Electropolymerization of Nitrophenol Isomers in Various Aqueous Electrolytic Solutions

Ahmad S. Barham*

Basic Sciences Department, College of Engineering, University of Business and Technology, Jeddah, Saudi Arabia

*E-mail: ahmad.shawqi@gmail.com

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This study focuses on the electrodeposition of 2-nitrophenol, 3-nitrophenol, and 4-nitrophenol in either acidic, alkaline or neutral aqueous solutions. All the isomers have been electropolymerized using cyclic voltammetry (CV). A notable feature in all CV measurements was that the insulating polymer films deposited on gold electrodes ($A = 0.02 \text{ cm}^2$) from solutions were revealed by the rapid drop in current measured, when compared to the original CV scans. Generally, the anodic oxidation potential for 3-nitrophenol was slightly lower than that for 2-nitrophenol and 4-nitrophenol electropolymerized from solutions of similar pH. Values of the molecular orbital energies of the HOMO and LUMO orbitals of the nitrophenol monomers in various ionization states were determined. Energy values were calculated and used to explain the electrochemistry of nitrophenol isomers. Electropolymerization of nitrophenol isomers was found to be most difficult in acid and easiest in basic medium. This was also confirmed by the calculated diffusion coefficients of the monomers. In conclusion, 3-nitrophenol showed the best electropolymerization performance, and 2-nitrophenol showed very poor coverage on the electrode surface.

Keywords: Modified Electrodes; Thin Film; Oxidation; Diffusion.

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