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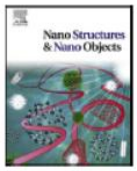

Enhanced photocatalytic degradation of hazardous dyes under visible light with biogenically synthesized ZnO-decked multi-walled carbon nanotubes (ZnO/MWCNT) nanocomposite: Catalyst fabrication, performance and mechanistic insight

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ABSTRACT

The research describes a novel strategy to addressing the environmental difficulties faced by hazardous dyes, with an emphasis on the production and characterisation of biogenically produced ZnO-decked multi-walled carbon nanotubes (ZnO/MWCNT) nanocomposites. The biogenic synthesis process is used using Aloe vera leaf extract to provide an environmentally friendly and sustainable route. The resultant nanocomposite is comprehensively studied by X-ray diffraction, Scanning Electron Microscopy (SEM), Brunauer-Emmett-Teller (BET) analysis, and Transmission Electron Microscopy (TEM). The study found that ZnO and MWCNT create heterojunctions, as evidenced by XRD, BET-specific surface area, and EDAX studies. The coating morphology is investigated using TEM and SEM, which provide insights into the nanostructure of the produced ZnO/MWCNT nanocomposite. Further, their photodegradation effectiveness was determined by immersing them in dye solutions and exposing them to visible light following a 10-minute dark period. The nanocomposites with different ZnO/ MWCNT ratios (1:1, 1:2, and 1:3) were carefully examined under UV light. The optimal conditions for maximal dye degradation are determined by adjusting the nanocomposite catalyst dosage, initial dye concentration, and pH. The observed optimum circumstances (catalyst dose of 0.2 g, dye concentration of 10 ppm)