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

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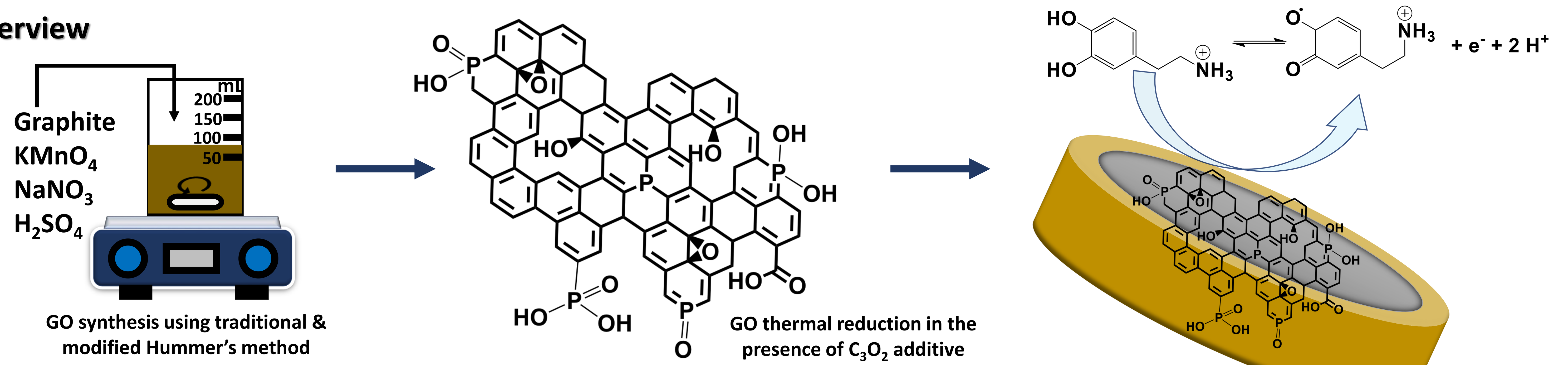
Introduction

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 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. 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.

Overview

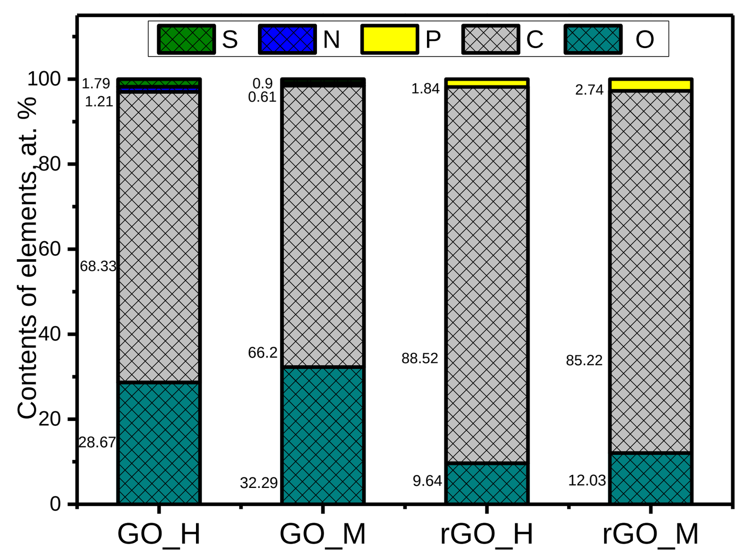


GO synthesis using traditional & modified Hummer's method

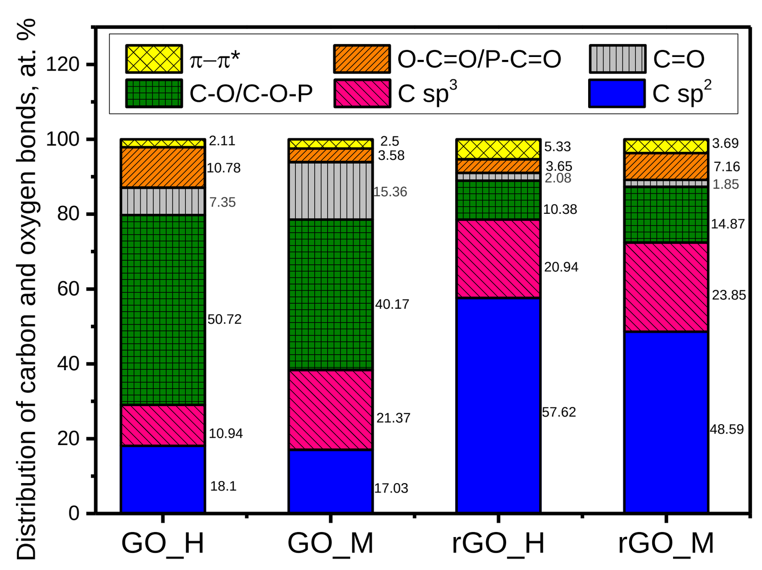
GO thermal reduction in the presence of C_3O_2 additive

GO_H – synthesised by traditional Hummers' method;
GO_M – obtained using a pre-oxidation step of graphite with $H_3BO_3/H_2SO_4/CrO_3$ mixture.

