Zinc oxide/Vancomycin-based Electrochemical Chiral Sensor for the Recognition of Penicillamine Enantiomers

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In this study, an electrochemical chiral sensor based on Zinc oxide/vancomycin-modified indium tin oxide glass substrate (ZnO/Van/ITO) was successfully fabricated and used in the chiral recognition of penicillamine (Pen) enantiomers. The preparation of the modified electrode was a two-step procedure in which electrodeposition of ZnO was conducted first on the ITO glass substrate. The deposition parameters were conducted at -0.9 V, in a buffer solution of pH 7 at 60 °C for 900 s. The second part of the procedure involved drop casting Van on the surface of the ZnO/ITO modified electrode. Different oxidation peak current, I_p of L- and D- Pen were observed in the differential pulse voltammograms (DPV). Under optimal condition, the chiral sensor exhibited good linear response to Pen enantiomers in a linear range of 5 mM to 30 mM with a detection limit of 23.56 mM and 14.73 mM ($S/N=3$) for the D-Pen and L-Pen, respectively. The modified electrode fabricated possessed exceptional performance of having low detection limit and good enantioselectivity for Pen enantiomers. The association constant from the experiment, K_D and K_L obtained were 2.314×10^3 L/mol and 1.076×10^3 L/mol for the D and L-Pen, respectively. The value of K_D was larger compared to K_L indicating that the binding effect is higher between ZnO/Van with D-Pen. The findings suggested that this proposed chiral sensor has the ability to discriminate Pen enantiomers which can bring good use in the pharmaceutical industries.

Keywords: chiral sensor, vancomycin, ZnO, enantioselectivity, penicillamine

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