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Electropolymerized Congo Red Film based Sensor for Dopamine: A Voltammetric Study

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ABSTRACT

Dopamine, which belongs to the neurotransmitters catecholamine family , is prepared in a sequential reaction in which amino acid decarboxylase and tyrosine hydroxylase convert tyrosine to L-dihydroxyphenylalanine (L-dopa), followed by L-dopa decarboxylation into dopamine. Dopamine plays a crucial role in the movement regulation and has been associated with the motor symptoms encountered in Parkinson's disease patients. Different studies show that the products for dopamine oxidation can inhibit the function of different proteins and correlate cysteine l-dopamine formation conjugates with neurotoxicity induced by dopamine. Changes in the amount of dopamine in adrenal glands affect many facets of brain function as a potent neurotransmitter. Parkinsonism, for example, is associated with decreased levels of dopamine, whereas schizophrenia is associated with an increased dopamine activity.

In vivo dopamine concentrations are within nanomolar range. Considering the broad range of physiological and pathway implications, the production of analytical assays for reliable, low level, and selective dopamine measurement is highly desirable. Dopamine is formed by substantial nigra neurons located in large nucleus, a region of brain in large amounts (50 mol / g). DA is usually broken down in the human body by the oxidation which is catalyzed by monoamine oxidase enzyme. In comparison, DA is also able to undergo autoxidation i.e., it reacts with oxygen, yielding free radicals as products together with quinones. The creation of a fast and easy quantification method for Dopamine in routine analysis for diagnostic, pharmaceutical and neurological applications.

The Congo red polymerization film was prepared by electropolymerization on surface of carbon paste electrode using cyclic voltammetric method. Higher catalytic activity for electrocatalytic oxidation of Dopamine was reported, with dramatic reversibility enhancement and peak current in 0.2 phosphate buffer solution of pH 7.0 at 100 mV/s sweep rate. Variation in sweep rate and pH was

reported. The Dopamine detection limit was defined to be 0.06 μM. Differential pulse voltammetric technique was used to effect of interference studies. In the simultaneous look at, cyclic voltammetric technique separate Dopamine and Uric acid. The approach proposed suggested strong selectivity, sensitivity and reproducibility. Congo red is electropolymerized directly on the electrode surface of carbon paste by CV method. The prepared poly (Congo red) MCPE showed strong electrocatalytic activity against DA and UA oxidation and also shows the substantial increases in individual and simultaneous oxidation of DA and UA. The effect of pH indicates the participation of equal number of electrons and protons in the catalytic oxidation. The modified electrode was very effective and suitable for determination of DA and UA was possible at poly (Congo red) MCPE with peak to peak separation by CV techniques at 151 mV.

Keywords: Uric acid; Dopamine; Congo red; Electropolymerization; Cyclic voltammetry; Carbon paste electrode