

ABSTRACT

Ni-doped ZnO thin layer electrodes have been successfully deposited on Indium-tin oxide (Ni-ZnO/ITO) coated glass substrates synthesized using the Chemical Bath Deposition (CBD) method. The synthesized electrode was characterized using XRD, SEM-EDX, and UV-Vis DRS analysis to determine its characteristics, namely crystal structure, morphology, and band gap energy. Additionally, the photoelectrodegradation efficiency of methylene blue was studied. The XRD characterization results show that the Ni-ZnO/ITO anode has a hexagonal wurtzite structure with the average crystal diameter increasing with the influence of Ni doping of 79.933 from 55.635 nm in ZnO/ITO. The Ni-ZnO/ITO thin layer electrode is in the form of nanoflakes and EDX shows the presence of Ni metal ions in the ZnO crystalline lattice. There was a decrease in the band gap energy on the Ni-ZnO/ITO thin layer electrode, namely from 3.198 eV to 3.152 eV for ZnO/ITO without Ni doping. The photoelectrocatalytic efficiency of Ni-ZnO/ITO against methylene blue after 210 minutes and an initial methylene blue concentration of 10 mg/L was 95.67%, an increase from 66.87% for ZnO/ITO under the same conditions. Kinetics studies show that photoelectrocatalytic decolorization proceeds in accordance with a pseudo-second order reaction kinetics model, with an observed rate constant (k_{app}) of 0.0064 min^{-1} . The Ni-ZnO/ITO electrode shows that it has good photoelectrocatalytic decolorization stability.

Keywords: anode, methylene blue, photoelectrocatalysis, semiconductor, zinc oxide