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CHEMICAL EFFECTS

Effect of low molecular weight organic acids on the lead and chromium release from widely-used lead chromate pigments under sunlight irradiation

2023-09-14

Lead chromate pigments are commonly used yellow inorganic pigments. They can pose environmental risks as they contain toxic heavy metals lead and chromium. Low molecular weight organic acids (LMWOAs), as widespread dissolved organic matter (DOM), affect the lead and chromium release from the pigment in water. In this work, the role of LMWOAs in the photodissolution of commercial lead chromate pigment was investigated. The pigment underwent significant photodissolution under simulated sunlight exposure with LMWOAs, and subsequently released Cr(III) and Pb(II). The photodissolution process is caused by the reduction of Cr(VI) by photogenerated electrons of the lead chromate pigment. The LMWOAs promoted photodissolution of the pigment by improving the electron-hole separation. The formation of Cr(III)-contained compounds leads to a slower release of chromium than lead. The photodissolution kinetics increase with decreasing pH and increasing LMWOAs concentration. The photodissolution of lead chromate pigment was basically positively related to the total number of hydroxyl and carboxyl groups in LMWOAs. The LMWOAs with stronger affinity to lead chromate pigment, lower adiabatic ionization potential (AIP) and higher energy of the highest occupied molecular orbital (EHOMO) are favorable to Cr(VI) reduction by photogenerated electrons and pigment photodissolution. 2.39% of chromium and 10.34% of lead released from the lead chromate pigment in natural conditions during a 6-h sunlight exposure. This study revealed the photodissolution mechanism of lead chromate pigment mediated by LMWOAs with different molecular structures, which helps understand the environmental photochemical behavior of the pigment. The present results emphasize the important role of DOM in the heavy metals release from commercial inorganic pigments.

Authors: Han Gao, Huixin Li, Xinwei Zhou, Jing Wei, Xiaolei Qu, Tao Long

Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Sep 14;122553. doi: 10.1016/j.envpol.2023.122553.

Lead chromate pigments are commonly used yellow inorganic pigments.

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Interfacial Micro-Environment of Electrocatalysis and Its Applications for Organic Electro-Oxidation Reaction

2023-09-15

Conventional designing principal of electrocatalyst is focused on the electronic structure tuning, on which effectively promotes the electrocatalysis. However, as a typical kind of electrode-electrolyte interface reaction, the electrocatalysis performance is also closely dependent on the electrocatalyst interfacial micro-environment (IME), including pH, reactant concentration, electric field, surface geometry structure, hydrophilicity/hydrophobicity, etc. Recently, organic electro-oxidation reaction (OEOR), which simultaneously reduces the anodic polarization potential and produces value-added chemicals, has emerged as a competitive alternative to oxygen evolution reaction, and the role IME played in OEOR is receiving great interest. Thus, this article provides a timely review on IME and its applications toward OEOR. In this review, the IME for conventional gas-involving reactions, as a contrast, is first presented, and then the recent progresses of IME toward diverse typical OEOR are summarized; especially, some representative works are thoroughly discussed. Additionally, cutting-edge analytical methods and characterization techniques are introduced to comprehensively understand the role IME played in OEOR. In the last section, perspectives and challenges of IME regulation for OEOR are shared.

Authors: Yi Liu, Zhihui Yang, Yuqin Zou, Shuangyin Wang, Junying He

Full Source: Small (Weinheim an der Bergstrasse, Germany) 2023 Sep 15;e2306488. doi: 10.1002/smll.202306488.

Conventional designing principal of electro-catalyst is focused on the electronic structure tuning, on which effectively promotes the electrocatalysis.

Modified air-Fenton with MIL-88A for chemical oxygen demand treatment in used coolant oil

2023-09-16

Coolant oil from auto part manufacturing contains additives resulting in high chemical oxygen demand (COD) in wastewater. In this study, COD treatment of coolant oil was investigated in a metal-organic framework (MOF) with MIL-88A by a modified air-Fenton (MAF) process by varying synthetic coolant oil concentrations (1-5%), pH (3-9), air-flow rate (1-2 L/min), amount of MIL-88A (0.2-1.0 g), and reaction time (30-180 min). The results were analyzed using central composite design (CCD) and response surface methodology (RSM) using Minitab ver. 19. The characteristic MIL-88A was characterized by XRD that showed a spindle-like shape with 2θ at 10.2° and 13.0°. The FTIR spectrum revealed the vibrational frequencies at Fe-O (564 cm-1), C-O (1391 and 1600 cm-1), and C = O (1216 and 1710 cm-

