Characterization of SnO₂ nanoparticles via *Morinda citrifolia* leaf extract

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ABSTRACT

This study presents a green synthesis approach for fabricating tin oxide nanoparticles (SnO₂ NPs) using *Morinda citrifolia* leaf extract as a reducing and capping agent. The influence of varying extract concentrations (ratios 1:1, 1:3, 1:5, 1:7 and 1:10) on the structural, optical and compositional properties of SnO₂ NPs was systematically investigated. Characterization was performed using FTIR, XRD, UV-DRS and XPS techniques. FTIR confirmed the formation of Sn-O-Sn and Sn-OH functional groups, while XRD analysis revealed rutile tetragonal crystalline structure with varying degrees of crystallinity, highest at the 1:3 extract ratio. UV-DRS analysis indicated tunable optical properties, with the energy band gap ranging from 3.17 to 3.71 eV depending on extract concentration. XPS characterization of the optimal low-band-gap sample (1:10) confirmed the presence of Sn⁴⁺ and lattice oxygen. The study demonstrates that extract concentration significantly affects properties of SnO₂ NPs, highlighting the potential of M. citrifolia for eco-friendly nanoparticle synthesis.