Degradation

1-Enzymatic degradation of polylactic acid (PLA)

By Shalem, A (Shalem, Adi) [1] ; Yehezkeli, O (Yehezkeli, Omer) [1] ; Fishman, A (Fishman, Ayelet) [1] (provided by Clarivate) Source APPLIED MICROBIOLOGY AND BIOTECHNOLOGY Volume 108 Issue 1 DOI 10.1007/s00253-024-13212-4 Article Number 413 Published DEC 2024 Indexed 2024-07-24 Document Type Review

Abstract

Environmental concerns arising from the increasing use of polluting plastics highlight polylactic acid (PLA) as a promising eco-friendly alternative. PLA is a biodegradable polyester that can be produced through the fermentation of renewable resources. Together with its excellent properties, suitable for a wide range of applications, the use of PLA has increased significantly over the years and is expected to further grow. However, insufficient degradability under natural conditions emphasizes the need for the exploration of biodegradation mechanisms, intending to develop more efficient techniques for waste disposal and recycling or upcycling. Biodegradation occurs through the secretion of depolymerizing enzymes, mainly proteases, lipases, cutinases, and esterases, by various microorganisms. This review focuses on the enzymatic degradation of PLA and presents different enzymes that were isolated and purified from natural PLA-degrading microorganisms, or recombinantly expressed. The review depicts the main characteristics of the enzymes, including recent advances and analytical methods used to evaluate enantiopurity and depolymerizing activity. While complete degradation of solid PLA particles is still difficult to achieve, future research and improvement of enzyme properties may provide an avenue for the development of advanced procedures for PLA degradation and upcycling, utilizing its building blocks for further applications as envisaged by circular economy principles.

Keywords
Author Keywords
Polylactic acidDepolymerizationBiodegradationHydrolasesUpcycling

Keywords Plus
CUTINASE-LIKE ENZYMEPOLY(L-LACTIC ACID)POLY(LACTIC ACID)PROTEINASE-KPOLY(L-LACTIDE)-DEGRADING ENZYMESTRUCTURAL INSIGHTSGENE CLONINGLIPASE T6DEPOLYMERASEBIODEGRADATION

Degradation

2-Photocatalytic Dye Degradation from Textile Wastewater: A Review

By Khan, S (Khan, Sadia) [1] ; Noor, T (Noor, Tayyaba) [1] ; Iqbal, N (Iqbal, Naseem) [2] ; Yaqoob, L (Yaqoob, Lubna) [3] (provided by Clarivate) **Source ACS OMEGA Volume 9 Issue 20 Page 21751-21767 DOI 10.1021/acsomega.4c00887 Published MAY 10 2024 Early Access MAY 2024 Indexed 2024-05-25 Document Type Review**

Abstract

The elimination of dyes discharged from industrial wastewater into water bodies is crucial due to its detrimental effects on aquatic organisms and potential carcinogenic impact on human health. Various methods are employed for dye removal, but they often fall short in completely degrading the dyes and generating large amounts of suspended solids. Hence, there is a critical need for an efficient process that can achieve complete dye degradation with minimal waste emission. Among traditional water treatment approaches, photocatalysis stands out as a promising method for degrading diverse toxic and organic pollutants present in wastewater. In this review, the heterogeneous photocatalysis process is well explained for dye removal. This comprehensive review not only provides insightful illumination on the classification of dyes but also thoroughly explains various dye removal methods and the underlying mechanisms of photocatalysis. Furthermore, factors which effect the activity of the photocatalysis process are also explained in detail. Likewise, we categorized the heterogeneous photocatalyst in three generations and observed their activity for dye removal. This review also addresses the challenges and effectiveness of this promising field. Its primary aim is to offer a comprehensive overview of the photocatalytic degradation of pollution and to explore its potential for further future applications.

Keywords

Keywords Plus

METAL-OXIDEENVIRONMENTAL APPLICATIONSTITANIUM-DIOXIDEACTIVATED CARBONREACTIVE DYESAZO DYESTIO2REMOVALZNONANOPARTICLES

Degradation

3-Transferrin receptor targeting chimeras for membrane protein degradation

---

By Zhang, DP (Zhang, Dingpeng) [1] , [2] ; Duque-Jimenez, J (Duque-Jimenez, Jhoely) [1] ; Facchinetti, F (Facchinetti, Francesco) [3] , [4] , [5] ; Brixi, G (Brixi, Garyk) [6] ; Rhee, K (Rhee, Kaitlin) [1] , [2] ; Feng, WW (Feng, William W.) [3] , [4] , [5] ; Jnne, PA (Janne, Pasi A.) [3] , [4] , [5] , [7] ; Zhou, X (Zhou, Xin) [1] , [2] (provided by Clarivate) Source NATURE Volume 638 Issue 8051 DOI 10.1038/s41586-024-7947-3 Published FEB 20 2025 Early Access SEP 2024 Indexed 2024-10-27 Document Type Article

