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Electronic Supplementary Material

Wiring of glucose oxidase with graphene nanoribbons: an electrochemical third generation glucose biosensor

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Characterization of GN, native GOx, FAD and apo-GOx

Characterization by UV-Vis spectrophotometry

One peak is observed at around 260 nm which can be attributed to the presence of aromatic structures in FAD and in the peptide chain. Two further peaks found at around 370 and 450 nm are attributed to the flavin group present in FAD [1]. In the spectrum of apo-GOx only the peak at 270 nm, attributed to the aromatic structures in the peptide chain, can be observed whereas the two peaks at higher wavelengths (attributed to FAD) are missing. The reconstituted enzyme shows the same characteristics as the native GOx, proving that the whole process of wiring was successful.

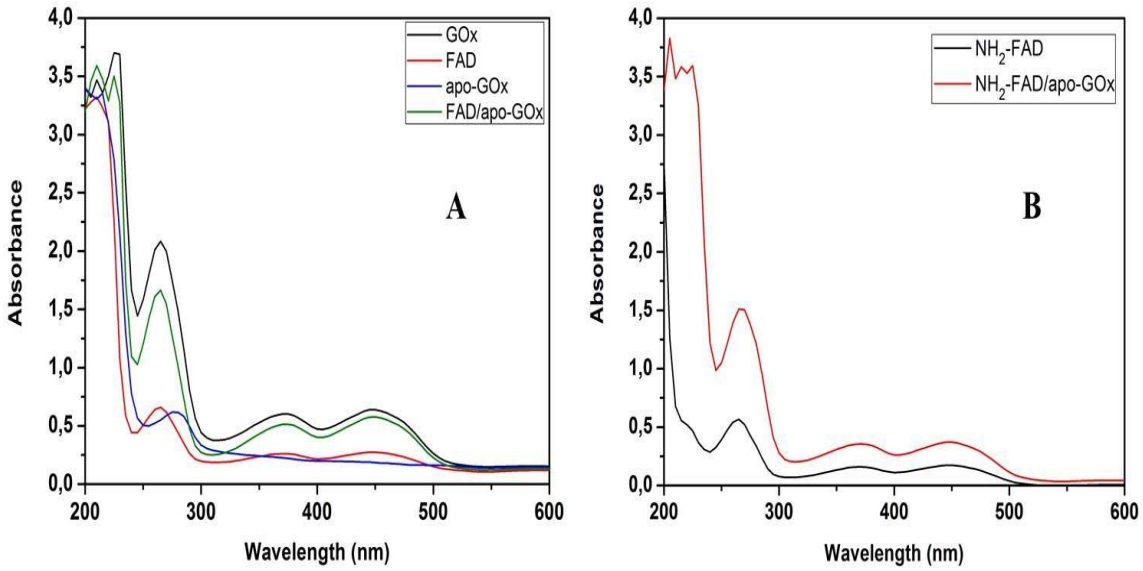

Fig.1S: UV-VIS absorption spectra of native GOx, native FAD, apo-GOx and GOx recombined with native FAD (A); spectra of aminated FAD and of GOx recombined with aminated FAD (B).

