Aqueous Solution

1-Efficient Capture and Electroreduction of Dilute CO_2 into Highly Pure and Concentrated Formic Acid Aqueous Solution

---

By Zhao, ZH (Zhao, Zhen-Hua) [1] ; Huang, JR (Huang, Jia-Run) [1] ; Huang, DS (Huang, Da-Shuai) [1] ; Zhu, HL (Zhu, Hao-Lin) [1] ; Liao, PQ (Liao, Pei-Qin) [1] ; Chen, XM (Chen, Xiao-Ming) [1] , [2] (provided by Clarivate) Source JOURNAL OF THE AMERICAN CHEMICAL SOCIETY Volume 146 Issue 20 Page 14349-14356 DOI 10.1021/jacs.4c04841 Published MAY 14 2024 Early Access MAY 2024 Indexed 2024-05-25 Document Type Article

Abstract

High-purity CO2 rather than dilute CO2 (15 vol %, CO2/N-2/O-2 = 15:80:5, v/v/v) similar to the flue gas is currently used as the feedstock for the electroreduction of CO2, and the liquid products are usually mixed up with the cathode electrolyte, resulting in high product separation costs. In this work, we showed that a microporous conductive Bi-based metal-organic framework (Bi-HHTP, HHTP = 2,3,6,7,10,11-hexahydroxytriphenylene) can not only efficiently capture CO2 from the dilute CO2 under high humidity but also catalyze the electroreduction of the adsorbed CO2 into formic acid with a high current density of 80 mA cm(-2) and a Faradaic efficiency of 90% at a very low cell voltage of 2.6 V. Importantly, the performance in a dilute CO2 atmosphere was close to that under a high-purity CO2 atmosphere. This is the first catalyst that can maintain exceptional eCO(2)RR performance in the presence of both O-2 and N-2. Moreover, by using dilute CO2 as the feedstock, a 1 cm(-2) working electrode coating with Bi-HHTP can continuously produce a 200 mM formic acid aqueous solution with a relative purity of 100% for at least 30 h in a membrane electrode assembly (MEA) electrolyzer. The product does not contain electrolytes, and such a highly concentrated and pure formic acid aqueous solution can be directly used as an electrolyte for formic acid fuel cells. Comprehensive studies revealed that such a high performance might be ascribed to the CO2 capture ability of the micropores on Bi-HHTP and the lower Gibbs free energy of formation of the key intermediate *OCHO on the open Bi sites.

Keywords

Keywords Plus

ELECTROCATALYTIC REDUCTIONCONVERSIONMOFS

Aqueous Solution

2-Continuously Producing Highly Concentrated and Pure Acetic Acid Aqueous Solution via Direct Electroreduction of CO_2

By Zhu, HL (Zhu, Hao-Lin) [1] ; Huang, JR (Huang, Jia-Run) [1] ; Zhang, MD (Zhang, Meng-Di) [1] ; Yu, C (Yu, Can) [2] ; Liao, PQ (Liao, Pei-Qin) [1] ; Chen, XM (Chen, Xiao-Ming) [1] , [3] (provided by Clarivate) SourceJOURNAL OF THE AMERICAN CHEMICAL SOCIETY Volume 146 Issue 1 Page 1144-1152 DOI 10.1021/jacs.3c12423 Published JAN 2 2024 Indexed 2024-01-22 Document Type Article

Abstract

It is crucial to achieve continuous production of highly concentrated and pure C-2 chemicals through the electrochemical CO2 reduction reaction (eCO(2)RR) for artificial carbon cycling, yet it has remained unattainable until now. Despite one-pot tandem catalysis (dividing the eCO(2)RR to C-2 into two catalytical reactions of CO2 to CO and CO to C-2) offering the potential for significantly enhancing reaction efficiency, its mechanism remains unclear and its performance is unsatisfactory. Herein, we selected different CO2-to-CO catalysts and CO-to-acetate catalysts to construct several tandem catalytic systems for the eCO(2)RR to acetic acid. Among them, a tandem catalytic system comprising a covalent organic framework (PcNi-DMTP) and a metal-organic framework (MAF-2) as CO2-to-CO and CO-to-acetate catalysts, respectively, exhibited a faradaic efficiency of 51.2% with a current density of 410 mA cm(-2) and an ultrahigh acetate yield rate of 2.72 mmol m(-2) s(-1) under neutral conditions. After electrolysis for 200 h, 1 cm(-2) working electrode can continuously produce 20 mM acetic acid aqueous solution with a relative purity of 95+%. Comprehensive studies revealed that the performance of tandem catalysts is influenced not only by the CO supply-demand relationship and electron competition between the two catalytic processes in the one-pot tandem system but also by the performance of the CO-to-C-2 catalyst under diluted CO conditions.