Abstract

Cancer cells require high levels of iron for rapid proliferation, leading to significant upregulation of cell-surface transferrin receptor 1 (TfR1), which mediates iron uptake by binding to the iron-carrying protein transferrin1-3. Leveraging this phenomenon and the fast endocytosis rate of TfR1 (refs. 4,5), we developed transferrin receptor targeting chimeras (TransTACs), a heterobispecific antibody modality for membrane protein degradation. TransTACs are engineered to drive rapid co-internalization of a target protein of interest and TfR1 from the cell surface, and to enable target protein entry into the lysosomal degradation pathway. We show that TransTACs can efficiently degrade a diverse range of single-pass, multi-pass, native or synthetic membrane proteins, including epidermal growth factor receptor, programmed cell death 1 ligand 1, cluster of differentiation 20 and chimeric antigen receptor. In example applications, TransTACs enabled the reversible control of human primary chimeric antigen receptor T cells and the targeting of drug-resistant epidermal growth factor receptor-driven lung cancer with the exon 19 deletion/T790M/C797S mutations in a mouse xenograft model. TransTACs represent a promising new family of bifunctional antibodies for precise manipulation of membrane proteins and targeted cancer therapy.

Transferrin receptor targeting chimeras have been developed that enable targeting of drug resistance in epidermal growth factor receptor-driven lung cancer and reversible control of human primary chimeric antigen receptor T cells, representing a promising new family of bifunctional antibodies for targeted cancer therapy.

Degradation

4-Monitoring $Ti_3C_2T_x$ MXene Degradation Pathways Using Raman Spectroscopy

---

By Adomaviciute-Grabusove, S (Adomaviciute-Grabusove, Sonata) [1] ; Popov, A (Popov, Anton) [2] ; Ramanavicius, S (Ramanavicius, Simonas) [6] ; Sablinskas, V (Sablinskas, Valdas) [1] ; Shevchuk, K (Shevchuk, Kateryna) [3] , [4] ; Gogotsi, O (Gogotsi, Oleksiy) [5] ; Baginskiy, I (Baginskiy, Ivan) [5] ; Gogotsi, Y (Gogotsi, Yury) [3] , [4] ; Ramanavicius, A (Ramanavicius, Arunas) [7] , [8] (provided by Clarivate) **Source ACS NANO Volume 18 Issue 20 Page 13184-13195**
DOI 10.1021/acsnano.4c02150 Published MAY 6 2024 Early Access MAY 2024 Indexed 2024-05-24
Document Type Article

Abstract

Extending applications of Ti3C2Tx MXene in nanocomposites and across fields of electronics, energy storage, energy conversion, and sensor technologies necessitates simple and efficient analytical methods. Raman spectroscopy is a critical tool for assessing MXene composites; however, high laser powers and temperatures can lead to the materials' deterioration during the analysis. Therefore, an in-depth understanding of MXene photothermal degradation and changes in its oxidation state is required, but no systematic studies have been reported. The primary aim of this study was to investigate the degradation of the MXene lattice through Raman spectroscopic analysis. Distinct spectral markers were related to structural alterations within the Ti3C2Tx material after subjecting it to thermal- and laser-induced degradation. During the degradation processes, spectral markers were revealed for several specific steps: a decrease in the number of interlayer water molecules, a decrease in the number of -OH groups, formation of C-C bonds, oxidation of the lattice, and formation of TiO2 nanoparticles (first anatase, followed by rutile). By tracking of position shifts and intensity changes for Ti3C2Tx, the spectral markers that signify the initiation of each step were found. This spectroscopic approach enhances our understanding of the degradation pathways of MXene, and facilitating enhanced and dependable integration of these materials into devices for diverse applications, from energy storage to sensors.

Keywords

Author Keywords

2D materialsMXenesRaman spectroscopyTiO2 nanoparticlesTi3C2TxMXene degradationlaser-induced disruption

Keywords Plus

SURFACE TERMINATIONS2-DIMENSIONAL TI3C2OXIDATIONPERFORMANCECARBONOH

Degradation

5-Strong-bonding hole-transport layers reduce ultraviolet degradation of perovskite solar cells

---

By Fei, CB (Fei, Chengbin) [1] ; Kuvayskaya, A (Kuvayskaya, Anastasia) [2] ; Shi, XQ (Shi, Xiaoqiang) [1] ; Wang, MR (Wang, Mengru) [1] ; Shi, ZF (Shi, Zhifang) [1] ; Jiao, HY (Jiao, Haoyang) [1] ; Silverman, TJ (Silverman, Timothy J.) [3] ; Owen-Bellini, M (Owen-Bellini, Michael) [3] ; Dong, YF (Dong, Yifan) [4] ; Xian, YM (Xian, Yeming) [5] ; (provided by Clarivate)

Source SCIENCE Volume 384 Issue 6700 Page 1126-1134 DOI 10.1126/science.adi4531 Published JUN 7 2024 Indexed 2024-07-02 Document Type Article

Abstract

The light-emitting diodes (LEDs) used in indoor testing of perovskite solar cells do not expose them to the levels of ultraviolet (UV) radiation that they would receive in actual outdoor use. We report degradation mechanisms of p-i-n-structured perovskite solar cells under unfiltered sunlight and with LEDs. Weak chemical bonding between perovskites and polymer hole-transporting materials (HTMs) and transparent conducting oxides (TCOs) dominate the accelerated A-site cation migration, rather than direct degradation of HTMs. An aromatic phosphonic acid, [2-(9-ethyl-9H-carbazol-3-yl)ethyl]phosphonic acid (EtCz3EPA), enhanced bonding at the perovskite/HTM/TCO region with a phosphonic acid group bonded to TCOs and a nitrogen group interacting with lead in perovskites. A hybrid HTM of EtCz3EPA with strong hole-extraction polymers retained high efficiency and improved the UV stability of perovskite devices, and a champion perovskite minimodule-independently measured by the Perovskite PV Accelerator for Commercializing Technologies (PACT) center-retained operational efficiency of >16% after 29 weeks of outdoor testing.

