A superior sensor for the electrochemical detection of Tryptophan in food samples using Ag-doped TiO₂ nanoparticles modified glassy carbon electrode

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This work presented preparation and characterization of silver doped TiO₂ nanoparticles modified glassy carbon electrode (Ag-TiO₂ NPs/GCE) and application to electrochemical detection of tryptophan as amino acids in food. The TiO₂ NPs and Ag-TiO₂ NPs were electrodeposited on GCE and their structural characterization with SEM and XRD exhibited that TiO₂ NPs was synthesized in rutile phase on GCE in sponge-like structure and Ag-TiO₂ NPs/GCE had the higher porosity and roughness than undoped electrode which indicated the higher effective surface area. The electrochemical measurements with cyclic voltammetry (CV) and amperometry showed that the nanostructured surface of electrode behaved as mediator and shuttled the electron between electrolyte and electrode surface and decreased the kinetic barrier in transfer of electron. Therefore, the comparable liner range (10 to 220 μM), the higher sensitivity (0.9150 μA/μM) and lower detection limit (0.003 μM) were obtained for Ag-TiO₂ NPs/GCE to determine tryptophan compared to other reported tryptophan sensors. The stability, repeatability and selectivity of response for Ag-TiO₂ NPs/GCE was evaluated towards interference effect on determination of tryptophan which showed high anti-interfering capability and selective response of the Ag-TiO₂ NPs/GCE as tryptophan sensor. The practicability of the proposed sensors was used for the determination of tryptophan in egg white as the real sample that presented the tryptophan content in the prepared real sample is 0.10 μM. Furthermore, the acceptable values of obtained recoveries (102.50% to 90.00%) and RSDs (1.44% to 3.25%) indicated that the proposed sensors could satisfactorily be applied for determination of tryptophan in food samples.

Keywords: Electrochemical sensor; Amino acids; Tryptophan; Silver doped TiO₂ nanoparticles; Cycle voltammetry

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