

Nanostructured chitosan/maghemite composites thin film for potential optical detection of mercury ion by surface plasmon resonance investigation

ABSTRACT

In this study, synthesis and characterization of chitosan/maghemite (Cs/Fe₂O₃) composites thin film has been described. Its properties were characterized using Fourier transform infrared spectroscopy (FTIR), atomic force microscopy (AFM) and ultraviolet-visible spectroscopy (UV-Vis). FTIR confirmed the existence of Fe–O bond, C–N bond, C–C bond, C–O bond, O=C=O bond and O–H bond in Cs/Fe₂O₃ thin film. The surface morphology of the thin film indicated the relatively smooth and homogenous thin film, and also confirmed the interaction of Fe₂O₃ with the chitosan. Next, the UV-Vis result showed high absorbance value with an optical band gap of 4.013 eV. The incorporation of this Cs/Fe₂O₃ thin film with an optical-based method, i.e., surface plasmon resonance spectroscopy showed positive response where mercury ion (Hg²⁺) can be detected down to 0.01 ppm (49.9 nM). These results validate the potential of Cs/Fe₂O₃ thin film for optical sensing applications in Hg²⁺ detection.

Keyword: Chitosan; Maghemite; Optical; Mercury ion; Surface plasmon resonance