Keywords

Keywords Plus

EFFICIENTINTERFACEFILMS

Degradation

6-Physics-informed neural network for lithium-ion battery degradation stable modeling and prognosis

---

By Wang, FJ (Wang, Fujin) [1] , [2] ; Zhai, Z (Zhai, Zhi) [1] , [2] ; Zhao, ZB (Zhao, Zhibin) [1] , [2] ; Di, Y (Di, Yi) [1] , [2] ; Chen, XF (Chen, Xuefeng) [1] , [2] (provided by Clarivate) Source NATURE COMMUNICATIONS Volume 15 Issue 1 DOI 10.1038/s41467-024-48779-z Article Number 4332 Published MAY 21 2024 Indexed 2024-06-22 Document Type Article

Abstract

Accurate state-of-health (SOH) estimation is critical for reliable and safe operation of lithium-ion batteries. However, reliable and stable battery SOH estimation remains challenging due to diverse battery types and operating conditions. In this paper, we propose a physics-informed neural network (PINN) for accurate and stable estimation of battery SOH. Specifically, we model the attributes that affect the battery degradation from the perspective of empirical degradation and state space equations, and utilize neural networks to capture battery degradation dynamics. A general feature extraction method is designed to extract statistical features from a short period of data before the battery is fully charged, enabling our method applicable to different battery types and charge/discharge protocols. Additionally, we generate a comprehensive dataset consisting of 55 lithium-nickel-cobalt-manganese-oxide (NCM) batteries. Combined with three other datasets from different manufacturers, we use a total of 387 batteries with 310,705 samples to validate our method. The mean absolute percentage error (MAPE) is 0.87%. Our proposed PINN has demonstrated remarkable performance in regular experiments, small sample experiments, and transfer experiments when compared to alternative neural networks. This study highlights the promise of physics-informed machine learning for battery degradation modeling and SOH estimation.

Reliable lithium-ion battery health assessment is vital for safety. Here, authors present a physics-informed neural network for accurate and stable state-of-health estimation, overcoming challenges of varied battery types and usage conditions.

Keywords

Keywords Plus

CAPACITY FADEHEALTHSTATEOPTIMIZATIONSIMULATION

Degradation

7-Facile preparation of a 3D rGO/g-C_3N_4 nanocomposite loaded with Ag NPs for photocatalytic degradation

---

By Cao, KS (Cao, Kesheng) [1] ; Ge, XY (Ge, Xueyu) [1] ; Li, S (Li, Shuang) [1] ; Tian, ZS (Tian, Zhengshan) [1] ; Cui, SY (Cui, Suya) [1] ; Guo, GJ (Guo, Guijin) [1] ; Yang, LQ (Yang, Liuqing) [1] ; Li, XW (Li, Xingwu) [1] ; Wang, YB (Wang, Yabo) [1] ; Bai, SZ (Bai, Suzhen) [1] ;

(provided by Clarivate) Source RSC ADVANCES Volume 15 Issue 22 Page 17089-17101 DOI 10.1039/d5ra02399h Published MAY 21 2025 Indexed 2025-06-08 Document Type Article

Abstract

Graphene-based and g-C3N4-based nanocomposites can effectively remove organic pollutants from water. However, the reasonable design and scale preparation of hybrid nanomaterials of reduced graphene oxide (rGO), g-C3N4 and silver nanoparticles (Ag NPs) with improved performance for practical application need to be further explored. Herein, a 3D rGO/g-C3N4 nanocomposite loaded with Ag NPs was successfully fabricated through a facile three-step synthetic route. The microstructure and morphology of GO, g-C3N4, rGO/g-C3N4 and rGO/g-C3N4 nanocomposite loaded with Ag NPs were characterized and analyzed. The experimental results show that the as-prepared nanocomposite loaded with Ag NPs has excellent activity to remove methylene blue (MB) from water under visible light irradiation, and its maximum removal capacity is high as 49.60 mg g-1 within 60 min. Based on its possible catalytic process and kinetic analysis, the adsorption and catalytic performance of this nanocomposite may be attributed to a synergistic effect of rGO, g-C3N4 and Ag NPs. In addition, it can provide a useful reference for the rational design and scale preparation of rGO/g-C3N4 nanocomposite for practical applications.