Keywords
Keywords Plus
EFFICIENT ELECTROCHEMICAL REDUCTIONFRAMEWORKACETATE

Aqueous Solution

3-Zwitterionic Cellulose-Based Polymer Electrolyte Enabled by Aqueous Solution Casting for High-Performance Solid-State Batteries

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By Cheng, Y (Cheng, Yong) [1] ; Cai, ZC (Cai, Zhichao) [1] ; Xu, JL (Xu, Jinglei) [1] ; Sun, ZF (Sun, Zhefei) [1] ; Wu, XY (Wu, Xiaoyu) [1] ; Han, JJ (Han, Jiajia) [1] ; Wang, YH (Wang, Yao-Hui) [1] ; Wang, MS (Wang, Ming-Sheng) [1] (provided by Clarivate) Source ANGEWANDTE CHEMIE-INTERNATIONAL EDITION Volume 63 Issue 30 DOI 10.1002/anie.202400477 Published JUL 22 2024 Early Access JUN 2024 Indexed 2024-06-24 Document Type Article

Abstract

Polyethylene oxide (PEO)-based solid-state batteries hold great promise as the next-generation batteries with high energy density and high safety. However, PEO-based electrolytes encounter certain limitations, including inferior ionic conductivity, low Li+ transference number, and poor mechanical strength. Herein, we aim to simultaneously address these issues by utilizing one-dimensional zwitterionic cellulose nanofiber (ZCNF) as fillers for PEO-based electrolytes using a simple aqueous solution casting method. Multiple characterizations and theoretical calculations demonstrate that the unique zwitterionic structure imparts ZCNF with various functions, such as disrupting PEO crystallization, dissociating lithium salts, anchoring anions through cationic groups, accelerating Li+ migration by anionic groups, as well as its inherent reinforcement effect. As a result, the prepared PL-ZCNF electrolyte exhibits remarkable ionic conductivity (5.37x10(-4) S cm(-1)) and Li+ transference number (0.62) at 60 degrees C without sacrificing mechanical strength (9.2 MPa), together with high critical current density of 1.1 mA cm(-2). Attributed to these merits of PL-ZCNF, the LiFePO4|PL-ZCNF|Li solid-state full-cell delivers exceptional rate capability and cycling performance (900 cycles at 5 C). Notably, the assembled pouch-cell can maintain steady operation over 1000 cycles with an impressive 93.7 % capacity retention at 0.5 C and 60 degrees C, highlighting the great potential of PL-ZCNF for practical applications.

Keywords
Author Keywords
Solid-state BatteriesSolid-state Polymer ElectrolyteZwitterionic CelluloseLi+ ConductivityMechanical Strength
Keywords Plus
NANOFIBRILS

Aqueous Solution

4-Preparation of amidoxime modified covalent organic framework for efficient adsorption of lead ions in aqueous solution

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By Xiang, DW (Xiang, Dawei) [1] , [2] ; Zhu, R (Zhu, Rong) [1] , [2] ; Chen, YF (Chen, Yuefeng) [1] , [2] ; Zhu, MY (Zhu, Manying) [1] , [2] ; Wang, SX (Wang, Shixing) [1] , [2] ; Wu, YH (Wu, Yihui) [1] , [2] ; Luo, JX (Luo, Jiaxin) [1] , [2] ; Fu, LK (Fu, Likang) [1] , [2] (provided by Clarivate)

Source CHEMICAL ENGINEERING JOURNAL Volume 492 DOI 10.1016/j.cej.2024.152292
Article Number 152292 Published JUL 15 2024 Early Access MAY 2024 Indexed 2024-08-20 Document Type Article

Abstract

Lead ion is one of the most common heavy metal contaminants for human health. Therefore, it is necessary to develop the efficient and selective adsorbents to remove lead ions in wastewater. Here, an amidoximated covalent organic framework was designed as adsorbent (COF-NHOH) for the removal of lead ions from aqueous solutions. The adsorption properties were studied by batch adsorption. The adsorption process is quickly completed in just 30 min. The highest adsorption capacity of the COF-NHOH is 368.68 mg/g at 298 K, which is much higher than that of JUC-500. Kinetic, isotherm and thermodynamic results show that the adsorption process is a spontaneous monolayer chemical adsorption process. The adsorbent removes selectively lead ions from a complex multi-ion environment. Moreover, the adsorption ability of the adsorbent decreased by only 14.05 % after five cycle experiments. COF-NHOH exhibits excellent anti-interference ability and reusability. Finally, COF-NHOH achieves efficient removal of lead ions through chelation and electrostatic action based on DFT calculations and others. In conclusion, the adsorbent showed excellent application for the removal of lead ions from aqueous solutions.

