Voltammetric Biosensor Based on a Modified Chitosan Membrane Enzyme Peroxidase

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The determination of hydrogen peroxide (H₂O₂) has a significant meaning in environmental, pharmaceutical, healthcare and food analyses. The current work is focused on construction of a fast but reliable and accurate voltammetric biosensor enabling detection of H₂O₂ giving opportunity to its application into practice. This biosensor was based on screen printed electrode covered with chitosan membrane entrapping horseradish peroxidase (HRP), magnetic particles (MPs) and Prussian blue (PB). MPs an inorganic substrate having pseudo-peroxidase activity together with HRP catalyzed reduction of H₂O₂ and PB as mediator of electron transfer enabled highly sensitive detection at low applied potential. Square wave voltammetry (SWV) was chosen as a detection device. Average area peaks of each H₂O₂ concentration created calibration curve replying Michaelis-Menten equation with correlation coefficient 0.999. Limit of detection was equal to 8.2 µmol/l of H₂O₂. Uric acid, ascorbic acid, water soluble derivate of vitamin E (trolox), acetaminophen and reduced glutathione were measured as possibly interfering substances replacing H₂O₂ in the reaction and no significant influence on the assay was observed when presented in equivalent concentrations as the H₂O₂. Different personal care matrix substances (tooth paste, hand cream and skin tonic) were spiked with H₂O₂ and no effect of matrix on the determination was detected. On the basis of the presented results, the proposed assay was considered to be highly sensitive, accurate and fast assay for detection of H₂O₂ so this platform can be applied in wide spectrum of research and clinical fields.

Keywords: Voltammetry; hydrogen peroxide; horseradish peroxidase; Prussian blue; magnetic particles

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