ULTRA-SENSITIVE DETERMINATION OF VITAMIN B\textsubscript{12} USING LOW-COST GRAPHITE SCREEN-PRINTED ELECTRODES AND ADSORPTIVE VOLTAMMETRY IN NON-DEEAERATED SOLUTIONS IN THE PRESENCE OF EDTA

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A facile, rapid and selective method for the ultra-sensitive determination of cyanocobalamin (Vitamin B\textsubscript{12}) at the sub-nanomolar concentration range is described. The method is based on the cathodic preconcentration of square planar vitamin B\textsubscript{12a}, as occurred due to the electro-reduction of Co(III) center in vitamin B\textsubscript{12a} to Co(I), at \(-1.3\) V \textit{versus} Ag/AgCl/3 M KCl for 40 s, onto the surface of the graphite screen-printed electrodes in non-de aerated solutions in the presence of EDTA, followed by a square wave anodic scan and quantification of the peak current appeared at \(-0.75\) V \textit{versus} Ag/AgCl/3 M KCl, due to the oxidation of Co(I) to Co(II) in the adsorbed molecule. EDTA was found to serve as a key-component of the electrolyte by eliminating the background signal caused by metal cations impurities contained in both the graphite ink and the electrolyte (0.1 M phosphate buffer in 0.1 M KCl, pH 3). It also blocks trace metals contained in real samples, thus eliminating their interference effect. Various experimental variables, such as the concentration of EDTA, the deposition potential, the deposition time, the composition and pH of the buffer solution etc., were investigated and under the selected conditions a linear calibration curve in the range \(1\times10^{-10} - 8\times10^{-3}\) mol L\(^{-1}\) vitamin B\textsubscript{12} was constructed (R\(^2=0.994\)). The 3σ limit of detection (7×10\(^{-11}\) mol L\(^{-1}\)) is the lowest value of any reported in the literature for the electrochemical determination of vitamin B\textsubscript{12}. The effect of potential interferences was also examined and finally, the sensors were successfully applied to the determination of vitamin B\textsubscript{12} in pharmaceutical products.

KEYWORDS: Screen-printed electrodes; Vitamin B12; voltammetry; pharmaceutical products