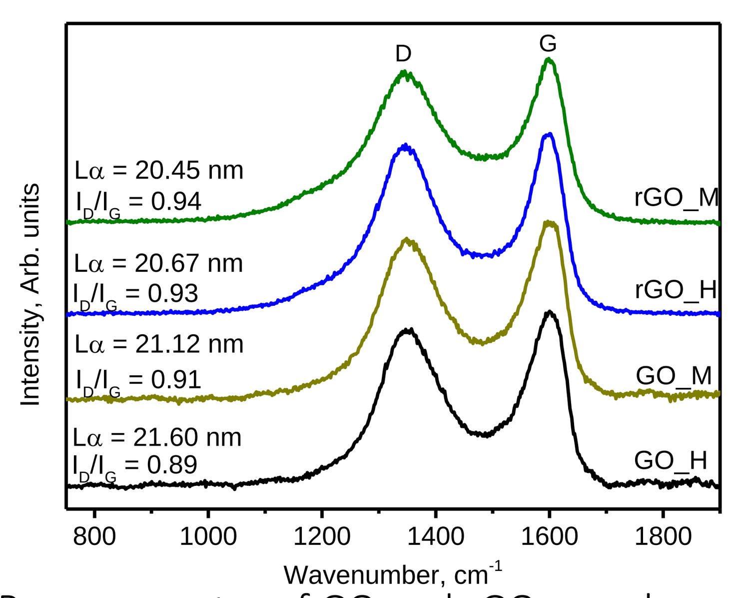
Experimental Results



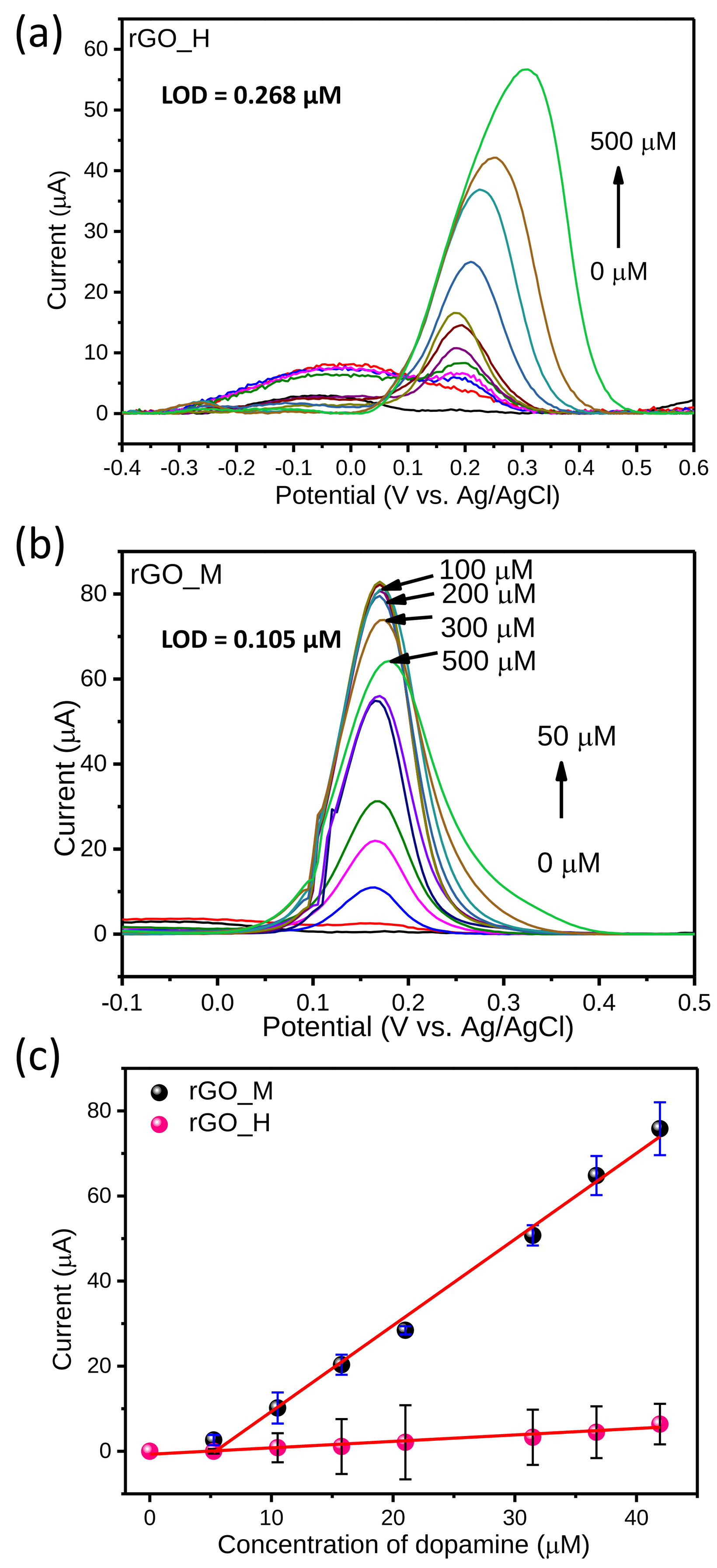
Surface elemental composition of GO and rGO samples determined by the XPS



