing a significant increase in age-related non-communicable diseases, including cardiovascular and brain pathologies.

## Enhancing industrial environmental performance: interplay among environmental sustainability, green HRM, and green competitive advantage

2023-09-08

This study highlights the importance of green human resource management (HRM) practices, which investigates the connection between environmental sustainability and green competitive advantage. Using the CGM model and the generalized method of moments (GMM), this research investigates how green HRM may foster environmental sustainability by creating a competitive advantage for businesses. Research shows that green HRM may achieve green competitive advantage practices, crucial for environmental sustainability. By "green HRM practices," we mean incorporating environmental concerns into traditional HRM processes, including hiring, training, evaluating, and compensating employees. However, the importance of green HRM practices cannot be overstated due to their efficiency in creating a competitive advantage and advancing environmental sustainability. Specifically, the research shows that businesses that have adopted "green HRM practices" outperform their competitors in terms of environmental sustainability. The last section emphasizes the importance of green HRM as a key facilitator of environmental sustainability. Implications for businesses that want to improve their environmental performance are also provided.
Authors: Ran He, Xue Wang
Full Source: Environmental science and pollution research international 2023 Sep 8. doi: 10.1007/s11356-023-29513-6.

This study highlights the importance of green human resource management (HRM) practices, which investigates the connection between environmental sustainability and green competitive advantage.

## PHARMACEUTICAL/TOXICOLOGY

### Environmental and Lifestyle Cancer Risk Factors: Shaping Extracellular Vesicle OncomiRs and Paving the Path to Cancer Development

2023-08-29

Intercellular communication has been transformed by the discovery of extracellular vesicles (EVs) and their cargo, including microRNAs (miRNAs), which play crucial roles in intercellular signaling. These EVs were previously disregarded as cellular debris but are now recognized as vital mediators of biological information transfer between cells. Furthermore, they respond not only to internal stimuli but also to environmental and lifestyle factors. Identifying EV-borne oncomiRs, a subset of miRNAs implicated in cancer development, could revolutionize our understanding of how environmental and lifestyle exposures contribute to oncogenesis. To investigate this, we studied the plasma levels of EV-borne oncomiRs in a population of 673 women and 238 men with a body mass index > 25 kg/m2 (SPHERE population). The top fifty oncomiRs associated with the three most common cancers in women (breast, colorectal, and lung carcinomas) and men (lung, prostate, and colorectal carcinomas) were selected from the OncomiR database. Only oncomiRs expressed in more than 20% of the population were considered for statistical analysis. Using a Multivariate Adaptive Regression Splines (MARS) model, we explored the interactions between environmental/lifestyle exposures and EV oncomiRs to develop optimized predictor combinations for each EV oncomiR. This innovative approach allowed us to better understand miRNA regulation in response to multiple environmental and lifestyle influences. By uncovering non-linear relationships among variables, we gained valuable insights into the complexity of miRNA regulatory networks. Ultimately, this research paves the way for comprehensive exposome studies in the future.

Authors: Valentina Bollati, Paola Monti, Davide Biganzoli, Giuseppe Marano, Chiara Favero, Simona Iodice, Luca Ferrari, Laura Dioni, Francesca Bianchi, Angela Cecilia Pesatori, Elia Mario Biganzoli

Full Source: Cancers 2023 Aug 29;15(17):4317. doi: 10.3390/cancers15174317.

Intercellular communication has been transformed by the discovery of extracellular vesicles (EVs) and their cargo, including microRNAs (miRNAs), which play crucial roles in intercellular signaling.



CHEMWATCH
Bulletin Board
Technical
SEP. 15, 2023

### A data-derived reference mixture representative of European wastewater treatment plant effluents to complement mixture assessment

2023-08-17

Aquatic environments are polluted with a multitude of organic micropollutants, which challenges risk assessment due the complexity and diversity of pollutant mixtures. The recognition that certain source-specific background pollution occurs ubiquitously in the aquatic environment might be one way forward to approach mixture risk assessment. To investigate this hypothesis, we prepared one typical and representative WWTP effluent mixture of organic micropollutants (EWERBmix) comprised of 81 compounds selected according to their high frequency of occurrence and toxic potential. Toxicological relevant effects of this reference mixture were measured in eight organism- and cell-based bioassays and compared with predicted mixture effects, which were calculated based on effect data of single chemicals retrieved from literature or different databases, and via quantitative structure-activity relationships (QSARs). The results show that the EWERBmix supports the identification of substances which should be considered in future monitoring efforts. It provides measures to estimate wastewater background concentrations in rivers under consideration of respective dilution factors, and to assess the extent of mixture risks to be expected from European WWTP effluents. The EWERBmix presents a reasonable proxy for regulatory authorities to develop and implement assessment approaches and regulatory measures to address mixture risks. The highlighted data gaps should be considered for prioritization of effect testing of most prevalent and relevant individual organic micropollutants of WWTP effluent background pollution. The here provided approach and EWERBmix are available for authorities and scientists for further investigations. The approach presented can furthermore serve as a roadmap guiding the development of archetypic background mixtures for other sources, geographical settings and chemical compounds, e.g. inorganic pollutants.

