

Synthesis and characterization of Chitosan-supported Ni and Cu nanoparticles

Vithana C.T.* and Kalutharage N.K.

Department of Chemistry, University of Ruhuna, Matara, Sri Lanka

Nanotechnology has taken an incomparable place in science and technology. In this study, the synthesis of copper (Cu) and nickel (Ni) nanoparticles (NPs) was explored using chitosan due to their low cost and readily accessible features. Nanoparticle synthesis was carried out using a convenient and inexpensive chemical reduction method using $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ as precursors. Chitosan was used as the stabilizer to modulate the size of metal NPs during synthesis and to preserve their stability by reducing the high surface charge of metal NPs. According to the UV-Vis spectroscopic analysis, Cu-NPs and Ni-NPs showed λ_{max} at 580 nm and 240 nm respectively. Cu-NPs and Ni-NPs were also characterized by FT-IR spectroscopy, which showed overlapping stretching vibrations of NH_2 and OH groups at 3302 cm^{-1} , C-H stretching at 2899 cm^{-1} , NH_2 bending at 1652 cm^{-1} , C-N stretching at 1584 cm^{-1} , and C-H bending at 1387 cm^{-1} . A blue shift was observed in copper chitosan (Cu-Ch) and nickel chitosan (Ni-Ch) NPs compared with the neat chitosan spectrum, and new absorption peaks at 614 cm^{-1} and 611 cm^{-1} confirmed the capping of Cu, Ni NPs by chitosan. It was determined that 71.4% is the ideal w/w ratio of copper/chitosan, and 1% chitosan is the optimum concentration for the synthesis of copper- chitosan NP. According to the Field Emission Scanning Electron Microscope, four major peaks of 44.21% O, 18.21% Cu, 17.34% C, and 15.87%N for Cu-Ch NP and 19.83% C, 22.42% O, and 48.7% Ni for Ni-Ch NP were observed. The mean size of both Cu and Ni NPs was calculated using X-ray diffraction data, and it is in the range of 35–75 nm, with diffraction angles of 36.50° , 42.50° , 61.50° , and 74.00° for Cu-Ch and 15.05° for crystalline Ni-Ch NPs.

Keywords: Chitosan, Copper-Chitosan nanoparticles, Nickel-Chitosan nanoparticles

*Corresponding Author: ctvithana.na@gmail.com