A Facile Synthesis of α -Fe₂O₃/Carbon Nanotubes and Their Photocatalytic and Electrochemical Sensing Performances

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doi: 10.20964/2019.01.09

Received: 5 October 2018 / Accepted: 31 October 2018 / Published: 30 November 2018

This study reports a simple process for synthesizing efficient photocatalyst based on mesoporous carbon nanotubes (CNT)- α -Fe₂O₃ nanohybrids at different CNT contents as well as their photocatalytic performance under visible light illumination. TEM image of CNT- α -Fe₂O₃ nanohybrid exhibited that Fe₂O₃ nanoparticles are well distributed homogeneously in the CNT surface with size of <10 nm and lattice fringes were obviously assigned with a spacing of 0.252 nm, conforming to the (110) planes of α -Fe₂O₃. The prepared mesoporous CNT- α -Fe₂O₃ nanohybrids act as efficient and reusable photocatalysts for the photocatalytic oxidation of Bismarck Brown R (BBR) Dye. The total removal efficiency was boosted from 83 to 98% with the increase of CNT contents from 0 to 50%. The decolorization rate of BBR dye over 50% CNT- α -Fe₂O₃ nanohybrid is greater by almost 35 times than that of the pure mesoporous Fe₂O₃. The superior photocatalytic performance of mesoporous CNT- α -Fe₂O₃ nanohybrids over mesoporous α -Fe₂O₃ is mainly owing to the synergistic effect and effective retard electron-hole recombination at the CNT/Fe₂O₃ interfaces. The high photocatalytic performance and easily recyclable of CNT- α -Fe₂O₃ nanohybrids come to be promising photocatalyst and adsorbent for industrial and domestic wastewater treatment. Furthermore, the optimal sample of 50% CNT- α -Fe₂O₃ modified glassy carbon electrode (GCE) was examined to the electrochemical detection and determination of phenyl-hydrazine. The sensor electrode exhibited outstanding sensitivity of 1081 $\mu\text{AmM}^{-1}\text{cm}^{-2}$ within a linear dynamic range from 10 μM to 1 mM with a correlation coefficient $R^2 = 0.9995$ and a low limit of detection (LOD) 6.25 μM .

Keywords: CNT- α -Fe₂O₃; Nanohybrids; Electrochemical sensing; Photocatalyst; Photodegradation

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