Keywords
Author Keywords
Covalent organic frameworksDensity functional theoryAdsorptionLead ions
Keywords Plus
REMOVALPB(II)PB2+

Aqueous Solution

5-Efficient Removal of Cr (VI) and As (V) from Aqueous Solution Using Magnetically Separable Nickel Ferrite Nanoparticles

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By Hassan, AA (Hassan, Ahmed Anwar) [1] ; Fahim, YA (Fahim, Yosri A.) [2] ; Ali, MEM (Ali, Mohamed Eid M.) [3] (provided by Clarivate) Source JOURNAL OF CLUSTER SCIENCE Volume 36 Issue 1 DOI 10.1007/s10876-024-02736-4 Article Number 4 Published FEB 2025 Indexed 2024-12-21 Document Type Article

Abstract

A promising nickel ferrite ($NiFe_2O_4$) NPs with excellent magnetic characteristics was synthesized using an aqueous-based reflux approach that eliminates the need for calcination temperature. The magnetic nanoparticles obtained were analysed using X-ray diffraction (XRD), Fourier-transform infrared (FTIR), and scanning electron microscopy (SEM). The analysis showed that synthesized nickel ferrite had a spherical shape with an average size ranging from 18 to 29 nm. The synthesized nickel ferrite is utilized for the removal of hexavalent chromium (Cr (VI)) and pentavalent arsenic (As (V)) ions from aqueous solution through adsorption method. The removal of Cr (VI) ions achieved a maximum efficiency of 65% after 120 minutes at a pH of 5, with a ferrite dose of 2 g/L and a concentration of Cr (VI) ions of 25 mg/L. while the removal of As (V) at a pH of 5, with a dose of 1 g/L of ferrite and an initial concentration of 25 mg/L of As (V) ions was 77% after 120 minutes. In addition, the data obtained from the isotherms of Langmuir (R^2 = 0.99, 0.98), Freundlich (R^2 = 0.86, 0.97) and Temkin (R^2 = 0.83, 0.97). The adsorption of Cr (VI) ions is governed by a pseudo first-order kinetics process, whereas the adsorption of As (V) ions is governed by a pseudo second-order kinetics reaction. After five adsorption-desorption cycles at the same optimal operating condition, Cr (VI) and As (V) removal efficiency dropped from 65%, 77% to 25%, 30%, respectively.

Keywords

Author Keywords

Nickel ferriteHexavalent chromiumPentavalent arsenicAdsorptionWastewater treatment

Keywords Plus

HEXAVALENT CHROMIUMWASTE-WATERFENTON-LIKEADSORPTIONADSORBENTCHITOSANISOTHERMOPTIMIZATIONDEGRADATIONMETALS

Aqueous Solution

6-Perylenedioic Acid-Derived Carbon Dots with Near 100% Quantum Yield in Aqueous Solution for Lasing and Lighting

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By Liu, YP (Liu, Yupeng) [1] ; Wang, BZ (Wang, Bingzhe) [1] ; Zhang, YS (Zhang, Yunsen) [2] , [3] ; Guo, J (Guo, Jia) [1] ; Wu, XY (Wu, Xiaoyi) [4] ; Ouyang, DF (Ouyang, Defang) [2] , [3] ; Chen, S (Chen, Shi) [1] ; Chen, YQ (Chen, Yeqing) [4] ; Wang, SP (Wang, Shuangpeng) [1] ; Xing, GC (Xing, Guichuan) [1] ; (provided by Clarivate) Source ADVANCED FUNCTIONAL MATERIALS Volume 34 Issue 36 DOI 10.1002/adfm.202401353 Article Number 2401353 Published SEP 2024 Early Access MAR 2024 Indexed 2024-03-13 Document Type Article

