

THE ELECTROCHEMICAL BEHAVIOUR OF Au-PEDOT/rGO MODIFIED ELECTRODE IN URIC ACID

(Sifat Elektrokimia Elektrod Bermodifikasi Komposit Au-PEDOT/rGO dalam
Asid Urik)

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Abstract

The development of gold nanoparticle/poly(3,4-ethylene dioxythiophene)/reduced graphene oxide (denoted as Au-PEDOT/rGO) sensor is necessary for the detection of UA as the irregular amount of UA in the human body may cause several diseases such as gout, heart disease, kidney stone and hypertension. In this work, Au-PEDOT/rGO nanocomposite was synthesized by a facile chemical technique. The morphology, composition, and structure of Au-PEDOT/rGO composite were confirmed by FTIR, SEM, and XRD characterization. FTIR spectrum showed the presence of C-O-C stretching and C-S stretching of the thiophene ring. The attachment of Au with PEDOT and rGO was confirmed by SEM. XRD analysis showed the presence of Au(111), Au(200), Au(220), Au(311) and Au(222) corresponding to Au-PEDOT/rGO composite. This proved that Au-PEDOT/rGO has been successfully synthesized. The electrochemical behavior of Au-PEDOT/rGO/GCE was evaluated by cyclic voltammetry (CV) in 1.0 M KCl with 5 mM K₄[Fe(CN)₆] and the results demonstrated that Au-PEDOT/rGO/GCE has a better electrical conductivity for detection of UA in the real sample. DPV measurements showed a linear relationship between oxidation peak current and concentration of UA in phosphate buffer (pH 7) over the concentration range 0.10 µM

until 25.0 μM . The limit of detection of UA is 0.05 μM , and the limit of quantification of UA is 0.22 μM . Thus, Au-PEDOT/rGO electrode composite is a worthy alternative for the detection of UA in human's urine.

Keywords: conducting polymer, gold nanoparticles, reduced graphene oxide, uric acid

Abstrak

Pembangunan sensor buat zarah nano aurum/poli(3,4-etilenadioxitiofena/grafin oksida terturun (dilabel sebagai Au-PEDOT/rGO) adalah diperlukan untuk pengesanan UA kerana jumlah UA yang tidak normal dalam tubuh manusia boleh menyebabkan beberapa kondisi penyakit seperti gout, penyakit jantung, batu ginjal dan darah tinggi. Dalam kajian ini, komposit nano Au-PEDOT/rGO telah disintesis melalui teknik kimia mudah. Morfologi, komposisi, dan struktur komposit Au-PEDOT/rGO telah disahkan melalui teknik pencirian FTIR, SEM, dan XRD. Spektrum FTIR menunjukkan kehadiran regangan C-O-C dan regangan C-S bagi ikatan tiofena manakala penggabungan Au kepada lembaran PEDOT dan rGO telah dibuktikan melalui SEM. Analisis XRD menunjukkan kehadiran Au(111), Au(200), Au(220), Au (311) dan Au(222) sepadan dengan komposit Au-PEDOT/rGO. Keputusan tersebut telah mengesahkan bahawa Au-PEDOT/rGO telah berjaya disintesis. Sifat elektrokimia Au-PEDOT/rGO telah dinilai melalui voltammetri berkitar (CV) di dalam 1.0 M KCl bersama dengan 5 mM $\text{K}_4[\text{Fe}(\text{CN})_6]$ dan hasil kajian menunjukkan bahawa Au-PEDOT/rGO memiliki konduksi elektrik yang bagus untuk pengesanan UA di dalam sample nyata. Analisis DPV menunjukkan hubungan linear antara puncak pengoksidaan arus dan kepekatan UA di dalam penimbal fosfat (pH 7) diantara julat kepekatan 0.10 μM hingga 25.0 μM . Had pengesanan yang diukur bagi UA ialah 0.05 μM manakala had pengukuran UA adalah 0.22 μM . Oleh itu, komposit Au-PEDOT/rGO merupakan alternatif yang berbaloi untuk mengesan UA dalam air kencing manusia.

Kata kunci: polimer pengalir, zarah nano aurum, grafen oksida terturun, asid urik

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