Preparation of An Efficient and Selective Sensor Based on Carbon Electrodes Modified with TiO_2 Nanoparticles and Carbon Nanomaterial's for Macrolide Electrochemical Quantification

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The tetragonal (rutile) nanostructures of TiO_2 have attained immense significance due to their large active sites, electronic states, superior electrode performance, stability and conductivity. Metal oxide NPs as a multicomponent material combined with carbon material has pointed with several advantages to which we have proposed novel TiO_2 NPs using carbon ink as bulk material to prepare screen printed carbon electrodes as an electrochemical sensor for quantification of macrolides, specifically Azithromycin (AZM) and Erythromycin (ERM). Azithromycin (AZM) is one of the top prioritized antibiotics which are used by humans at high concentrations; lastly it is one the most used antibiotic to treat patients with COVID-19 infection, where the side effects and waste produced by antibiotics to human and environment is causing significance damage. There over, there is much need to develop a sensitive and selective method for the determination of AZM using flexible modified screen-printed carbon electrode (SPCE). Additionally, using different carbon nanomaterial's such as MWCNT and CNPL as a modifier were done studies for electrochemical activity of macrolides. Characteristic analysis like SEM analysis was performed to determine the physical and surface properties. Cyclic voltammetry and differential pulse voltammetry (DPV) analysis determined prepared TiO_2 NPs/SPCE electrode has a low limit of detection (LOD) of 0.93 µM with a limit of quantification (LOQ) of 3.1 µM, sensitivity of 7.36 µA μM^{-1} cm^{-2} (S/N = 3) and with a linear range of 0.05–50 µM towards determination of AZM. The prepared sensor has specific selectivity with high reproducibility and stability through real sample monitoring in human urine and water samples to present environmentally friendly strategy in determination of Macrolides.

References

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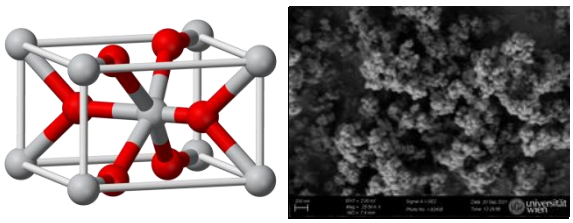

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Figure 1: (A) Rutile (TiO_2) 3D structure (B) SEM images of TiO_2 NPs