1). The optimum treatment efficiency was studied from 30 CCD conditions in the presence of coolant oil (5%, COD ~ 132,000 mg/L), pH (9), air flow rate (2 L/min), and MIL-88A (1 g) within 177 min. The results obtained from the experiment and the COD prediction were found to be 92.64% and 93.45%, respectively. The main mechanism of iron(III) in MIL-88A is proposed to be the production of hydroxyl radical (·OH) that oxidizes the organic matter in the coolant oil. Moreover, the MAF process was applied to the used industrial coolant oil and was found to be 62.59% efficient.
Authors: Kwanruedee Suwannasung, Vorapot Kanokkantapong, Sumeth Wongkiew
Full Source: Environmental science and pollution research international 2023 Sep 16. doi: 10.1007/s11356-023-29685-1.

ENVIRONMENTAL RESEARCH

Empirical linkages of the construction sector, intensive energy consumption, and economic openness with chemical oxygen demand pollution

2023-09-15

Though construction sector development and economic openness contribute to regional economic development, they have also been debated to pose some environmental challenges. Along these lines, we explored the long- and short-term connections of intensive energy consumption, economic openness, and construction sector development with the chemical oxygen demand throughout the scales of regional development of China's 30 provincial units over the 2004-2021 period. Theoretically, we contribute to the existing knowledge by incorporating chemical oxygen demand pollution, construction sector development, and economic openness to the Kaya identity's baseline framework. Empirically, we apply a series of advanced methods of panel data econometrics for robust results. Our key findings are as follows: First, we revealed a long-term stable cointegrating association among our variables of interest. Second, using the common correlated effect mean group estimator, we unfolded that the intensive energy consumption showed a chemical oxygen demand pollution reduction influence in both the long and short term, demonstrating the most substantial influence in the high regional development panel while expressing the least powerful influence the least regional development setting. Third, we unveiled that economic openness and construction sector development showed a linear chemical oxygen demand pollution enhancement influence in moderately and least

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developed regions. Nevertheless, both established an inverted U-shaped linkage with chemical oxygen demand pollution for the whole country as well as for high regional development data samples. Eventually, we found consistent estimates across long- and short-term investigations regarding signs of relationships; however, long-term effects remained more powerful than short-term ones. These findings would serve as factual scientific knowledge to help local as well as national governments create the optimal environmental regulations for the construction sector to achieve the sustainable development goals (SDGs), especially the Climate Action Plan (i.e., SDG-13).
Authors: Desire Wade Atchike, Weishang Guo, Zhi Yang, Munir Ahmad
Full Source: Environmental science and pollution research international 2023 Sep 15. doi: 10.1007/s11356-023-29487-5.

Biodegradation and valorization of feather waste using the keratinase-producing bacteria and their application in environmentally hazardous industrial processes

2023-09-13

Poultry feathers are widely discarded as waste worldwide and are considered an environmental pollutant and a reservoir of pathogenic bacteria. Therefore, developing sustainable and environmentally friendly methods for managing feather waste is one of the important environmental protection requirements. In this study, we investigated a rapid and eco-friendly method for the degradation and valorization of feather waste using keratinase-producing Pseudomonas geniculata H10 and evaluated the applicability of keratinase in environmentally hazardous chemical processes. Strain H10 completely degraded chicken feathers within 48 h by producing keratinase using them as sources of carbon, nitrogen, and sulfur. The culture contained a total of 402.8 μM amino acids, including 8 essential amino acids, which was higher than the chemical treatment. Keratinase was a serine-type metalloprotease with optimal temperature and pH of 30 °C and 9, respectively, and showed relatively high stability at 10-40 °C and pH 3-10. Keratinase was also able to degrade various insoluble keratins such as duck feathers, wool, human hair, and nails. Furthermore, keratinase exhibited more efficient depilation and wool modification than chemical treatment, as well as novel functionalities such as nematicidal and exfoliating activities. This suggests that strain H10 is a promising candidate for the efficient degradation and valorization of

Poultry feathers are widely discarded as waste worldwide and are considered an environmental pollutant and a reservoir of pathogenic bacteria.

feather waste, as well as the improvement of current industrial processes that use hazardous chemicals.
Authors: Gyulim Park, Kwang Min Lee, Young Seok Lee, Yedam Kim, Chae Min Jeon, O-Mi Lee, Yu-Jin Kim, Hong-Joo Son
Full Source: Journal of environmental management 2023 Sep 13;346:118986. doi: 10.1016/j.jenvman.2023.118986.