Abstract

Carbon dots (CDs) are a burgeoning star of luminescent carbon-based nanomaterials with emerging interest for various applications. Luminescence from the sp2-conjugated domains in the carbon cores is considered to be the intrinsic bandgap emission of CDs, whereas the relationship between them remains poorly understood. Simultaneously, the solvent relaxation of water molecules will quench the fluorescence of CDs, thus, obtaining strong luminescence from CDs aqueous solutions remains a great challenge. Herein, a facile one-step spatial-confined cross-condensation method that uses a heat-induced self-foaming process in ambient pressure has been developed to synthesize highly luminescent CDs with unprecedented photoluminescence quantum yield (PLQY) over 97.2% in water. The unique precursor-derived cross-arranged perylene skeleton in the cores hinders pi-pi stacking, while the hydrophobicity of the conjugated units mitigates solvent relaxation by water molecules, resulting in near-unity PLQY in aqueous solutions, enabling this to demonstrate the first optically pumped green lasing emission in the CDs aqueous solution. Moreover, a biomaterial-based white light emitting diode is fabricated using the CDs-stained silks as a fluorescence conversion cover to realize a high luminous efficiency of 60.7 lm W-1 with CIE color coordinate of (0.33, 0.35).
Carbon dots (CDs) with cross-arranged perylene-derived segments are prepared through a muffin-inspired thermal-induced self-foaming method, resulting in a approximate to 100% photoluminescence quantum yield (PLQY) in water. Unprecedented aqueous-based lasering is realized from the CDs aqueous solution. Furthermore, high-brightness biomaterial-based white LEDs are fabricated utilizing CDs-stained silk fibers.
image

Keywords

Author Keywords
aqueous-based lasercarbon dotscross-condensationnear-unity PLQYwhite LEDs
Keywords Plus
MECHANISMEMISSION

Aqueous Solution

7-Adsorptive removal of synthetic dye from its aqueous solution by using chitosan-bentonite composite: DFT and experimental studies

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By Senol, ZM (Senol, Zeynep Mine) [1] ; Ertap, H (Ertap, Huseyin) [2] ; Fernine, Y (Fernine, Yasmine) [3] ; El Messaoudi, N (El Messaoudi, Noureddine) [4] (provided by Clarivate) **Source POLYMER BULLETIN Volume 81 Issue 14 Page 12795-12817 DOI 10.1007/s00289-024-05323-9 Published SEP 2024 Early Access MAY 2024 Indexed 2024-06-05 Document Type Article**

Abstract

This research investigates the adsorption efficiency of a chitosan-bentonite (Ch-B) composite in removing methyl orange (MO), a common textile dye, from aqueous solutions. The study integrates experimental and theoretical analyses, employing density functional theory (DFT) to gain insights into the molecular interactions between the composite material and MO molecules. The Ch-B composite was characterized using various techniques, including FT-IR spectroscopy, XRD, and SEM-EDX. The experimental results indicate that the Ch-B composite exhibits a high adsorption capacity for MO, with optimal conditions identified for efficient removal. The Langmuir model was found to best fit the experimental data and the adsorption capacity was 117 mg g-1. Adsorption thermodynamics showed that the adsorption process was spontaneous, feasible, and exothermic. DFT calculation results are correlated with experimental findings to confirm theoretical predictions and improve the overall understanding of the adsorption process. Electronic structure calculations reveal the nature of the interactions between the Ch-B composite and MO molecules, including hydrogen bonds and electrostatic forces.

Keywords
Author Keywords
ChitosanBentoniteComposite beadsMO adsorptionDFT calculationWastewater treatment
Keywords Plus
METHYL-ORANGE DYEEFFICIENT ADSORPTIONKINETICSADSORBENTFTIRISOTHERMCARBON

Aqueous Solution

8-Tuning oxygen vacancy and missing linkers of defective MOF-808 for advanced adsorption of Yb(III) from aqueous solution

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By Sun, CY (Sun, Chengyu) [1] ; Ji, YH (Ji, Yihao) [1] ; Bi, KC (Bi, Kaicheng) [1] ; Tian, HP (Tian, Haipeng) [1] ; Wang, CD (Wang, Chundong) [2] ; Deng, FL (Deng, Fuli) [1] ; Zhang, Y (Zhang, Yi) [1]

(provided by Clarivate) Source SEPARATION AND PURIFICATION TECHNOLOGY Volume 347
DOI 10.1016/j.seppur.2024.127585 Article Number 127585 Published NOV 11 2024 Early Access
APR 2024 Indexed 2024-06-05 Document Type Article

Abstract

To improve the adsorption performance of rare earth elements by metal organic frameworks (MOFs) based adsorbents from aqueous solution, two kinds of defective MOF-808 with abundant oxygen vacancies are fabricated via the different strategies, and named as MOF-808-DLX and MOF-808-DSX, respectively. The as-prepared defective MOF-808 were characterized by X-ray diffraction (XRD), infrared spectrometer (IR), thermogravimetric analyzer (TGA), electron paramagnetic resonances (EPR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM), confirming the crystal structures, the morphologies, the presences of oxygen vacancies and missing-linker defects. In addition, the adsorption kinetics, adsorption isotherms, and the effects of pH, different rare earth ions on adsorption performance, as well as the cyclic stability of two typical defective MOF-808 were carefully investigated. The results showed that MOF-808-DL1 and MOF-808-DS2 exhibited much higher adsorption capacities than the corresponding pristine MOF-808 at 30 degrees C and pH = 6. Furthermore, the adsorption mechanisms were clarified through energy dispersive spectroscopy (EDS), X-ray photoelectron spectroscopy (XPS), Zeta potential, and density functional theory (DFT) calculations, verifying the complexation interaction between Yb(III) and oxygen vacancies originated from Zr6 clusters both for MOF-808-DLX and MOF808-DSX. Meanwhile, the electrostatics attraction also contributed to the adsorption of Yb(III) for MOF-808-DSX. In summary, this work provides two feasible strategies for manufacturing MOF-808 with missing-linkers defects to promote their potential applications in adsorbing Yb(III) from aqueous solutions.

