

An efficient green protocol for photo-degradation of bromophenol blue dye

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ABSTRACT

Green synthesis is a simple, healthy, ecofriendly approach that has captivated the scientific community's focus worldwide. Recoverable biogenic hematite photocatalyst was fabricated via a one-step green method from a natural bio-waste precursor, namely *Psidium guajava* leaves. The synthesized product was given the name G-Fe₂O₃-NP's. It was monitored and fully characterized by various analytical techniques, and its photocatalytic activity has been studied for the degradation of aqueous bromophenol blue dye. The pure rhombohedral hematite phase of α -Fe₂O₃ with needle-like shape crystals of an average size ~ (40–50) nm was confirmed via scanning electron microscopy and transmission electron microscopy. Brunauer–Emmett–Teller (BET) analysis displayed that BET surface area and mean pore diameter of the as-synthesized iron oxide nanoparticles were 15.8 m² g⁻¹ and 14.9 nm, respectively. Results revealed complete degradation of the non-biodegradable dye in 12 min. Furthermore, 97% mineralization was confirmed by TOC removal. Reusability study for the photocatalyst was conducted for five successive cycles and indicated high efficiency of the synthesized hematite in visible light. Additionally, G-Fe₂O₃-NP's were examined for their antibacterial and antioxidant activities. It showed activity towards both *Pseudomonas aereginosa*, *Staphylococcus aureus*, and mild antioxidant activity.

Keywords: Biocatalyst; Biogenic iron oxide; Bromophenol blue dye; Green synthesis; Degradation

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