# A NOVEL REDUCED GRAPHENE OXIDE BASED ELECTROCHEMICAL SENSOR FOR THE DETECTION OF DOPAMINE

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Dopamine (DA) is a neurotransmitter that plays several important roles in the brain and body. It has been involved in motivation, memory, attention and even regulating body movements [1]. When dopamine is released in large amounts, it creates feelings of pleasure and reward, which motivates you to repeat a specific behavior. In contrast, low levels of dopamine are linked to reduced motivation and decreased enthusiasm for things that would excite most people. Moreover, a common nervous disease that occurs in the deficiency of DA is depression, hallucinosis, Alzheimer's, and Parkinson's [2]. Therefore, the precise determination of DA and the development of sensitive and selective platforms for the detection of DA have become an important issue in clinical diagnosis, especially at a very low concentration.

The aim of this work was to prepare new highly electrocatalytically active graphene-based materials, as well as the characterization and testing of the electrochemical performance of new samples in dopamine detection.

This research presents modified Hummers' methods, including the pre-oxidation of graphite powder by mixtures of $H_3BO_3/H_2SO_4/CrO_3$ [3]. The obtained pre-oxidized graphite was subjected to oxidation by the Hummers' method using $NaNO_3$, $H_2SO_4$, and $KMnO_4$ [4]. Compared to the traditional Hummers' method, these substantial improvements greatly enhanced the number of oxygen functionalities onto graphene oxide (GO) layers. The thermally reduced graphene oxide (rGO) samples were produced from GO using a thermal shock method. The dried GO powders with malonic acid and $P_2O_5$ additives were quickly inserted into a preheated tubular furnace at a temperature of about 800 °C in Ar atmosphere. The obtained materials were characterized by XPS and Raman spectroscopy. Electrochemical measurements, in particular, cyclic voltammetry and differential pulse voltammetry, were used to evaluate the obtained samples sensitivity toward DA detection.

The results demonstrated that the thermal treatment of GO in the presence of malonic acid and $P_2O_5$ mixture led to effective incorporation of P element into the graphene-based material structure. Raman analysis revealed a slightly higher structural disorder in rGO layers synthesized using modified Hummers' method than in the rGO structure, derived from GO prepared by the traditional Hummers' method. Further, rGO samples were tested as label-free dopamine sensors electrodes. The electrochemical investigations showed that the samples were prospective on dopamine sensing. rGO derived from new synthesized GO using $H_2SO_4/H_3BO_3/CrO_3$ mixture provides a unique opportunity for future work in this area due to its relatively high sensitivity 28.64 $\mu A \cdot \mu M^{-1} \cdot cm^{-2}$.

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**References**

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