Keywords

Keywords Plus

REDUCED GRAPHENE OXIDECARBON NITRIDEADSORPTIONSILVERWATERNANOPARTICLESG-C3N4ANTIBACTERIAL

Degradation

8-Synergistic electric fields induced by unilateral doping modulation for enhanced organic pollutant degradation and sterilization

---

By Fu, YJ (Fu, Yangjie) [1] ; Chi, JR (Chi, Jiurui) [1] ; Wu, YL (Wu, Yanling) [1] ; Li, J (Li, Jun) [3] ; Tan, M (Tan, Meng) [1] ; Li, CJ (Li, Chunjuan) [1] ; Du, H (Du, Hao) [1] ; Hao, DR (Hao, Derek) [4] ; Zhu, HY (Zhu, Huayue) [2] ; Wang, Q (Wang, Qi) [1] ; (provided by Clarivate) Source APPLIED SURFACE SCIENCE Volume 692 DOI 10.1016/j.apsusc.2025.162711 Article Number 162711 Published MAY 30 2025 Early Access FEB 2025 Indexed 2025-03-03 Document Type Article

Abstract

Constructing a robust and large built-in electric field to boost photogenerated carrier separation efficiency has been a persistent challenge in photocatalysis. Herein, a carbon-rich carbon nitride (CCN/WO3) S-scheme heterojunction was successfully developed, achieving effective charge separation through the synergistic interaction of the in-plane electric field within CCN and the interfacial electric field at the CCN/WO3 interface. The robust inplane electric field of CCN originated from the asymmetric structure induced by carbon substitution for nitrogen atoms in g-C3N4. Additionally, a strong interfacial electric field was established through combining CCN with WO3 via a one-pot synthesis process. The CCN/WO3 heterojunction demonstrated excellent performance in bacteria inactivation and organic pollutant degradation, with antibacterial activity against E. coli 20.4 times and 4.2 times higher than those of WO3 and CN/WO3, respectively, and a photocatalytic TC degradation rate constant 5.5 times higher than that of WO3. Quantitative analysis revealed that the CCN/WO3 heterojunction achieved 96.7 % selectivity for free radical generation, significantly higher than that of g-C3N4 (40.9 %), indicating a strong preference for activating O2 through charge-carrier transfer pathways. This study demonstrates that leveraging the synergy between in-plane and interfacial electric fields offers a promising strategy to enhance charge separation in photocatalysts.

Keywords

Author Keywords

Carbon-rich carbon nitrideBuilt-in electric fieldS -schemeBacteria inactivationTC degradation

Keywords Plus

GRAPHITIC CARBON NITRIDEPHOTOCATALYSISACID

Degradation

9-N-doped biochar-Fe/Mn as a superior peroxymonosulfate activator for enhanced bisphenol a degradation

---

By Xiao, HJ (Xiao, Huiji) [1] ; Wang, Y (Wang, Yun) [1] ; Lv, KW (Lv, Kewei) [2] ; Zhu, CX (Zhu, Chenxi) [1] ; Guan, XH (Guan, Xiaohong) [3] ; Xie, B (Xie, Bing) [3] , [4] ; Zou, XM (Zou, Xiaoming) [1] ; Luo, XB (Luo, Xubiao) [1] ; Zhou, YB (Zhou, Yanbo) [1] , [2] , [4] (provided by Clarivate) Source WATER RESEARCH Volume 278 DOI 10.1016/j.watres.2025.123399 Article Number 123399 Published JUN 15 2025 Early Access MAR 2025 Indexed 2025-03-18 Document Type Article

Abstract

Emerging contaminants (ECs) are characterized by their widespread environmental distribution and low concentrations, posing significant challenges for their effective removal from source wastewater. To better deal with the problems associated with ECs, we developed a robust Fe-Mn bimetallic catalyst supported on N-doped biochar (FM@NBC-8) for peroxymonosulfate (PMS)-mediated advanced oxidation system, in which bisphenol A (BPA) was investigated as a typical EC. Particularly, complete degradation of BPA in the FM@NBC-8/PMS system was achieved within 5 min, accompanying with a high TOC removal. The degradation rate of BPA with FM@NBC-8 was 143 times that of the initial biochar (BC-8), 20 and 91 times that of single metal-doped catalysts Fe (F@NBC-8) and Mn (M@NBC-8), respectively. The degradation rate of BPA was enhanced to 1.7337 min^{-1} with 0.6 g L^{-1} FM@NBC-8 utilized to activate PMS, achieving a superior performance in BPA degradation compared to most reported results in the literature (0.081 similar to 1.43 min^{-1}). The introduction of Fe, Mn, and N elements dramatically enhanced the specific surface area (from 46.285 to 218.541 m^2 g^{-1}) of the catalyst, thereby enhancing the adsorption capacity of PMS and pollutants on the catalyst. Moreover, the accelerated electron transfer between the catalyst and PMS favored the formation of low-valent metal intermediates (Fe(II)-O-O-$SO3^-$ and Mn(II)-O-O-$SO3^-$), responsible for the generation of $SO4^{center\ dot-}$and $^{center\ dot}$OH. And ^{1}O2 was generated mainly via the decomposition of $SO5^{center\ dot-}$ in FM@NBC-8/PMS system, thereby collectively enhancing the pollutant degradation. The stability of the catalyst was attributed to the synergistic effects of nitrogen doping and biochar encapsulation, which ensured effective operation of the FM@NBC-8/PMS system across a broad pH range of 3 to 10, while also providing resistance to interference from ubiquitous anions. This study indicates that the bimetal biochar-based materials for catalytic PMS activation have significant potential for practical application in green environmental remediation.

