Study on Enzymatic and Electrochemical Properties of Cellulase Immobilized with Multi-Walled Carbon Nanotubes as Sensor for Catechol

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This work focused on studying the enzymatic and electrochemical properties of cellulase immobilized on carboxylated MWCNTs (cellulase/c-MWCNTs). The morphology and attachment of impurities, enzymatic and electrochemical properties of c-MWCNTs and cellulase/c-MWCNTs were studied. Results of morphology and attachment of impurities by FESEM and FTIR showed that the c-MWCNTs were prepared in bundles structure with porous and smooth surface but after cellulase immobilization by entrapment inside c-MWCNTs matrix, the prepared cellulase/c-MWCNTs displayed the rougher surface with more saturated pores. These results of FTIR evidenced to form N–H and O–H stretching vibrations of cellulase, and presence of nitriles, amide group and aliphatic amide bond in cellulase/c-MWCNTs structure that confirmed to successfully immobilization of cellulase enzyme on the c-MWCNTs side walls. Study of enzymatic properties showed that the optimum condition for electrochemical study of the cellulase/c-MWCNTs was concentration of 4 mg/ml, pH 4 and temperature of 35°C. Electrochemical study of cellulase/c-MWCNTs for detection catechol showed linear range and detection limit were obtained 10 to 160 μ M and 0.004 μ M, respectively. The comparison of sensing properties of cellulase/c-MWCNTs and other reported catechol sensors indicated the comparable electrochemical properties. Low detection limit for determination of catechol on the cellulase/c-MWCNTs can be due to formation of fast electron transfer pathways between the cellulase/c-MWCNTs electrode and the electrolyte.

Keywords: Enzymatic property; Electrochemical sensor; Cellulase; Carbon nanotubes; Cyclic voltammetry; Amperometry

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