Hot Articles

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Science & Technology

Title: Electrochemical advanced oxidation processes: A review on their application to synthetic and real wastewaters

Author: Francisca C. Moreira, Rui A.R. Boaventura, Enric Brillas, Vítor J.P. Vilar

Journal: Applied Catalysis B: Environmental

Volume: 202 **Issue:** - **Page:** 217–261

Doi: 10.1016/j.apcatb.2016.08.037

Abstract

Over the last decades, research efforts have been made at developing more effective technologies for the remediation of waters containing persistent organic pollutants. Among the various technologies, the so-called electrochemical advanced oxidation processes (EAOPs) have caused increasing interest. These technologies are based on the electrochemical generation of strong oxidants such as hydroxyl radicals (radical dotOH). Here, we present an exhaustive review on the treatment of various synthetic and real wastewaters by five key EAOPs, i.e., anodic oxidation (AO), anodic oxidation with electrogenerated H_2O_2 (AO-H_2O_2), electro-Fenton (EF), photoelectro-Fenton (PEF) and solar photoelectro-Fenton (SPEF), alone and in combination with other methods like biological treatment, electrocoagulation, coagulation and membrane filtration processes. Fundamentals of each EAOP are also given.

Database

ScienceDirect

Title: Core-shell $LaPO_4/g\text{-}C_3N_4$ nanowires for highly active and selective CO_2 reduction

Author: Mengli Li, Lingxia Zhang, Xiangqian Fan, Meiying Wu, Min Wang, Ruolin Cheng, Linlin Zhang, Heliang Yao, Jianlin Shi

Journal: Applied Catalysis B: Environmental

Volume: 201 **Issue:** - **Page:** 629–635

Doi: 10.1016/j.apcatb.2016.09.004

Abstract

We have synthesized a series of $LaPO_4/g\text{-}C_3N_4$ core-shell nanowires via an *in-situ* hydrothermal growth of $LaPO_4$ nanorods in tubular $g\text{-}C_3N_4$ and investigated their photocatalytic activity in CO_2 reduction. It was found that in the synthesized core-shell structure, the outer $g\text{-}C_3N_4$ nano-shells coated on the $LaPO_4$ nanorod cores resulted in the enhanced light absorption and charge carrier separation/transfer ability, thus improved the room temperature photocatalytic performance of the nanocomposites in CO_2 photocatalytic reduction compared with the $g\text{-}C_3N_4$ and $LaPO_4$ individuals. A maximum CO yield of 0.433 μmol has been obtained from CO_2 reduction within 1 h irradiation on 30 mg nanocomposite photocatalyst under the absence of any noble metal. Finally, a possible mechanism, which is featured with $LaPO_4$ activation due to significantly promoted separation/transfer of photo-generated charge carriers, was proposed. The encouraging performance in CO_2 photoreduction demonstrates that this novel nanocomposite will be a prospective material in environmental protection and energy conversion.

Database

ScienceDirect

Title: Photocatalytic robust solar energy reduction of dinitrogen to ammonia on ultrathin MoS_2

Author: Songmei Sun, Xiaoman Li, Wenzhong Wang, Ling Zhang, Xiang Sun

Journal: Applied Catalysis B: Environmental

Volume: 200 **Issue:** - **Page:** 323–329

Doi: 10.1016/j.apcatb.2016.07.025

Abstract

The crux for solar N_2 reduction to ammonia is activating N_2 into its high-energy intermediate. Applying a simultaneous multi-electron reduction process could avoid intermediate generation and decrease the thermodynamic barrier. However, this process is extremely difficult from a kinetic view and experiments so far have not shown it is accessible. Here we show the first direct evidence of trion induced multi-electron N_2 reduction on ultrathin MoS_2. By applying light induced trions, N_2 molecular was activated and transformed into ammonia by a simultaneous six-electron reduction process, with a high ammonia synthesis rate of 325 μmol/g h without the assistant of any organic scavengers or co-catalyst. Bulk MoS_2 without trions did not exhibit any activity. This demonstrates multi-electron reduction may be realized in electron-rich semiconductors with high concentration of localized electrons such as trions. The methodology of simultaneous multi-electron reduction has wide implications for reactions beyond N_2 reduction and for materials beyond MoS_2.