Keywords

Author Keywords

Advanced oxidationPeroxymonosulfate activationBimetallic catalystN -doped biocharEmerging contaminants

Keywords Plus

CARBON NANOTUBESPERSULFATE PS

Degradation

10-Efficient antibiotic tetracycline degradation and toxicity abatement via the perovskite-type CaFexNi1-xO3 assisted heterogeneous electro-Fenton system

---

By Liang, YL (Liang, Yuling) [1] ; Feng, AC (Feng, Aochen) [2] ; Al-Dhabi, NA (Al-Dhabi, Naif Abdullah) [3] ; Zhang, J (Zhang, Jing) [4] ; Xing, WL (Xing, Wenle) [5] ; Chen, T (Chen, Tao) [1] ; Han, YX (Han, Yuxuan) [1] ; Zeng, GM (Zeng, Guangming) [1] ; Tang, L (Tang, Lin) [1] ; Tang, WW (Tang, Wangwang) [1] (provided by Clarivate) Source WATER RESEARCH Volume 279 DOI 10.1016/j.watres.2025.123432 Article Number 123432 Published JUL 1 2025 Early Access MAR 2025 Indexed 2025-03-18 Document Type Article

Abstract

As one of the emerging contaminants, antibiotics are posing a great threat to the human health and environment, which requires effective treatment methods. Heterogeneous electro-Fenton is a promising technique for organic contaminant elimination, but preparation of an appropriate heterogeneous electro-Fenton catalyst still remains challenging. In this work, the feasibility of perovskite-type CaFexNi1-xO3 as heterogeneous electro-Fenton catalyst for tetracycline (TC) removal and toxicity abatement has been explored. It was found that, among the examined CaFexNi1-xO3 catalysts with different Ni doping amount, CaFe3/4Ni1/4O3 exhibited the best performance, achieving 92.1 % TC removal within 30 min without pH adjustment in the presence of 0.05 M Na2SO4 electrolyte. Choosing Cl--containing electrolyte enabled further improvement towards TC elimination. In addition, the CaFe3/4Ni1/4O3 based heterogeneous electro-Fenton system presented other advantages including good recyclability and universal applicability, and significant toxicity reduction (verified via both ECOSAR simulation and soybean germination test). The TC degradation pathways were elucidated through identification of intermediate products and DFT calculations. Mechanism investigations revealed that there existed a strong synergy between Fe and Ni, and center dot OH and center dot O2- played the primary roles in the system while 1O2 played an auxiliary role. This study presented a promising heterogeneous electro-Fenton catalyst for degradation of antibiotics such as tetracycline.

Keywords

Author Keywords

Heterogeneous electro-FentonTetracycline degradationPerovskite-type catalystToxicity abatement

Keywords Plus

BIFEO3

Degradation

11-Preparation of FeCu-LDH/g-C3N4 catalysts and synergistic activation of potassium persulfate for photocatalytic significant degradation of tetracycline

---

By Bai, Y (Bai, Yan) [1] ; Dong, W (Dong, Wen) [1] , [2] ; Zhang, Q (Zhang, Qi) [1] , [2] ; She, HD (She, Houde) [2] ; Chen, XP (Chen, Xiaoping) [3] ; Wang, QZ (Wang, Qizhao) [2] , [4] (provided by Clarivate)
Source JOURNAL OF ALLOYS AND COMPOUNDS Volume 1033 DOI 10.1016/j.jallcom.2025.181237
Article Number 181237 Published JUN 20 2025 Early Access MAY 2025 Indexed 2025-06-13 Document Type Article

Abstract

Semiconductor materials have great potential for use in photocatalytic degradation of organic pollutants. Degradation of antibiotic organic pollutants in the aqueous phase based on fenton-like advanced oxidation processes is of great interest. While graphitic phase carbon nitride (g-C3N4) was found to have the advantages of good photocatalytic stability, green and simple synthesis process and easy functionalization, the low catalytic activity of g-C3N4 limited its practical application. Therefore, the present work addresses the shortcomings of gC3N4 by adopting the method of compounding with FeCu-LDH semiconductor to change the disadvantages of gC3N4, such as high photogenerated e--h+ pair compounding rate, narrower photoresponsive range, and low efficiency of surface charge mobilization, so as to intensify the catalytic capabilities of FeCu-LDH/g-C3N4 catalysts for the photocatalytic degradation of tetracycline by activation of potassium peroxysulfate (PMS) for (TC) catalysis. In addition, the structural properties, visible light response and photoelectric properties of the composite photocatalyst were analyzed by a variety of characterization tools, for example XRD, XPS, ZETA, BET and SEM. Finally, its photocatalytic mechanism was explored in depth.

