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GLUCOSE OXIDASE ENZYME IMMOBILIZED ON A NANOSTRUCTURED PENCIL GRAPHITE ELECTRODE FOR BIOSENSOR AND BIOFUEL CELL APPLICATIONS

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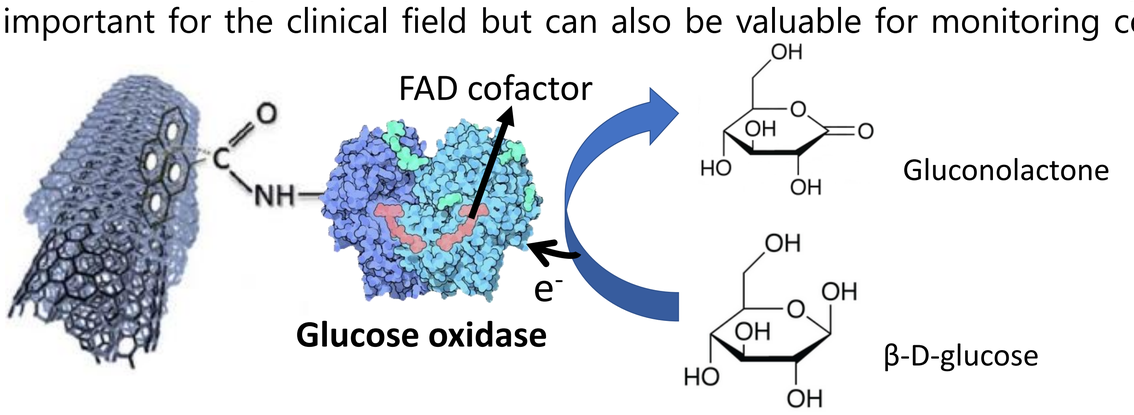
INTRODUCTION

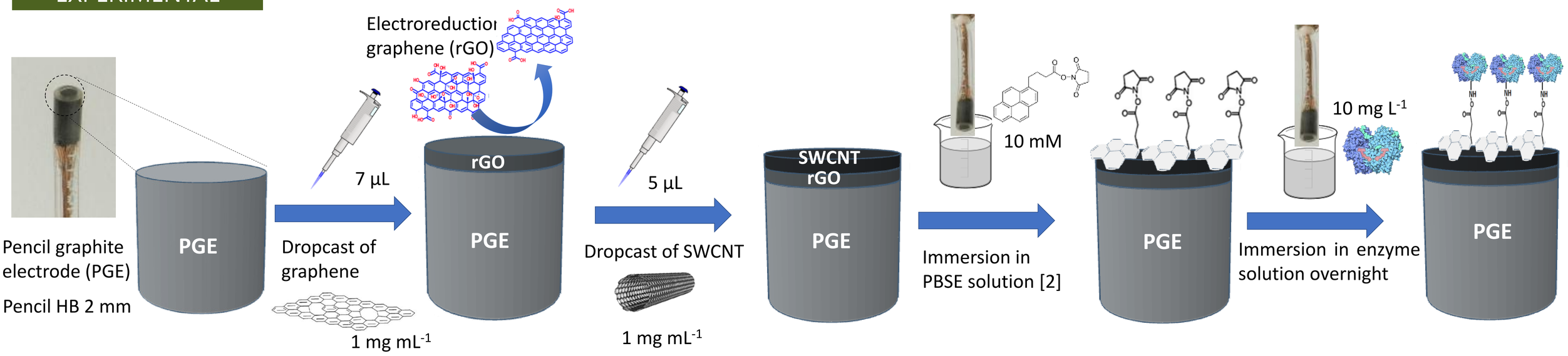
Pencil graphite electrodes (PGE) can be a viable alternative to more conventional and expensive electrodes such as platinum and glassy carbon due to their negligible cost, availability, presenting also good electrical conductance properties. These advantages are more evident when disposable applications are equated. Moreover, a wide variety of sizes are commercially available enabling miniaturization of the active site and the whole PGE. Nanostructuration of PGEs can always compensate some lack of performance. Carbon-based nanomaterials not only serve as electron transfer enhancers between the electrode and analyte in solution but also they can serve as bridge or substrate for attachment of biological entities (such as enzymes) to facilitate direct electron transfer (DET). The immobilization of biological entities in these inexpensive electrodes can therefore produce miniaturized, cheap and disposable biosensors or biofuel cells. Particularly, the immobilization of glucose oxidase (GOx) for fabrication of glucose biosensors is important for the clinical field but can also be valuable for monitoring certain contaminants through an inhibitory detection principle [1]

AIM

- The objective of the present work is the development and characterization of a pencil graphite bioelectrode comprising immobilized glucose oxidase (GOx) capable of achieving DET.

