Construction and thermodynamic evaluation of vitamin Nanobiosensor

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Carbon paste electrodes (CPE) are very popular due to their wide anodic potential range, low residual current and low cost. Ionophore due to its good biocompatibility, high conductivity and low cost, has become an attractive electrode material for biosensors. On the other hand, multi-walled carbon nanotubes (MWCNTs) have been widely used as electrode material due to their high surface, high electrical conductivity, remarkable mechanical strength and outstanding ability to mediate fast electron transfer kinetics for a wide range of electroactive species. In addition, surfactants at trace levels have also been employed successfully as modifiers and have proved to be effective in the electroanalysis of biological compounds and drugs. Vitamin B12 is an essential vitamin for the body and is essential for cell proliferation and function of the nervous system. Owing to its importance, researchers used many analytical methods to study it, including high-performance liquid chromatography. There were some reports about electrochemical study of Vitamin B12 due to its electroactivity. Of this study, carbon paste electrode modified with carbon nanotubes and organic matter synthesied for investigation of the electrochemical behavior of Vitamin B12 in base media (pH= 10) using cyclic voltammetry techniques. Comparative experiments were carried out using CPE. These studies revealed that the oxidation of Vitamin B12 is facilitated at ION-MWCNT/CPE. After optimization of analytical conditions, the anodic peak current was linear to Vitamin B12 concentration in 3.69 × 10-4 - 2.95 × 10-3 M. The detection limit was 8.76 × 10-5 M. This method was successfully applied to detection of Vitamin B12 in human blood serum. Kinetic and Thermodynamic parameters were assessed by changes in ambient temperature test.

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