Keywords

Author Keywords

Photocatalytic degradationAntibioticsPotassium persulfate

Keywords Plus

GRAPHITIC CARBON NITRIDE

Degradation

12-Acid-engineered UiO-66(Ce): From the limitations of concealed MOF sites to catalytic excellence for rapid atrazine degradation

---

By Wang, D (Wang, Da) [1] , [5] ; Ying, YF (Ying, Yufeng) [1] ; Cai, LW (Cai, Liwen) [1] ; Cheng, HJ (Cheng, Haijun) [2] ; Giannakis, S (Giannakis, Stefanos) [3] ; Moussavi, G (Moussavi, Gholamreza) [4] ; He, ZQ (He, Zhiqiao) [1] ; Song, S (Song, Shuang) [1] ; Ma, J (Ma, Jun) [2] (provided by Clarivate) Source CHEMICAL ENGINEERING JOURNAL Volume 516 DOI 10.1016/j.cej.2025.163890 Article Number 163890 Published JUL 15 2025 Early Access MAY 2025 Indexed 2025-06-06 Document Type Article

Abstract

Metal-organic frameworks (MOFs) hold promise for catalytic ozonation in environmental remediation; however, their application is hindered by limited active site exposure and structural instability. This study introduces a novel acid-assisted ligand engineering approach to enhance the accessibility of the metal sites in UiO-66(Ce), a Ce-MOF catalyst. By substituting formic acid with certain organic ligands (terephthalic acid) and subsequent hydrochloric acid treatment, we synthesized UiO-66-F-H, a modified catalyst that exhibited significantly increased Lewis acid sites and enhanced structural robustness. Comparative analyses demonstrated that UiO-66-F-H achieved an atrazine degradation rate 5.7 times higher than that of its unmodified counterpart and 17.7 times that of ozonation alone under the optimal experimental conditions (pH = 7.0, T = 10 degrees C, and [O3] = 3 mg L-1). The characterization results confirmed a 40% increase in the number of surface Lewis acid sites and a notable improvement in catalyst stability, which was attributed to the exposed coordinated unsaturated Ce metal sites. The enhanced catalytic performance, coupled with superior stability and recyclability, suggests that UiO-66-F-H is a promising candidate for broader environmental applications, introducing a new paradigm for MOF modification. This study addresses the critical limitations of MOFs in catalytic ozonation and fosters the development of sophisticated MOF-based materials tailored for environmental remediation applications.

Keywords

Author Keywords

Metal-organic frameworksAcid treatmentAtrazineCoordination unsaturated Ce metal sitesReactive oxygen speciesLigand defect engineering

Keywords Plus

METAL-ORGANIC FRAMEWORKSFACILE SYNTHESISOZONATIONREMOVAL

Degradation

13-Study on the degradation mechanism of mechanical properties of red sandstone under static and dynamic loading after different high temperatures

---

By Lin, HX (Lin, Haixiao) [1] ; Liu, WD (Liu, Weidong) [1] ; Zhang, D (Zhang, Duan) [1] ; Chen, B (Chen, Bin) [1] ; Zhang, XS (Zhang, Xinsheng) [1] (provided by Clarivate) Source SCIENTIFIC REPORTS Volume 15 Issue 1 DOI 10.1038/s41598-025-93969-4 Article Number 11611 Published APR 4 2025 Indexed 2025-04-13 Document Type Article

Abstract

To study the effect of high temperature on the mechanical properties of red sandstone, YNS600 electro-hydraulic servo universal testing machine and pneumatic separating Hopkinson press bar (SHPB) device were respectively used to conduct static and dynamic load loading tests on red sandstone after 500 similar to 1000 degrees C action, and X diffraction detection. The damage pattern and mechanical property index changes before and after high temperature action were compared, and the relationship between mineral composition, microstructure and mechanical parameters of the specimens and temperature was analyzed, and a theoretical model was constructed. With the increase of temperature, the peak strength and elastic modulus under static and dynamic loading decreased significantly, and compared with the static stress-strain curve, the dynamic stress-strain curve did not have an obvious compaction phase, and the mass loss rate, volume expansion rate, and longitudinal wave velocity attenuation rate increased above 600 degrees C. Minerals such as zeolite and pyrite within the red sandstone specimen gradually reacted after high temperature. The theoretical model explains the degradation mechanism of the mechanical properties of red sandstone under the action of idealized high temperature. The research results can provide a reliable scientific basis for the assessment and prediction of rock engineering after high-temperature fire.

Keywords

Author Keywords

Rock damageRock stressSeepageCoupling

Degradation

14-Removal and degradation of dyes from textile industry wastewater: Benchmarking recent advancements, toxicity assessment and cost analysis of treatment processes

---

By Sahu, A (Sahu, Abhispa) [1] ; Poler, JC (Poler, Jordan C.) [2] (provided by Clarivate) Source JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING Volume 12 Issue 5 DOI 10.1016/j.jece.2024.113754 Article Number 113754 Published OCT 2024 Early Access AUG 2024 Indexed 2024-09-10
Document Type Article

