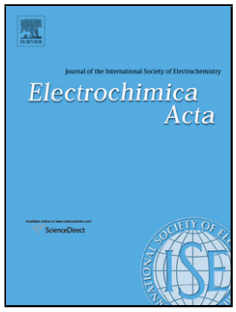

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Investigation of Vegetable Tannins and Their Iron Complex Dyes for Dye Sensitized Solar Cell Applications

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Abstract

In this study, ZnO nanoplates were synthesized rapidly via microwave assisted hydrothermal synthesis methods at relatively low temperatures and without any organic surfactants. The ZnO nanoplates were used as a dye sensitized photoanode. The vegetable tannins (Turkish valonea, sweet chestnut, mimosa and quebracho) and their Fe complexes were studied as a sensitizer for the solar cell system. The Fourier transform infrared spectroscopy (FTIR) and UV-Vis absorption spectroscopy were employed to investigate these vegetable tannins and their Fe complexes. Additionally, the HOMO and LUMO energy levels of tannins and band gap values were calculated, and the cyclic voltammetry results for these dyes were discussed. The maximum cell efficiency of DSSC based a valonea and Fe-valonea complexes dye were 0.58% and 0.99%, respectively. The cell efficiency of gallotannins and ellagitannins (Turkish valonea and sweet chestnut) and their Fe complexes are much higher than those of condensed tannins (mimosa and quebracho) and their Fe complexes. These cell efficiency results showed that the valonea (gallotannin), chestnut (ellagitannin), and their Fe complexes are useful as dye sensitizers along with obtainability from environmentally friendly, low cost and renewable sources.

Keywords: ZnO nanoplate, gallotannins and ellagitannin, condensed tannin, Fe-tannin complex, dye sensitized solar cell.

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