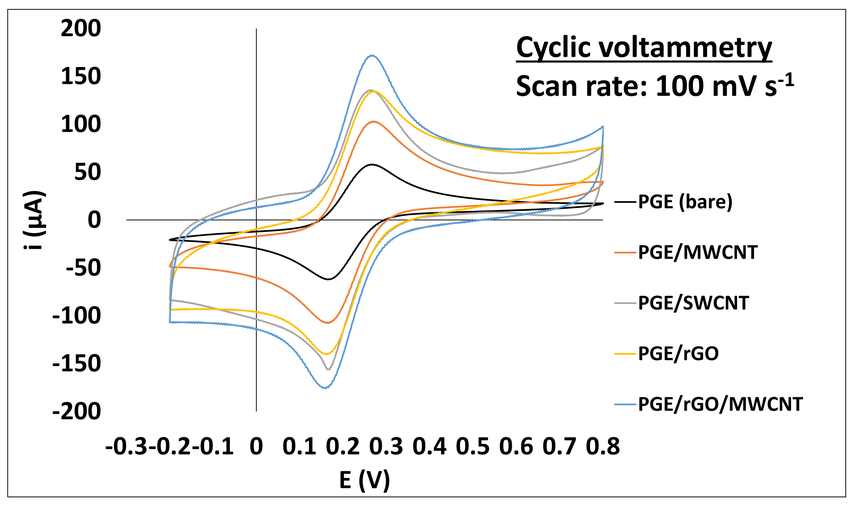


EXPERIMENTAL



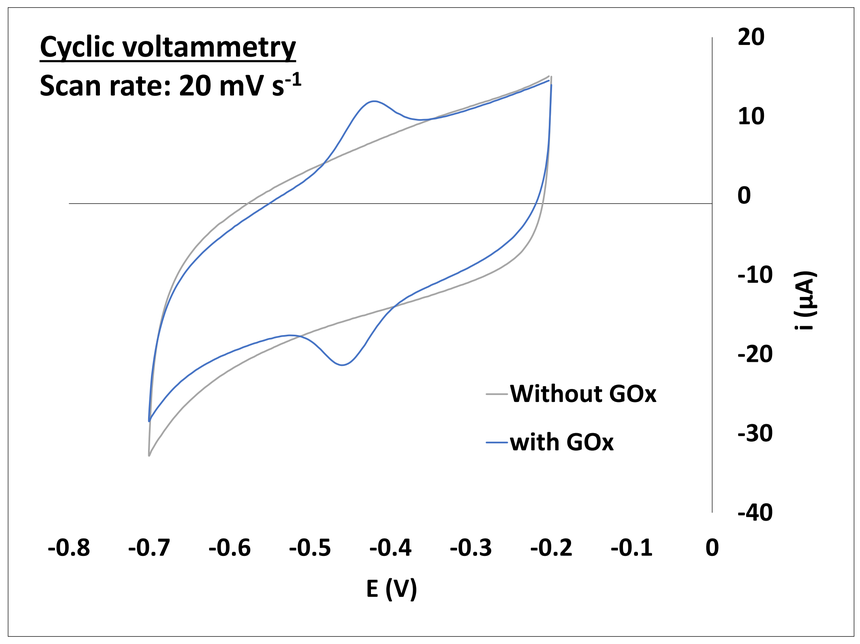
RESULTS

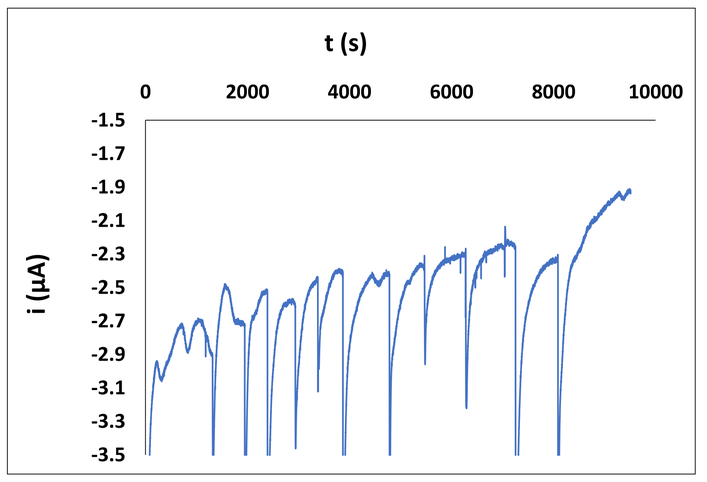
Effect of nanostructuration of PGE

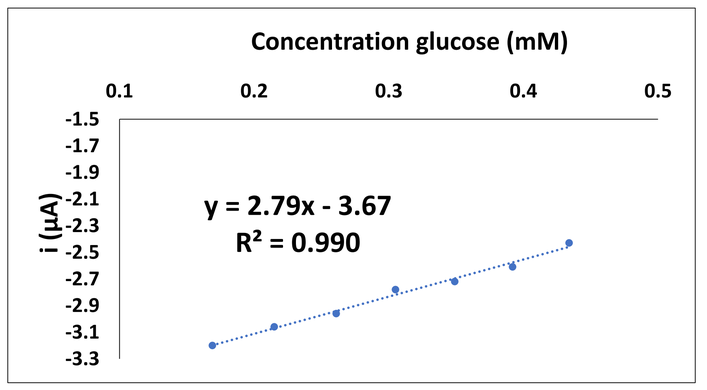


PGE configuration	$I_{p,oxi}$ (µA)	$I_{p,red}$ (µA)	$\lvert I_{p.red}/I_{p,oxi} \rvert$	ΔE_P (mV)
PGE	66.4	-64.9	1.0	95
PGE/MWCNTs	102	-111.9	1.1	92
PGE/SWCNTs	91.6	-147.7	1.6	104
PGE/rGO	109	-116.7	1.1	104
PGE/rGO/MWCNTs	136.8	-151.9	1.1	101

Characterizations and performance of GOx biosensor







Biosensor configuration	Sensitivity (µA mM^{-1} cm^{-2})	LOD (µM)	LOQ (µM)
PGE/SWCNTs/PBSE/GOx	26.0	25.5	77.2
PGE/rGO/SWCNTs/PBSE/GOx	88.5	12.2	36.8

CONCLUSIONS

- Modification of PGE with carbon based nanomaterials enhanced the electrochemical signal; Best results were obtained when PGE was modified with rGO and CNTs;
- A glucose biosensor was successful fabricated through immobilization of GOx with PBSE tethering agent, achieving direct electron transfer.

ACKNOWLEDGMENTS

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