Abstract

Clean and safe drinking water is vital. Tragically, this quality has been degraded due to the anthropomorphic and continuous discharge of toxic and non-biodegradable organic pollutants into the aquatic environment. Among the many sources of water pollution, the textile industry has become a major problem as wastewater containing dyes is often discharged into natural water bodies. Studies have shown that a major portion (similar to 20 %) of dyes is lost during synthesis and processing operations and end up in wastewater. Due to their ubiquitous industrial use, textile dyes are categorized as pollutants of major concern, posing an ongoing threat worldwide. The discharge of dyes and/or their degradation byproducts in the aquatic environment poses serious health risks to aquatic plants, organisms, and humans, making it necessary to remove them at their source. This review article aims to present and discuss the most advanced and state-of-art technical and scientific developments in the removal and degradation of dyes from textile wastewater. This review discusses the emergence of the latest nanomaterials, current focus, and superior efficiencies of the state-of-the-art materials, with emphasis on physical and chemical approaches. By comparing frequently studied treatment methods for cost and efficiency, the future outlook provides insights into selection of treatment options, knowledge gaps, and how to improve the efficiency of applicable systems. This feasibility analysis will help readers select the most efficient treatment process from both a performance and financial perspective. While multistage hybrid technologies are worth pursuing, few technologies such as ozonation and photo-Fenton have emerged as promising independent processes. Their individual combination with filtration methods has the ability to provide an economically feasible and time-efficient solution. However, there is room for further improvement in developing or tailoring models, methods and processes that target not only dyes but also secondary factors (such as chemical oxygen demand), while remaining cost-effective and affordable for all parts of the world.

Keywords
Author Keywords
Dye removal and degradationTextile dyes wastewater treatmentPhysical approachChemical degradationBiological remediation processesOperational cost analysis
Keywords Plus
ADVANCED OXIDATION PROCESSESSOLAR PHOTOELECTRO-FENTONWHITE-ROT FUNGIAZURE-B DYEMALACHITE GREENACTIVATED CARBONAQUEOUS-SOLUTIONMETHYLENE-BLUEELECTRO-FENTONREACTIVE DYES

Degradation

15-Efficient photocatalytic degradation of antibiotics using Z-scheme MIL-88 (Fe)/Ti3C2/MoO3: Mechanistic insights and toxicity assessment

---

By Li, Q (Li, Qiang) [1] ; Zhou, H (Zhou, Hao) [5] ; Li, ZH (Li, Zhiheng) [1] ; Liu, AX (Liu, Aoxiang) [1] ; Wang, E (Wang, Erpeng) [2] ; Wu, YL (Wu, Yanling) [1] ; Tang, XJ (Tang, Xiujuan) [1] ; Du, H (Du, Hao) [1] ; Jin, LM (Jin, Limin) [1] ; Zhu, HY (Zhu, Huayue) [3] ; (provided by Clarivate) **Source JOURNAL OF AZARDOUS MATERIALS Volume 486 DOI 10.1016/j.jhazmat.2024.137051 Article Number 137051 Published MAR 15 2025 Early Access JAN 2025 Indexed 2025-01-25 Document Type Article**

Abstract

Antibiotic residues cause water contamination and disrupt aquatic ecosystems. Herein, we reported the fabrication of a novel Z-scheme heterojunction, MIL-88A(Fe)/Ti3C2/MoO3 (MTO), for safe and efficient removal of antibiotics. Ti3C2 was introduced into the MIL-88A(Fe)/MoO3 (MO) heterojunction as an electronic mediator to accelerate charge separation. Consequently, the ternary MTO achieved a tetracycline (TC) degradation rate 2.5 times higher than that of MO. Notably, the MTO heterojunction maintained high TC degradation efficiency over 36 consecutive hours without significant decline. Photogenerated holes, hydroxyl radicals, and superoxide radicals synergistically led to efficient and deep mineralization of TC. Furthermore, toxicity assessments were performed using Toxicity Estimation Software Tool (T.E.S.T.), bacteria (S. aureus and E. coli) cultivation, wheat germination and cultivation. The results all confirmed the safe degradation of TC. Therefore, this study provides a promising strategy for photocatalytic removal of antibiotics and promotes sustainable water purification technologies.

Keywords

Author Keywords

AntibioticsPhotocatalysisZ -schemeEcotoxicity

Keywords Plus

ABSORPTION

دانشگاه علوم پزشکی و خدمات بهداشتی درمانی ایران
کتابخانه دانشکده بهداشت

Degradation

16-Fractional Quantum Anomalous Hall Effect in Rhombohedral Multilayer Graphene in the Moire<acute accent>less Limit

---

By Zhou, BR (Zhou, Boran) [1] ; Yang, H (Yang, Hui) [1] ; Zhang, YH (Zhang, Ya-Hui) [1] (provided by Clarivate) Source PHYSICAL REVIEW LETTERS Volume 133 Issue 20 DOI 10.1103/PhysRevLett.133.206504 Article Number 206504 Published NOV 15 2024 Indexed 2024-12-09 Document Type Article

Abstract

The standard theoretical framework for fractional quantum anomalous Hall (FQAH) effect assumes an isolated flat Chern band in the single particle level. In this Letter, we challenge this paradigm for the FQAH effect recently observed in pentalayer rhombohedrally stacked graphene aligned with hexagonal boron nitride. We show that the external moire superlattice potential is simply a perturbation in a model with continuous translation symmetry. Through Hartree-Fock calculations, we find that interaction opens a sizable remote-band gap, resulting in an isolated narrow C = 1 Chern band at filling nu = 1. From exact diagonalization we identify FQAH phases at various fillings. However, the FQAH states also exist in calculations without any external moire potential. We suggest that the quantum anomalous Hall (QAH) insulator at nu = 1 should be viewed as an interaction-driven topological Wigner crystal with QAH effect, which is subsequently pinned by a small moire potential. The C = 1 QAH crystal is robust with a crystal period around 10 nm in 4-layer, 5-layer, 6-layer, and 7-layer graphene systems. Our work suggests a new direction to explore the interplay between topology and FQAH with spontaneous crystal formation in the vanishing moire potential limit. We also propose a new system to generate and control both honeycomb and triangular moire superlattice potentials through Coulomb interaction from another control layer, which can stabilize or suppress the QAH crystal depending on the density of the control layer.