Authors: Liza-Marie Beckers, Rolf Altenburger, Werner Brack, Beate I Escher, Jörg Hackermüller, Enken Hassold, Gianina Illing, Martin Krauss, Janet Krüger, Paul Michaelis, Andreas Schüttler, Sarah Stevens, Wibke Busch

Full Source: Environment international 2023 Aug 17;179:108155. doi: 10.1016/j.envint.2023.108155.

Aquatic environments are polluted with a multitude of organic micropollutants, which challenges risk assessment due the complexity and diversity of pollutant mixtures.

## Recent Advances in Microbial-Assisted Remediation of Cadmium-Contaminated Soil

2023-08-31

Soil contamination with cadmium (Cd) is a severe concern for the developing world due to its non-biodegradability and significant potential to damage the ecosystem and associated services. Industries such as mining, manufacturing, building, etc., rapidly produce a substantial amount of Cd, posing environmental risks. Cd toxicity in crop plants decreases nutrient and water uptake and translocation, increases oxidative damage, interferes with plant metabolism and inhibits plant morphology and physiology. However, various conventional physicochemical approaches are available to remove Cd from the soil, including chemical reduction, immobilization, stabilization and electro-remediation. Nevertheless, these processes are costly and unfriendly to the environment because they require much energy, skilled labor and hazardous chemicals. In contrasting, contaminated soils can be restored by using bioremediation techniques, which use plants alone and in association with different beneficial microbes as cutting-edge approaches. This review covers the bioremediation of soils contaminated with Cd in various new ways. The bioremediation capability of bacteria and fungi alone and in combination with plants are studied and analyzed. Microbes, including bacteria, fungi and algae, are reported to have a high tolerance for metals, having a 98% bioremediation capability. The internal structure of microorganisms, their cell surface characteristics and the surrounding environmental circumstances are all discussed concerning how microbes detoxify metals. Moreover, issues affecting the effectiveness of bioremediation are explored, along with potential difficulties, solutions and prospects.

Authors: Usman Zulfiqar, Fasih Ullah Haider, Muhammad Faisal Maqsood, Waqas Mohy-Ud-Din, Muhammad Shabaan, Muhammad Ahmad, Muhammad Kaleem, Muhammad Ishfaq, Zoya Aslam, Babar Shahzad

Full Source: Plants (Basel, Switzerland) 2023 Aug 31;12(17):3147. doi: 10.3390/plants12173147.

Soil contamination with cadmium (Cd) is a severe concern for the developing world due to its non-biodegradability and significant potential to damage the ecosystem and associated services.



CHEMWATCH
Bulletin Board
Technical
SEP. 15, 2023

## OCCUPATIONAL

### Effect of an Early-Age Exposure on the Degradation Mechanisms of Cement Paste under External Sulfate Attack

2023-09-01

Among the most significant causes of concrete degradation is ESA (external sulfate attack). The majority of studies are currently conducted on samples that have been saturated and matured. Concrete structures, however, are exposed to the environment once the formwork has been removed. The purpose of this study is to determine what effects early exposure to external sulfates may have on degradation mechanisms. Microstructure, physical, and chemical behavior are monitored using a variety of experimental techniques, including NMR (27Al and 29Si), ICP, XRD, MIP, and SEM. Based on expansion measurements, mature Portland cement paste, unlike the early-age case, degraded rapidly due to the presence of compressed ettringite and gypsum, highlighted by SEM analysis. During ESA, sulfate ions diffuse through the cement matrix and are bound by chemical agents. Chemical analyses indicate that the chemical mechanism varies with the duration of curing. At an early age, external sulfates and aluminates are the most important reagents. For matured cases, these reagents include external sulfates, calcium derived from CH dissolution, and aluminates derived from the total dissolution of AFm.

Authors: Othman Omikrine Metalssi, Rim Ragoug, Fabien Barberon, Jean-Baptiste d'Espinose de Lacaillerie, Nicolas Roussel, Loïc Divet, Jean-Michel Torrenti

Full Source: Materials (Basel, Switzerland) 2023 Sep 1;16(17):6013. doi: 10.3390/ma16176013.

Among the most significant causes of concrete degradation is ESA (external sulfate attack).

### Exposure levels for carbon monoxide in nuclear submarine atmosphere

2023-09-07

This work proposes exposure limits for carbon monoxide in the nuclear submarine environment. Linear and non-linear forms of the Coburn-Foster-Kane equation were used to evaluate carbon monoxide exposure for an environment with low oxygen content, different exposure times and crew physical activity levels. We evaluated the 90-day Continuous Exposure Guidance Level, 24-h and 1-h Emergency Exposure Guidance Levels and 10-day and 24-h Submarine Escape Action Levels. The results showed that the concentration of carbon monoxide in the environment

must not exceed 9 ppm for the 90-day Continuous Exposure Guidance Level, 35 ppm for the 24-h Emergency Exposure Guidance Level, 90 ppm 1-h Emergency Exposure Guidance Level, 60 ppm for the 10-day Submarine Escape Action Level and 80 ppm for the 24-h Submarine Escape Action Level. Comparing these values with those established by the National Research Council for the United States Navy, the limits proposed by this work are verified to be lower, which may indicate a risk to the health of the crew. They also show the impact of the crew's level of physical activity on the formation of carboxyhemoglobin.

Authors: Alexandre G Chrestani, Rita M B Alves

Full Source: Journal of environmental management 2023 Sep 7;345:118908. doi: 10.1016/j.jenvman.2023.118908.