A Peptide-based electrochemical biosensor for the voltammetric determination of copper

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A voltammetric biosensor containing a peptide as an element of metal ion binding was constructed for the determination of Cu(II) in plant tissues. The peptide, which is a prion fragment, was chosen since it is a described in the literature as a ligand with high affinity and selectivity to Cu(II) metal ion. The peptide (H-CVNITKQHTVTTTT-NH_2) was synthesized by the solid phase methodology, purified by reversed-phase liquid chromatography and characterized by MALDI-ToF mass spectrometry. The construction of the biosensor was achieved by self-assembling of the molecule containing a sulfhydryl group (i.e., a cysteine residue) onto Au electrodes. The characterization of Au electrode modified with H-CVNITKQHTVTTTT-NH_2 was performed by titration with Cu(II) metal ion. Cyclic voltammetry results indicated a quasi-reversible redox process controlled by adsorption. Studies of the stability and precision of the biosensor at Cu(II) additions showed an intra-day precision of 4-11% along the working range. Other figures of merit of the method were analyzed and the following data were obtained: linearity (r = 0.9995); working range (1.0×10^{-7} to 1.0×10^{-6} mol L^{-1}); limit of detection (2.0×10^{-8} mol L^{-1}); limit of quantification (1.0×10^{-7} mol L^{-1}). An investigation of the biosensor selectivity for Cu(II) against other metal ions such as Zn(II), Fe(II), Cd(II) and Ni(II) was done and it was observed that these metal ions did not interfere in the titration of Cu(II) in the analyzed working range.

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