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Curve resolution on overlapped voltammograms for simultaneous determination of tryptophan and tyrosine at carbon paste electrode modified with $ZnFe_2O_4$ nanoparticles

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Abstract

Tryptophan (Trp) and tyrosine (Tyr) are important amino acids that usually coexist with each other in biological fluids. Therefore the simultaneous determination of them is very important because of their very nearly properties. On the other hand, differential pulse voltammetry studies show a high degree overlapping of voltammograms for oxidation of Trp and Tyr. Multivariate curve resolution-alternating least squares (MCR-ALS) with electrochemical methods have been applied to overcome this limitation for simultaneous determination of Trp and Tyr. Electrochemical sensor has been developed by utilizing the $ZnFe_2O_4$ nanoparticles modified carbon paste electrode. The characterization of the modified electrode was studied using different techniques such as field emission scanning electron microscopy, X-ray diffraction, electrochemical impedance spectroscopy, differential pulse and cyclic voltammetry methods. Operating conditions were optimized with central composite rotatable design (CCRD) associated with the response surface methodology (RSM). The proposed method under the optimized conditions was used to determine Trp and Tyr with linear ranges of 0.1–200.0 µM and 0.4–175.0 µM, detection limits of 0.04 µM and 0.10 µM (S/N = 3), respectively. The method was applied for simultaneous determination of Trp and Tyr in spiked human serum and urine samples.

Keywords: Tryptophan; Tyrosine; Multivariate curve resolution; Response surface methodology; $ZnFe_2O_4$ nanoparticles

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