Determining Caffeic Acid in Food Samples Using a Voltammetric Sensor Amplified by Fe₃O₄ Nanoparticles and Room Temperature Ionic Liquid

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In this study, the fabrication of a carbon paste electrode (CPE) amplified with Fe₃O₄ nanoparticles (Fe₃O₄-NPs) and 1-methyl-3-butylimidazolium bromide (MBIBr) is reported as a food analytical sensor for determining caffeic acid (CA). The electrochemical behavior of CA on the Fe₃O₄-NPs/MBIBr/CPE is investigated via voltammetric techniques. Also, the capability of the Fe₃O₄-NPs/MBIBr/CPE for CA determination in different food samples is checked. The Fe₃O₄-NPs/MBIBr/CPE shows a powerful ability for improving the oxidation signal of CA with a low limit of detection 8.0×10^{-9} mol/L. The recorded signals show linear a dynamic range 2.0×10^{-8} - 1.0×10^{-4} mol/L with linear coefficients of 0.9941 for CA determination at surface of Fe₃O₄-NPs/MBIBr/CPE. Additionally, the Fe₃O₄-NPs/MBIBr/CPE shows remarkably good stability, rapid response, repeatability, and selectivity.

Keywords: Caffeic acid, Fe₃O₄ nanoparticle, 1-methyl-3-butylimidazolium bromide, Food electrochemical sensor

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