Label-free optical spectroscopy for characterizing binding properties of highly sensitive nanocrystalline cellulose-graphene oxide based nanocomposite towards nickel ion

ABSTRACT

Surface plasmon resonance (SPR) is a label-free optical spectroscopy that is widely used for biomolecular interaction analysis. In this work, SPR was used to characterize the binding properties of highly sensitive nanocrystalline cellulose-graphene oxide based nanocomposite (CTA-NCC/GO) towards nickel ion. The formation of CTA-NCC/GO nanocomposite has been confirmed by FT-IR. The SPR analysis result shows that the CTA-NCC/GO has high binding affinity towards Ni^{2+} from 0.01 until 0.1 ppm with binding affinity constant of 1.620×10^3 M^{-1}. The sensitivity for the CTA-NCC/GO calculated was $1.509°$ ppm^{-1}. The full width at half maximum (FWHM), data accuracy (DA), and signal-to-noise ratio (SNR) have also been determined using the obtained SPR curve. For the FWHM, the value was $2.25°$ at 0.01 until 0.08 ppm and decreases to $2.12°$ at 0.1 until 10 ppm. The DA for the SPR curves is the highest at 0.01 until 0.08 ppm and lowest at 0.1 until 10 ppm. The SNR curves mirrors the curves of SPR angle shift where the SNR increases with the Ni^{2+} concentrations. For the selectivity test, the CTA-NCC/GO has the abilities to differentiate Ni^{2+} in the mixture of metal ions.