Database

ScienceDirect

Title: Potential microbial hazards from graywater reuse and associated matrices: A review

Author: Maya Benami, Osnat Gillor, Amit Gross

Journal: Water Research

Volume: 106 **Issue:** - **Page:** 183–195

Doi: 10.1016/j.watres.2016.09.058

Abstract

Millions of decentralized graywater-reuse systems are operating worldwide. This water is directly accessible to household inhabitants, raising environmental and public health concerns. Graywater may contain a variety of harmful organisms, the types and numbers of which vary with source-type, storage time, and background levels of infection in the community source. In this review, we find that most studies indicate high amounts of microbial pathogens in raw graywater and therefore treatment and disinfection are recommended to lower possible health risks. Where these recommendations have been followed, epidemiological and quantitative microbial risk-assessment studies have found negligible health risks of bacterial pathogens in treated graywater. Chlorine is currently suggested as the most cost-effective disinfection agent for inactivating graywater bacterial pathogens and preventing regrowth. Various studies demonstrate that the introduction and diversity of pathogenic bacteria in the soil via irrigation can be affected by several factors, but treated graywater may not be a major contributor of bacterial contamination or antibiotic resistance. However, an accurate assessment of the infectious capabilities, exposure pathways, and resistance of specific pathogens, particularly viruses and antibiotic-resistant bacteria found in treated graywater after disinfection, as well as in the graywater piping, irrigated soils, plants, and associated aerosols is largely lacking in the literature. In addition, research shows that fecal bacterial indicators might not reliably indicate the presence or quantities of pathogens in graywater and thus, the indicator standard for graywater contamination should be revised.

Database

ScienceDirect

Title: Energy efficiency of batch and semi-batch (CCRO) reverse osmosis desalination

Author: David M. Warsinger, Emily W. Tow, Kishor G. Nayar, Laith A. Maswadeh, John H. Lienhard V

Journal: Water Research

Volume: 106 **Issue:** - **Page:** 272–282

Doi: 10.1016/j.watres.2016.09.029

Abstract

As reverse osmosis (RO) desalination capacity increases worldwide, the need to reduce its specific energy consumption becomes more urgent. In addition to the incremental changes attainable with improved components such as membranes and pumps, more significant reduction of energy consumption can be achieved through time-varying RO processes including semi-batch processes such as closed-circuit reverse osmosis (CCRO) and fully-batch processes that have not yet been commercialized or modelled in detail. In this study, numerical models of the energy consumption of batch RO (BRO), CCRO, and the standard continuous RO process are detailed. Two new energy-efficient configurations of batch RO are analyzed. Batch systems use significantly less energy than continuous RO over a wide range of recovery ratios and source water salinities. Relative to continuous RO, models predict that CCRO and batch RO demonstrate up to 37% and 64% energy savings, respectively, for brackish water desalination at high water recovery. For batch RO and CCRO, the primary reductions in energy use stem from atmospheric pressure brine discharge and reduced streamwise variation in driving pressure. Fully-batch systems further reduce energy consumption by not mixing streams of different concentrations, which CCRO does. These results demonstrate that time-varying processes can significantly raise RO energy efficiency.

Database

ScienceDirect

Title: Material Cycles and Chemicals: Dynamic Material Flow Analysis of Contaminants in Paper Recycling

Author: Kostyantyn Pivnenko, David Laner, and Thomas F. Astrup

Journal: Environmental Science & Technology

Volume: 50 **Issue:** 22 **Page:** 12302–12311

Doi: 10.1021/acs.est.6b01791

Abstract

This study provides a systematic approach for assessment of contaminants in materials for recycling. Paper recycling is used as an illustrative example. Three selected chemicals, bisphenol A (BPA), diethylhexyl phthalate (DEHP) and mineral oil hydrocarbons (MOHs), are evaluated within the paper cycle. The approach combines static material flow analysis (MFA) with dynamic material and substance flow modeling. The results indicate that phasing out of chemicals is the most effective measure for reducing chemical contamination. However, this scenario was also associated with a considerable lag phase (between approximately one and three decades) before the presence of chemicals in paper products could be considered insignificant. While improved decontamination may appear to be an effective way of minimizing chemicals in products, this may also result in lower production yields. Optimized waste material source-segregation and collection was the least effective strategy for reducing chemical contamination, if the overall recycling rates should be maintained at the current level (approximately 70% for Europe). The study provides a consistent approach for evaluating contaminant levels in material cycles. The results clearly indicate that mass-based recycling targets are not sufficient to ensure high quality material recycling.

Database

American Chemical Society Journal (ACS)

Title: Gas-Particle Partitioning of Vehicle Emitted Primary Organic Aerosol Measured in a Traffic Tunnel

Author: Xiang Li, Timothy R. Dallmann, Andrew A. May, Daniel S. Tkacik, Andrew T. Lambe, John T. Jayne, Philip L. Croteau, and Albert A. Presto

Journal: Environmental Science & Technology

Volume: 50 **Issue:** 22 **Page:** 12146–12155

Doi: 10.1021/acs.est.6b01666

Abstract

We measured the gas-particle partitioning of vehicle emitted primary organic aerosol (POA) in a traffic tunnel with three independent methods: artifact corrected bare-quartz filters, thermodenuder (TD) measurements, and thermal-desorption gas-chromatography mass-spectrometry (TD-GC-MS). Results from all methods consistently show that vehicle emitted POA measured in the traffic tunnel is semivolatile under a wide range of fleet compositions and ambient conditions. We compared the gas-particle partitioning of POA measured in both tunnel and dynamometer studies and found that volatility distributions measured in the traffic tunnel are similar to volatility distributions measured in the dynamometer studies, and predict similar gas-particle partitioning in the TD. These results suggest that the POA volatility distribution measured in the dynamometer studies can be applied to describe gas-particle partitioning of ambient POA emissions. The POA volatility distribution measured in the tunnel does not have significant diurnal or seasonal variations, which indicate that a single volatility distribution is adequate to describe the gas-particle partitioning of vehicle emitted POA in the urban environment.