Living Material with Temperature-Dependent Light Absorption

2023-09-15
Engineered living materials (ELMs) exhibit desirable characteristics of the living component, including growth and repair, and responsiveness to external stimuli. Escherichia coli (E. coli) are a promising constituent of ELMs because they are very tractable to genetic engineering, produce heterologous proteins readily, and grow exponentially. However, seasonal variation in ambient temperature presents a challenge in deploying ELMs outside of a laboratory environment because E. coli growth rate is impaired both below and above 37 °C. Here, a genetic circuit is developed that controls the expression of a light-absorptive chromophore in response to changes in temperature. It is demonstrated that at temperatures below 36 °C, the engineered E. coli increase in pigmentation, causing an increase in sample temperature and growth rate above non-pigmented counterparts in a model planar ELM. On the other hand, at above 36 °C, they decrease in pigmentation, protecting the growth compared to bacteria with temperature-independent high pigmentation. Integrating the temperature-responsive circuit into an ELM has the potential to improve living material performance by optimizing growth and protein production in the face of seasonal temperature changes.
Authors: Lealia L Xiong, Michael A Garrett, Julia A Kornfield, Mikhail G Shapiro
Full Source: Advanced science (Weinheim, Baden-Wurttemberg, Germany) 2023 Sep 15;e2301730. doi: 10.1002/advs.202301730.

Engineered living materials (ELMs) exhibit desirable characteristics of the living component, including growth and repair, and responsiveness to external stimuli.

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PHARMACEUTICAL/TOXICOLOGY

Meticulous research for design of plasmonics sensors for cancer detection and food contaminants analysis via machine learning and artificial intelligence

2023-09-15
Cancer is one of the leading causes of death worldwide, making early detection and accurate diagnosis critical for effective treatment and improved patient outcomes. In recent years, machine learning (ML) has emerged as a powerful tool for cancer detection, enabling the development of innovative algorithms that can analyze vast amounts of data and provide accurate predictions. This review paper aims to provide a comprehensive overview of the various ML algorithms and techniques employed for cancer detection, highlighting recent advancements, challenges, and future directions in this field. The main challenge is finding a safe, auditable and reliable analysis method for fundamental scientific publication. Food contaminant analysis is a process of testing food products to identify and quantify the presence of harmful substances or contaminants. These substances can include bacteria, viruses, toxins, pesticides, heavy metals, allergens, and other chemical residues. Machine learning (ML) and artificial intelligence (A.I) proposed as a promising method that possesses excellent potential to extract information with high validity that may be overlooked with conventional analysis techniques and for its capability in a wide range of investigations. A.I technology used in meta-optics can develop optical devices and systems to a higher level in future. Furthermore (M.L.) and (A.I.) play key roles as a health Approach for nano materials NMs safety assessment in environment and human health research. Beside, benefits of ML in design of plasmonic sensors for different applications with improved resolution and detection are convinced.
Authors: Fatemeh Jafrasteh, Ali Farmani, Javad Mohamadi
Full Source: Scientific reports 2023 Sep 15;13(1):15349. doi: 10.1038/s41598-023-42699-6.

Cancer is one of the leading causes of death worldwide, making early detection and accurate diagnosis critical for effective treatment and improved patient outcomes.

Biomass waste as an alternative source of carbon and silicon-based absorbents for CO2 capturing application

2023-09-13
The production of low-cost solid adsorbents for carbon dioxide (CO2) capture has gained massive consideration. Biomass wastes are preferred as precursors for synthesis of CO2 solid adsorbents, due to their high

CO2 adsorption efficiency, and ease of scalable low-cost production. This review particularly focuses on waste biomass-derived adsorbents with their CO2 adsorption performances. Specifically, studies related to carbon (biochar and activated carbon) and silicon (silicates and geopolymers)-based adsorbents were summarized. The impact of experimental parameters including nature of biomass, synthesis route, carbonization temperature and type of activation methods on the CO2 adsorption capacities of biomass-derived pure carbon and silicon-based adsorbents were evaluated. The development of various enhancement strategies on biomass-derived adsorbents for CO2 capture and their responsible factors that impact adsorbent's CO2 capture proficiency were also reviewed. The possible CO2 adsorption mechanisms on the adsorbent's surface were highlighted. The challenges and research gaps identified in this research area have also been emphasized, which will help as further research prospects.

