Synthesis of Au Nanoparticles Decorated Carbon Nanotubes as an Electrochemical Sensor for Phenol Determination in Petrochemical Wastewater

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Phenolic compounds are identified as pollution in wastewater due to the petroleum industry. These hazard materials lead to many illnesses such as cancer. Therefore, study on the phenolic compounds and the detection techniques are necessary. In this study, Au nanoparticles decorated carbon nanotubes (Au NPs/CNTs) electrode was applied to determine phenol. CNTs were synthesized through chemical vapor deposition technique. The Au nanoparticles were decorated on synthesized CNTs by electrochemical deposition. The structural properties of synthesized CNTs and Au NPs/CNTs were studied by FESEM, XRD, and Raman analyses. Results showed that high density of CNTs with high aspect ratio and high effective surface area were synthesized. Electrochemical properties of Au NPs/CNTs electrodes were investigated by cycle voltammetry and differential pulse voltammetry techniques. The electrochemical characteristic of Au NPs/CNTs electrode showed oxidation sharp peak in 0.57 v for phenol in pH 7. The result of cycle voltammetry study showed the stability behavior of Au NPs/CNTs electrode for phenol oxidation. Differential pulse voltammetry studied revealed that modified sensor was selective and sensitive in determination of phenolic compounds. The linear range, sensitivity, and detection limit of sensor were estimated 1-200 μM , 0.499 $\mu\text{A}/\mu\text{M}$ and 6 nM, respectively, which were more competitive and superior than the previous reports.

Keywords: Au nanoparticles, Carbon nanotube-based sensor; Phenolic Compounds; Petrochemical Wastewater; Cycle voltammetry; Differential pulse voltammetry

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