Keywords
Author Keywords
Defect engineeringRare earthAdsorptionMechanism analysis
Keywords Plus
METAL-ORGANIC FRAMEWORKSRARE-EARTH-ELEMENTSEFFICIENTRECOVERYREMOVALWATERNANOPARTICLESPERFORMANCESORPTIONUIO-66

Aqueous Solution

9-Enhanced removal efficiency of Cd2+ and Pb2+ from aqueous solution by H3PO4-modified tea branch biochar: Characterization, adsorption and mechanism

---

By Xu, HJ (Xu, Haojie) [1] ; Zhou, Q (Zhou, Qi) [1] ; Yan, TY (Yan, Tengyu) [1] ; Jia, XW (Jia, Xiangwei) [1] ; Lu, DD (Lu, Dandan) [1] ; Ren, YF (Ren, Yanfang) [1] ; He, JY (He, Junyu) [1]

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Abstract

Biochar has been widely recognized as an environmentally efficient adsorbent for removal of heavy metals in wastewater. However, inferior adsorption capacity limits its practical application. In this study, a H3PO4-modified tea branch biochar (PTBB) was firstly prepared through the one step pyrolysis of H3PO4-pre- treated tea branch powder for enhancing removal efficiency of Cd2+ and Pb2+ from aqueous solutions. H3PO4 modification altered the physicochemical properties of pristine biochar. The PTBB exhibited superior adsorption performance. Its maximum adsorption capacities of Cd2+ and Pb2+ were 98.25 mg g-1 and 127.5 mg g-1 at the pH 6 and dosage of 2 g L-1, which was 1.5 and 1.3 folds of the pristine biochar, respectively. Cd2+ and Pb2+ adsorption data by PTBB were well fitted by the Langmuir isothermal and pseudo -second order kinetic models, indicating monolayer chemical adsorption controlled the adsorption process. The adsorption of Cd2+ and Pb2+ by PTBB was a spontaneous endothermic process and less affected by coexisting cations. PTBB demonstrated a greater affinity for Pb2+ as compared with Cd2+ in binary metal systems. Moreover, PTBB could maintain good stability and regeneration properties. The adsorption of Cd2+ and Pb2+ by PTBB was attributed to cation exchange, precipitation, complexation, and pi electron interactions. The quantitative analysis indicated that complexation and precipitation were the primary adsorption mechanisms, which accounted for 50.52-50.56% and 36.7-42.18% to total Cd2+ and Pb2+ adsorption for PTBB, respectively. Therefore, PTBB exhibits great potential for application in the remediation of wastewater containing Cd2+ or Pb2+.

Keywords
Author Keywords
H 3 PO 4 modifiedBiocharAdsorptionMechanismsCd2+Pb2+
Keywords Plus
CADMIUMCD(II)LEADTEMPERATUREPERFORMANCEBIOSORPTIONPYROLYSISCU(II)CR(VI)PB(II)

Aqueous Solution

10-Simultaneous degradation of methyl orange and indigo carmine dyes from an aqueous solution using nanostructured WO 3 and CuO supported on Zeolite 4A

By Foroughi, M (Foroughi, Mahsa) [1] ; Peighambardoust, SJ (Peighambardoust, Seyed Jamaleddin) [1] ; Ramavandi, B (Ramavandi, Bahman) [2] ; Foroutan, R (Foroutan, Rauf) [1] ; Peighambardoust, NS (Peighambardoust, Naeimeh Sadat) [3] (provided by Clarivate)

Source SEPARATION AND PURIFICATION TECHNOLOGY Volume 344 DOI 10.1016/j.seppur.2024.127265 Article Number 127265 Published SEP 20 2024 Early Access APR 2024 Indexed 2024-05-19 Document Type Article