Database

American Chemical Society Journal (ACS)

Title: Methane Leaks from Natural Gas Systems Follow Extreme Distributions

Author: Adam R. Brandt, Garvin A. Heath, and Daniel Cooley

Journal: Environmental Science & Technology

Volume: 50 **Issue:** 22 **Page:** 12512–12520

Doi: 10.1021/acs.est.6b04303

Abstract

Future energy systems may rely on natural gas as a low-cost fuel to support variable renewable power. However, leaking natural gas causes climate damage because methane (CH_4) has a high global warming potential. In this study, we use extreme-value theory to explore the distribution of natural gas leak sizes. By analyzing ∼15 000 measurements from 18 prior studies, we show that all available natural gas leakage data sets are statistically heavy-tailed, and that gas leaks are more extremely distributed than other natural and social phenomena. A unifying result is that the largest 5% of leaks typically contribute over 50% of the total leakage volume. While prior studies used log-normal model distributions, we show that log-normal functions poorly represent tail behavior. Our results suggest that published uncertainty ranges of CH_4 emissions are too narrow, and that larger sample sizes are required in future studies to achieve targeted confidence intervals. Additionally, we find that cross-study aggregation of data sets to increase sample size is not recommended due to apparent deviation between sampled populations. Understanding the nature of leak distributions can improve emission estimates, better illustrate their uncertainty, allow prioritization of source categories, and improve sampling design. Also, these data can be used for more effective design of leak detection technologies.

Database

American Chemical Society Journal (ACS)

Title: Rapid assemblage of diverse environmental fungal communities on public restroom floors

Author: J. Fouquier, T. Schwartz and S. T. Kelley

Journal: Indoor Air

Volume: 26 **Issue:** 6 **Page:** 869–879

Doi: 10.1111/ina.12279

Abstract

An increasing proportion of humanity lives in urban environments where they spend most of their lives indoors. Recent molecular studies have shown that bacterial assemblages in built environments (BEs) are extremely diverse, but BE fungal diversity remains poorly understood. We applied culture-independent methods based on next-generation sequencing (NGS) of the fungal internal transcribed spacer to investigate the diversity and temporal dynamics of fungi in restrooms. Swab samples were collected weekly from three different surfaces in two public restrooms (male and female) in San Diego, CA, USA, over an 8-week period. DNA amplification and culturing methods both found that the floor samples had significantly higher fungal loads than other surfaces. NGS sequencing of floor fungal assemblages identified a total of 2550 unique phylotypes (~800 per sample), less than half of which were identifiable. Of the known fungi, the majority came from environmental sources and we found little evidence of known human skin fungi. Fungal assemblages reformed rapidly in a highly consistent manner, and the variance in the species diversity among samples was low. Overall, our study contributes to a better understanding of public restroom floor fungal communities.

Database

Wiley Online Library

Title: Contribution of human-related sources to indoor volatile organic compounds in a university classroom

Author: S. Liu, R. Li, R. J. Wild, C. Warneke, J. A. de Gouw, S. S. Brown, S. L. Miller, J. C. Luongo, J. L. Jimenez and P. J. Ziemann

Journal: Indoor Air

Volume: 26 **Issue:** 6 **Page:** 925–938

Doi: 10.1111/ina.12272

Abstract

Although significant progress has been made in understanding the sources and chemistry of indoor volatile organic compounds (VOCs) during the past decades, much is unknown about the role of humans in indoor air chemistry. In the spring of 2014, we conducted continuous measurements of VOCs using a proton transfer reaction mass spectrometer (PTR-MS) in a university classroom. Positive matrix factorization (PMF) of the measured VOCs revealed a 'human influence' component, which likely represented VOCs produced from human breath and ozonolysis of human skin lipids. The concentration of the human influence component increased with the number of occupants and decreased with ventilation rate in a similar way to CO_2, with an average contribution of 40% to the measured daytime VOC concentration. In addition, the human skin lipid ozonolysis products were observed to correlate with CO_2 and anticorrelate with O_3, suggesting that reactions on human surfaces may be important sources of indoor VOCs and sinks for indoor O_3. Our study suggests that humans can substantially affect VOC composition and oxidative capacity in indoor environments.

Database

Wiley Online Library