An Efficient Electrochemical Sensor Based on Ag Nanoparticle Decorated MnO₂/reduced Graphene Oxide Ternary Nanocomposite for Detection of Acetaminophen in Human Urine Sample

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In this study, Ag/MnO₂@RGO ternary nanocomposite based electrochemical sensor was found to be the best for electrochemical detection of acetaminophen (ACTP). In which, reduced graphene oxide (RGO) sheets decorated with MnO₂ nanoclusters and silver nanoparticles (Ag NPs) by in situ growth of MnO₂ on graphene oxide (GO) sheets followed by co-reduction of Ag⁺ and GO. The Ag/MnO₂@RGO ternary nanocomposite possesses tremendous superiority in the ACTP sensing is mainly due to the large surface area and numerous electroactive sites. The structural and morphological characteristics of the as-synthesized nanomaterial were examined by XRD, FTIR, FE-SEM, HR-TEM, EDX. The electrochemical characteristics and catalytic behavior of the fabricated Ag/MnO₂@RGO ternary nanocomposite modified screen-printed carbon electrode for the determination of ACTP were demonstrated using electrochemical impedance spectroscopy, cyclic voltammetry, and differential pulse voltammetry. The results establish that the developed ACTP sensor exhibit a low detection limit of 0.0122 μM, the excellent linear response of 0.02-1810 μM with a good sensitivity of 4.144 μA μM⁻¹ cm⁻². The practicability of the sensor was investigated in the real sample of acetaminophen tablet and human urine sample.

Keywords: acetaminophen; chronic pain; Ag/MnO₂@RGO ternary nanocomposite; electrochemical detection; screen-printed carbon electrode.

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