Photoelectrochemical Degradation of 4-Nitrophenol using CuO-ZnO/exfoliated graphite Nanocomposite Electrode

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There has been a focused attention on the degradation of phenol and its nitro derivatives in industrial wastewater prior to its discharge into the environment due to the carcinogenic potential of these pollutants on biota. Hence, this study focused on the application of photoelectrochemical technique in the degradation of 4-Nitrophenol from simulated wastewater by using synergistic photoactive material (CuO-ZnO) combined with exfoliated graphite (EG) through co-precipitation method. The experiment was performed using EG, CuO-ZnO and EG/CuO-ZnO electrodes. Characterization techniques engaged to assess the morphology, crystallinity, surface area and chemical properties of the composites include SEM, TEM, XRD, UV-Vis and FTIR spectroscopies. The XRD analysis revealed that the CuO and ZnO exist in cubic and hexagonal phases respectively. SEM analysis showed a good dispersion of the CuO-ZnO onto the EG. The modification of the CuO-ZnO with EG endowed the composite with a larger surface area and strong light absorption in the visible light region. All the fabricated electrodes degraded the dye. However, the EG/CuO-ZnO demonstrated the highest degradation efficiency. The EG showed the least efficiency. The EG/CuO-ZnO was also used in the degradation of the dye on the basis of three techniques namely photolysis, electrochemical, and photoelectrochemical methods. The photoelectrochemical method showed a faster degradation when compared with photolysis and electrochemical oxidation. The synergistic effects of CuO, ZnO and EG promoted the efficiency of the EG/CuO-ZnO against the degradation of the dye.

Keywords: Exfoliated graphite, CuO, ZnO, 4-Nitrophenol, photoelectrochemical degradation, photocatalysis.

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