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ELECROCHEMICAL IMPEDANCE SPECTROSCOPY (EIS) STUDY OF METAL OXIDE NANOCOMPOSITE UREASE BASED BIOSENSOR PANI/zno/Urease AND PANI/mno2/Urease

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Abstract

Biosensors present an efficient alternative technique which can lead to the low cost heavy metal ion detector along with the features such as no need of special training for an operator, easily disposable, quick detection and less time consumption. In the present work, we have developed and compared two types of electrochemical amperometric biosensor by immobilizing Urease, to Stainless steel transducer. The stainless steel electrode was modified with PANI/ZnO and PANI/MnO_2 nanocomposite by the method of electro polymerization. Electrochemical impedance spectroscopy (EIS) measures the impedance of a system over a range of frequencies by perturbing the system with small AC amplitude. Often, data obtained by EIS is expressed graphically in a Nyquist plot. The cell was excited with 5 mV AC signal and impedance was measured at open circuit potential in the frequency range from 0.05 Hz to 100 kHz. Thus the charge transfer in the PANI/ZnO electrolyte was found much faster than that of the pure PANI. The NY Quist plot of the PANI/Zn/Urease composite showed well-defined frequency-dependent semicircle impedance curves over high frequencies, followed by straight lines. The semicircle diameter of PANI/MnO_2 was found much smaller than that of PANI/MnO_2/Urease and Pure PANI electrode, indicating that PANI/MnO_2 has much lower charge-transfer resistance. This result might be due to less favoring environment of PANI/MnO_2 matrix for the effective entrapment of the Urease, which is in agreement with the results obtained in the literature.

Keywords: Biosensor, Metal oxide nanocomposites, Electrochemical Impedance Spectroscopy (EIS), Nyquist plot.