Abstract

In this study, a novel composite catalyst system, Zeolite 4A/WO 3 /CuO with a Z-scheme design, was synthesized for photocatalysis, sonocatalysis, and sono-photocatalysis methyl orange (MO) and indigo carmine (IC) dyes simultaneously. The properties of the Zeolite 4A/WO 3 /CuO composite were thoroughly investigated using various techniques, and the results confirmed the synthesis of the desired catalyst system. In the sonophotocatalytic process, using the Zeolite 4A/WO 3 /CuO composite, the maximum efficiency for MO (99.12 %) and IC (97.24 %) was achieved at pH of 2 and 3, with a catalyst dosage of 0.15 g/L, a dye concentration of 10 mg/L, a contact time of 25 min, and H 2 O 2 dosage of 30 mu L/100 mL. The dye elimination efficiency using the sono-photocatalytic process was reduced in the presence of Cl - and PO 4 3- in the distilled water. The efficiency also declined in the medium of river and well water resources. Moreover, the Zeolite 4A/WO 3 /CuO catalyst maintained over 90 % of its performance even after five reuse cycles. Based on the kinetic study, the sonophotocatalytic process exhibited higher activation for the removal of MO (k: 0.1946 min -1 and t 1/2 : 3.561) and IC (k: 0.1433 min -1 and t 1/2 : 4.836) than other processes. The synergy values for the MO and IC degradation using the Zeolite 4A/WO 3 /CuO composite were determined to be 2.167 and 2.303, respectively. The impact of various scavengers demonstrated that in the degradation processes of the target dyes using the sonophotocatalytic process, different active species like OH center dot , e - , h + , and O 2 -center dot are involved. The purification of dyeladen water using the sono-photocatalytic process was not toxic for plant germination, microorganisms, and fish, highlighting the successful biocompatibility of the process for dye removal.

Keywords
Author Keywords
Sono-photocatalytic processScavengerAqueous solutionUltrasonicZeoliteDye
Keywords Plus
LIGHT PHOTOCATALYTIC ACTIVITYSONOPHOTOCATALYTIC DEGRADATIONCATALYTIC DEGRADATIONHYDROGEN-PRODUCTIONORGANIC-DYESSURFACENANOPARTICLESPRECIPITATIONOPTIMIZATIONBLUE

Aqueous Solution

11-Construction of S-scheme CuFe$_{12}$O$_{19}$/CuS green nanocomposite for effective photocatalytic degradation of tetracycline from aqueous solution: mechanism, recyclability, and kinetic study

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By Barkhor, H (Barkhor, Hajar) [1] ; Nasseri, MA (Nasseri, Mohammad Ali) [1] ; Amarzadeh, A (Amarzadeh, Alireza) [2] ; Nateq, K (Nateq, Kasra) [3] ; Ramavandi, B (Ramavandi, Bahman) [4] ; Nasseh, N (Nasseh, Negin) [5] (provided by Clarivate) Source APPLIED WATER SCIENCE Volume 15 Issue 2 DOI 10.1007/s13201-024-02346-5 Article Number 17 Published FEB 2025 Indexed 2025-01-15 Document Type Article

Abstract

This research was designed to evaluate the performance of the CuFe12O19/CuS/Xenon system in the degradation of tetracycline in aqueous solutions. In this study, after green synthesis of nanocomposite using the extract of the Artemisia plant, its properties were determined by XRD, FTIR, FESEM, TEM, BET, XPS, DRS, DLS, EDS, VSM, and PL. In addition, parameters affecting the photocatalytic degradation of tetracycline, including time, pH, TC initial concentration, and nanocomposite dose, were assessed. The findings showed that the degradation efficiency increases with increasing pH and catalyst dosage. Under optimum circumstances (pH = 9, nanocomposite dose of 0.5 g/L, and time 200 min), the process efficiency with concentration of 20 mg/L was 100%. The kinetics of the degradation rate of tetracycline obeyed the pseudo-first-order equation. In addition, the results show that after six consecutive cycles, the synthesized catalyst's ability did not significantly reduce. The results of the mineralization tests revealed that the COD and TOC degradation of the synthetic solution of tetracycline with a concentration of 20 mg/L reached 87.25% and 73.06%, respectively, in the optimal reaction conditions. The scavenger experiments confirmed that OH plays the most crucial role in the decomposition process of tetracycline. Generally, the CuFe12O19/CuS/Xenon photocatalytic system can effectively degradation tetracycline from aqueous environments.