Keywords

Keywords Plus

CHERN INSULATORS

Degradation

17-In situ growth of carbon quantum dots on acid/base 3D $\mathrm{Co_2V_O4}$ nanoplates to regulate photocatalysis and peroxymonosulfate activation towards highly efficient degradation of ciprofloxacin

---

By Jiteshwaran, T (Jiteshwaran, T.) [1] ; Steffy, JP (Steffy, J. P.) [2] ; Janani, B (Janani, B.) [3] ; Syed, A (Syed, Asad) [4] ; Elgorban, AM (Elgorban, Abdallah M.) [5] ; Abid, I (Abid, Islem) [5] ; Wong, LS (Wong, Ling Shing) [6] ; Khan, SS (Khan, S. Sudheer) [2] (provided by Clarivate) Source JOURNAL OF WATER PROCESS ENGINEERING Volume 71 DOI 10.1016/j.jwpe.2025.107336 Article Number 107336 Published MAR 2025 Early Access MAR 2025 Indexed 2025-03-14 Document Type Article

Abstract

Water contamination is considered as one of the greatest threats to the aquatic and human health. In this study, we focused on the fabrication of carbon quantum dots (CQDs) deposited Co2VO4 nano-hexagon sheets for visible light driven catalysis of ciprofloxacin (CIP) surging peroxymonosulphate (PMS) activation. The prepared nanocomposite (NCs) Co2VO4 base @CQDs (CVB/CQDs) achieved an exceptionally high CIP degradation (99.4 %) in presence of PMS, as well as the prepared counterparts Co2VO4 acid @CQDs (CVA/CQDs), Co2VO4 base, and Co2VO4 acid showed an appreciable photocatalytic performance against CIP. The rate of the reaction (k) of CVB/ CQDs is 0.372 min(-1) which was 3 times greater than CVB (0.105 min(-1)) and CVA/CQDs exhibit 0.119 min(-1) which was 2.6 times greater than CVA (0.0451 min(-1)). The prepared NCs was characterized by using FE-SEM, HR-TEM, XRD, XPS, RAMAN, EIS, UV-vis DRS and PL techniques. From the scavenging and radical trapping experiments it was confirmed that the production of center dot OH and SO4 center dot- are key radicals which participated in the photocatalytic degradation of CIP. The mechanism of degradation was proposed based on the results obtained from scavenging assays and DRS. The degradation pathway was predicted based on the GC-MS results and the intermediate's toxicity was analysed using ECOSAR program. The NCs showed exceptional stability and reusability after six consecutive cycles. This current study provides a new strategy for Co2VO4 based catalysis and PMS activation as a promising candidate in water remediation and removal of contaminants from water.

Keywords
Author Keywords
CQD deposited Co2VO4 catalystPMS activationCiprofloxacinIntermediate toxicity

Keywords Plus
HYDROGEN-PRODUCTIONENHANCEMENT

Degradation

18-Stiffness degradation and mechanical behavior of microfiber-modified high-toughness recycled aggregate concrete under constant load cycling

---

By Wang, CQ (Wang, Changqing) [1] , [3] ; Liu, JY (Liu, Jinyan) [1] ; Lu, B (Lu, Bo) [1] ; Zhang, YC (Zhang, Youchao) [2] ; Ma, ZM (Ma, Zhiming) [2] (provided by Clarivate) Source ENGINEERING FRACTURE MECHANICS Volume 312 DOI 10.1016/j.engfracmech.2024.110608 Article Number 110608 Published DEC 20 2024 Early Access NOV 2024 Indexed 2024-11-23 Document Type Article

Abstract

The mechanical properties of High-Toughness Recycled Aggregate Concrete (HTRAC) were investigated in this study as an innovative and environmentally friendly construction material, along with its potential applications in structural stability. Small-scale specimens with six levels of micro-steel fiber content were made, and a series of cyclic tests with constant loads were carried out. Using In-Situ 4D CT technology, the damage characteristics of the microstructure of HTRAC and the reinforcing effects of fibers on key mechanical parameters (peak stress, peak strain, ultimate strain, post-peak modulus, and toughness indicators) were analyzed. A comprehensive fiber reinforcing factor calculation model was proposed to assess its contribution to strength, deformability, and toughness, and the correlation between the number of cyclic loadings and stiffness degradation was also quantified. it is confirmed that HTRAC exhibits a significant advantage in toughness compared to traditional recycled aggregate concrete (RAC). The findings of this study provide crucial technical support for the further development and application of HTRAC, indicating its promising prospects in the field of sustainable construction materials.

Keywords
Author Keywords
High-toughness recycled aggregate concrete(HTRAC)Constant load cyclingMechanical performance characteristicsStiffness degradationToughness indicatorsIn-situ 4D CT testing
Keywords Plus
FIBER-REINFORCED-CONCRETESTEEL-FIBERCOMPRESSIVE BEHAVIORPLAIN CONCRETEPERFORMANCE