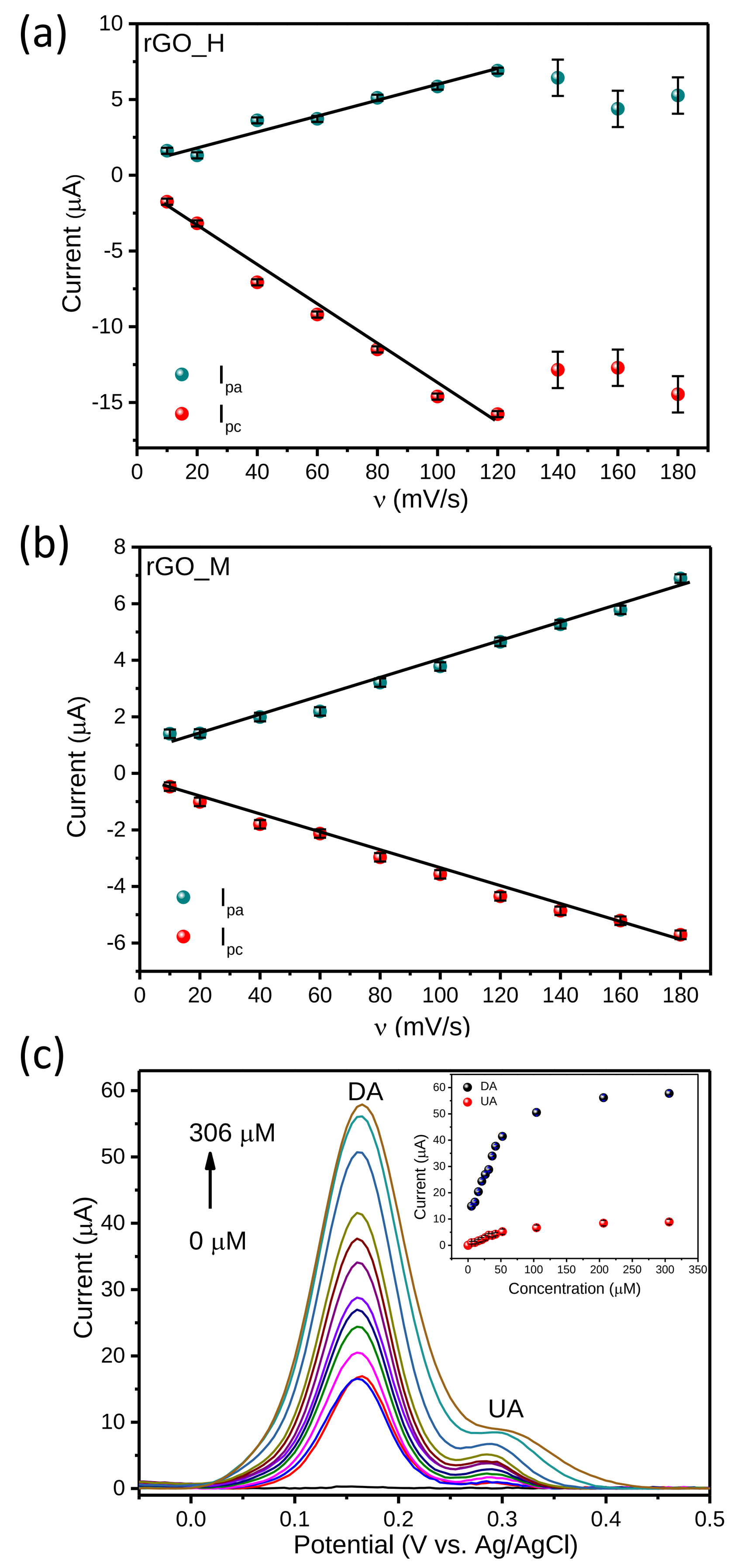
Distribution and concentration (at. %) of carbon and oxygen bonds determined by XPS



Raman spectra of GO and rGO samples



Differential pulse voltammograms with various DA concentrations (0, 5, 10, 15, 20, 35, 40, 50, 100, 200, 300, and 500μM) at GCE/rGO_H (a) and GCE/rGO_M (b) in 0.1 M PBS at pH 7.2. The calibration curves in low concentration range (c).



Linear variation of anodic and cathodic peak currents vs. scan rates of GCE/rGO_H (a) and GCE/rGO_M (b). DPV curves for simultaneous detection of dopamine and uric acid on GCE/rGO_M (c).

Conclusions

- The pre-oxidation step of pristine graphite played an essential part in controlling the oxidation degree and oxygen functionalities of GO.
- Raman analysis revealed a slightly higher structural disorder in rGO layers synthesized using modified Hummers' method
- 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 $\mu A \cdot \mu M^{-1} \cdot cm^{-2}$.

Acknowledgments

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