Keywords
Author Keywords
Green synthesisCuFe12O19/CuS magnetic nanocompositePhotocatalytic degradationTetracyclineXenon
Keywords Plus
FACILE SYNTHESISNANOPARTICLESOPTIMIZATIONFABRICATIONADSORPTION

Aqueous Solution

12-Efficient adsorptive removal of industrial dye from aqueous solution by synthesized zeolitic imidazolate framework-8 loaded date seed activated carbon and statistical physics modeling

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By Al-Hazmi, GAA (Al-Hazmi, Gamil A. A.) [1] , [2] ; El-Bindary, MA (El-Bindary, Mohamed A.) [3] ; El-Desouky, MG (El-Desouky, Mohamed G.) [4] ; El-Bindary, AA (El-Bindary, Ashraf A.) [5]

(provided by Clarivate) Source DESALINATION AND WATER TREATMENT Volume 258
Page 85-103 DOI 10.5004/dwt.2022.28397 Published MAY 2022 Early Access OCT 2024 Indexed
2022-12-14 Document Type Article

Abstract

New adsorbents of DSAC@ZIF-8 (0.05:0.6) and DSAC@ZIF-8 (0.05:0.6) were prepared using date seed activated carbon (DSAC) loaded at zeolitic imidazolate framework-8 (ZIF-8). The obtained adsorbents DSAC@ZIF-8 (0.05:0.6) and DSAC@ZIF-8 (0.1:0.6) were characterized by Fourier-transform infrared spectroscopy, scanning electron microscopy, powder X-ray diffraction, nitrogen adsorption/desorption tests at 77 K revealed the surface area to be 460.23 m(2)/g for DSAC@ZIF-8 (0.1:0.6). This material showed a high affinity for Gentian violet (GV) uptake from aqueous solutions: the maximum sorption capacity reached 638.99 mg/g at pH 9.0 and ambient temperature. Uptake kinetics and sorption isotherms were obtained and modelled using conventional and simple equations: the best results were respectively obtained with the pseudo-second-order rate equation and the Langmuir equation. The activation energy of absorption also was measured to be 15.87 kJ/mol, showing that the process of chemisorption is included. The distribution coefficient was obtained at different temperatures and the thermodynamic parameters have been calculated: the sorption is endothermic, spontaneous (especially at high relative temperature), and contributes to increasing the entropy (randomness) of the system. HCl (1.0 M) was used for GV desorption from DSAC@ZIF-8, and the sorbent could be efficiently recycled for a minimum of three sorption/desorption cycles. Therefore, sorbent could serve as a promising adsorbent for GV removal from industrial wastewater.

Keywords
Author Keywords
DSAC@ZIF-8Adsorption isothermThermodynamicsGentian violetStatistical physics modeling
Keywords Plus
METAL-ORGANIC FRAMEWORKCRYSTAL VIOLETWASTE-WATERMOLECULAR DOCKINGMETHYLENE-BLUECONGO REDEQUILIBRIUMISOTHERMSORPTIONNANOCOMPOSITE

Aqueous Solution

13-Rapid discrimination and ratio quantification of mixed antibiotics in aqueous solution through integrative analysis of SERS spectra via CNN combined with NN-EN model

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By Yuan, Q (Yuan, Quan) [1] , [2] ; Yao, LF (Yao, Lin-Fei) [2] ; Tang, JW (Tang, Jia-Wei) [1] ; Ma, ZW (Ma, Zhang-Wen) [3] ; Mou, JY (Mou, Jing-Yi) [4] ; Wen, XR (Wen, Xin-Ru) [1] , [2] ; Usman, M (Usman, Muhammad) [2] ; Wu, X (Wu, Xiang) [2] ; Wang, L (Wang, Liang) [1] (provided by Clarivate) Source
JOURNAL OF ADVANCED RESEARCH Volume 69 Page 61-74 DOI 10.1016/j.jare.2024.03.016
Published MAR 2025 Early Access MAR 2025 Indexed 2025-03-16 Document Type Article

Abstract

Introduction: Abusing antibiotic residues in the natural environment has become a severe public health and ecological environmental problem. The side effects of its biochemical and physiological consequences are severe. To avoid antibiotic contamination in water, implementing universal and rapid antibiotic residue detection technology is critical to maintaining antibiotic safety in aquatic environments. Surface-enhanced Raman spectroscopy (SERS) provides a powerful tool for identifying small molecular components with high sensitivity and selectivity. However, it remains a challenge to identify pure antibiotics from SERS spectra due to coexisting components in the mixture. Objectives: In this study, an intelligent analysis model for the SERS spectrum based on a deep learning algorithm was proposed for rapid identification of the antibiotic components in the mixture and quantitative determination of the ratios of these components. Methods: We established a water environment system containing three antibiotic residues of ciprofloxacin, doxycycline, and levofloxacin. To facilitate qualitative and quantitative analysis of the SERS spectra antibiotic mixture datasets, we developed a computational framework integrating a convolutional neural network (CNN) and a non-negative elastic network (NN-EN) method. Results: The experimental results demonstrate that the CNN model has a recognition accuracy of 98.68%, and the interpretation analysis of Shapley Additive exPlanations (SHAP) shows that our model can specifically focus on the characteristic peak distribution. In contrast, the NN-EN model can accurately quantify each component's ratio in the mixture. Conclusion: Integrating the SERS technique assisted by the CNN combined with the NN-EN model exhibits great potential for rapid identification and high-precision quantification of antibiotic residues in aquatic environments. (c) 2024 The Authors. Published by Elsevier B.V. on behalf of Cairo University. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords
Author Keywords
Surface-enhanced Raman spectroscopyMachine learning algorithmConvolutional neural networkAqueous solutionMixed antibiotics
Keywords Plus
RAMAN-SPECTROSCOPYSURFACE

