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EUROPEAN MATERIALS 2021: Radical Scavenging and Catalytic Activity of Fe-Cu Bimetallic Nanoparticles Synthesized from Ixora finlaysoniana Extract: Syed Taimoor Hassan - Department of Chemistry, University of Lahore. Pakistan

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Abstract

Iron–copper bimetallic nanoparticles (Fe-Cu BNPs) were prepared via a green synthesis route. Ixora finlaysoniana has been used in this study as a capping and stabilizing agent in the modification of Fe-Cu BNPs. As-synthesized BNPs were characterized using different techniques including UV/Vis spectrophotometry, FTIR, XRD and SEM. A particle size analyzer and SEM studies indicated the particle size to be in the range of 50–200 nm. In addition, degradation of MB dye in an aqueous system and radical-scavenging potential in a DPPH assay were also examined using BNPs. Methylene blue dye degradation in 17 min was monitored with UV/Vis spectrophotometry, which exhibited the efficiency of Fe-Cu BNPs. Bimetallic nanoparticles were also found to be efficient in neutralizing DPPH free radicals. Furthermore, kinetic studies of both dye degradation and radical scavenging potential are reported in this article. Subsequently, Fe-Cu BNPs synthesized via a green and sustainable method can be employed for dye degradation and free radical-scavenging activities. Findings: The purpose of this research work was to synthesize Fe-Cu bimetallic nanoparticles (BNPs) by a green method. Ixora finlaysoniana, an East Asian medicinal plant, was used as a source of biomolecules to synthesize BNPs. The confirmation for the synthesis of nanoparticles was carried out with a UV spectrophotometer. Their size range was checked by a size distribution analyzer which confirmed the presence of metal nanoparticles in the nanosized range. In addition, FTIR analysis, XRD and SEM studies confirmed the formation and structure of BNPs. The antioxidant potential in terms of radical-scavenging potential was determined by employing a DPPH assay and synthesized metal nanoparticles exhibited good antioxidant properties. The catalytic activity was determined using methylene blue dye as a substrate and sodium borohydride as a reducing agent. Conclusion & Significance: Results revealed that BNPs can effectively degrade the dye present in a water medium. Kinetic studies confirmed pseudo-first order reactions for both the radical-scavenging and catalytic activity. All the results of characterization and different studies proved that Fe-Cu BNPs can be successfully fabricated using Ixora finlaysoniana extract. Furthermore, these BNPs can be employed for radical scavenging and catalytic activities. Therefore, these Fe-Cu BNPs could attain much importance because they can meet the increasing demand for efficient and active nanoparticles in a sustainable, economical and ecofriendly way.

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