Authors: R Suresh, Lalitha Gnanasekaran, Saravanan Rajendran, A A Jalil, Matias Soto-Moscoso, Kuan Shiong Khoo, Zengling Ma, Heli Siti Halimatul Munawaroh, Pau Loke Show

Full Source: Chemosphere 2023 Sep 13;140173. doi: 10.1016/j.chemosphere.2023.140173.

OCCUPATIONAL

Assessing the exposure situations with naturally occurring radioactive materials across European countries by means of the e-NORM survey

2023-09-13

Despite the EU states being under the umbrella of the European Directive 2013/59/Euratom, a certain degree of heterogeneity may be noticed in the implementation of EU recommendations concerning regulation and handling of NORM into national legislation and practice. This is mainly a result of the still existing incomplete international knowledge about different phenomena related to NORM. Therefore, the attempt to advance the understanding of the behaviour and exposure of NORM is at the core of the European RadoNorm project. Within this context, an international survey on NORM has been prepared. The goals of the survey were to gather information and data from European countries that will contribute making an updated and/or new (a) systematic overview of NORM exposure situations and their analysis with respect to different radiation protection aspects, (b) knowledge about applied

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radioecological models in a variety of NORM exposure situations to improve evaluation of possible exposure doses and risk for population and workers, as well as of environmental risk, and (c) overview of overall mitigation measures applied in NORM involving industries, and possible remediation activities applied at NORM affected legacy sites. The survey is built upon an extended list of NORM-involving industries and processes, covers general aspects of NORM, presence of multi-stressors, as well as practical procedures applied in management and regulation, also in the context of a circular economy. The survey responses were obtained from 19 countries. An analysis of survey responses proved that NORM control is still a complex issue for many countries, and the recently introduced regulatory solutions require further interpretation for developing procedures and good practices. The present work provides a detailed analysis of the survey responses with respect to regulation, management and investigation of NORM.

Authors: Jelena Mrdakovic Popic, Laura Urso, Boguslaw Michalik

Full Source: The Science of the total environment 2023 Sep 13;905:167065. doi: 10.1016/j.scitotenv.2023.167065.

Particle transfer mediates dermal exposure of consumers to plasticizers in eraser and pen accessories

2023-09-09

Dermal exposure to chemicals released from daily consumer products is a rising concern, particularly for children who are susceptible to unintentional hand-to-mouth transfer and related chemical exposure risk. However, chemical transfer induced by tiny particles of intact products has yet to be adequately addressed. The objective of the present study was to determine the potentiality of particles release from intact erasers and pen grips upon dermal contact by measuring the migration rates of the embedded plasticizers (phthalates and its alternatives). The results showed that billions of particles were released from erasers (0.6-1.2 × 109) and pen grips (0.2-1.6 × 108) upon dermal contact at ambient temperature, with sizes mainly smaller than 1 μm. The composition of eraser leachates was identical to that of the corresponding bulk eraser, as confirmed by Fourier-transform infrared spectroscopy and pyrolysis. Migrated hydrophobic plasticizers may be used as indicators of particle release from erasers and pen grips. The potentiality of particle release was negatively correlated with the total plasticizer contents ($r = -0.51$; $p < 0.05$) for both erasers and pen grips. These findings indicated that particles directly released

Dermal exposure to chemicals released from daily consumer products is a rising concern, particularly for children who are susceptible to unintentional hand-to-mouth transfer and related chemical exposure risk.

from school supplies and accessories could be a non-negligible source of human exposure to plasticizers.
Authors: Chen-Chou Wu, Chun-Yan Chen, Li-Shan Zhong, Lian-Jun Bao, Eddy Y Zeng
Full Source: Environment international 2023 Sep 9;180:108191. doi: 10.1016/j.envint.2023.108191.