Aqueous Solution

14-Effective adsorption and removal of industrial dye from aqueous solution using mesoporous zinc oxide nanoparticles via metal organic frame work: equilibrium, kinetics and thermodynamic studies

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Abstract

Pollution industrial dyes is a serious environmental issue and successful purifying has thus far proven to be a difficult task. Therefore, in study, environmentally safe zinc oxide nanoparticles were synthesized through calcination of zeolitic imidazolate framework 7 at various temperatures for calcination 450 degrees C, 550 degrees C and 650 degrees C. The elimination of Congo red (CR) in wastewater samples was tested with good adsorption capability. Adsorption of CR using ZnO from aqueous solution. Scanning electron microscopy, Fourier-transform infrared spectroscopy, X- ray diffraction and the surface area and pore volume of ZnO were discovered during Brunauer-Emmett-Teller testing at 77 K to be 119.12 m(2).g(-1) and the total pore volume was 0.362 cm(3).g(-1). Adsorption at pH 3 was found the best for CR. Initial concentration and dosage, resulting in microporous surfaces that have a high potential to interact with and absorb CR. Adsorption tests demonstrated that ZnO had a good capability for removing CR (975 mg.g(-1)). However, after numerous reuse cycles, this performance was remained. The findings of the adsorption experiments demonstrated that the Langmuir equation for the adsorption isotherm and the pseudo-second-order model of the adsorption kinetics were compatible. Adsorption's activation energy was also found to be 24.7 kJ.mol(-1), demonstrating that chemisorption process. The adsorption process was calculated, and it was shown to be both endothermic and spontaneous also determine thermodynamic parameter Delta G degrees, Delta H degrees and Delta S degrees. The mesoporous ZnO adsorbent proved to be a simple and effective water purification. ZnO material has shown promise in the process of removing CR from aqueous solution.

Keywords
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Zinc oxide nanospheresAdsorption isothermThermodynamic parametersAdsorption kinetics
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REACTIVE BLACK 5CONGO RED-DYEANIONIC DYESMOLECULAR DOCKINGEFFICIENT REMOVALCARBON-DIOXIDEIRON-OXIDEGREENSEQUESTRATIONCONTAMINANTS

Aqueous Solution

15-Adsorption of food dyes from aqueous solution on a sweet potato residue-derived carbonaceous adsorbent: Analytical interpretation of adsorption mechanisms via adsorbent characterization and statistical physics modeling

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Abstract

The adsorption of three food dyes, namely allura red AC, carmine and tartrazine, on a sweet potato residuederived activated carbon (SPAC) was analyzed via experimental and theoretical tools. In a first step, SPAC was characterized by BET, FTIR and XRD to unravel its textural and surface properties. Adsorption isotherms of the three dyes were obtained at different temperatures ranging from 30 to 50 degrees C. Classical models were first applied to model the adsorption isotherms, but they were unable to describe the adsorption mechanisms. An alternative approach based on the application of mono- and multi -layer models from statistical physics theory was then used to better investigate the adsorption mechanisms. This alternative approach indicated that carmine and allura red AC adsorption followed a monolayer behavior, whereas the adsorption of tartrazine was a multilayer process. These dyes were adsorbed via different configurations (horizontal, non -horizontal, horizontal and non -horizontal at the same time), depending on the system and the temperature. Tartrazine dye was removed via an aggregation process at different temperatures, while carmine was aggregated only at high temperatures. This aggregation process was absent for the allura red AC adsorption. Endothermic physisorption processes was observed for dye adsorption under these experimental conditions. The theoretical analysis indicated that SPAC is a promising material for the removal of these dyes, particularly in the case of allura red AC dye molecule. Overall, this study reports a combination of experimental and theoretical results to provide a new perspective at the molecular level of the removal of dye molecules using a low-cost activated carbon.

Keywords
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