DPV of the biosensor

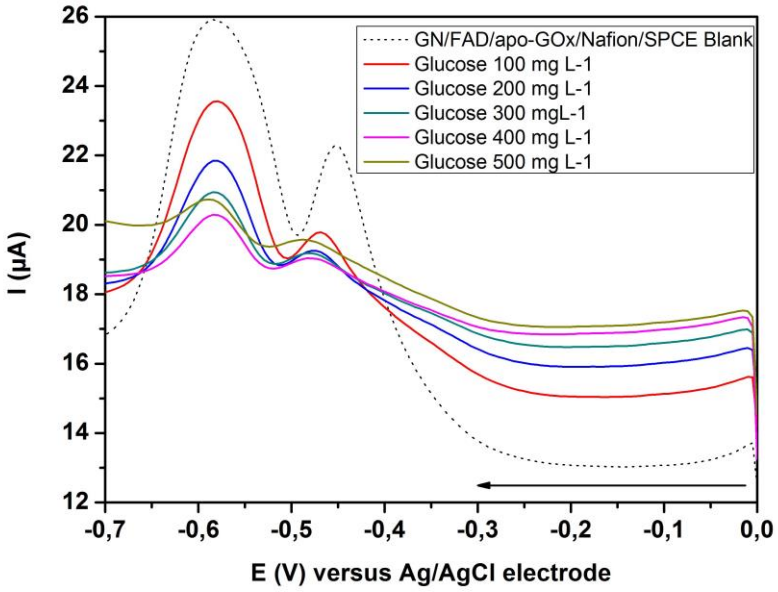

Fig. S2: Differential pulse voltammograms of the biosensor in the absence and presence of glucose.

The effect of operating potential and flow rate

A maximum current in flow injection analysis in the presence of glucose could be observed with a working potential of +0.475 V. A working potential of +0.475 V was used for all further experiments (Figure 2S A).

The flow rate was tested in the range 0.4 to 1 mL·min^{-1} with a maximum at 0.8 mL·min^{-1} which is an outcome of two concurring effects, i.e., dispersion and reaction kinetics. The higher the flow rate the higher is the concentration of the analyte in the sample plug moving through the carrier due to lack of time to be more dispersed. On the other hand fast flow rates cause shorter residence times of glucose over the enzyme layer leading to a less efficient conversion of the substrate (Figure 2S B).

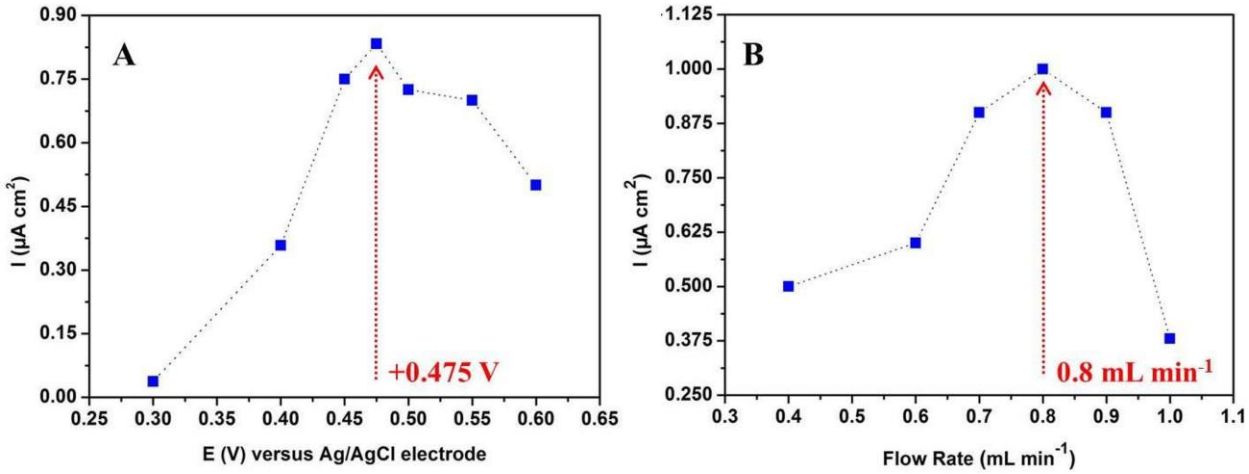

Fig.3S: Dependence of the current response of the GN/FAD/apo-GOx/Nafion/SPCE electrode on the: A) working potential, flow rate of 0.8 mL·min^{-1}; B) flow rate, on operating potential of +0.475 V; carrier 0.1 mol·L^{-1} buffer at pH 7.5; injections of 100 µL glucose 2000 mg·L^{-1}.

Flow injection analysis

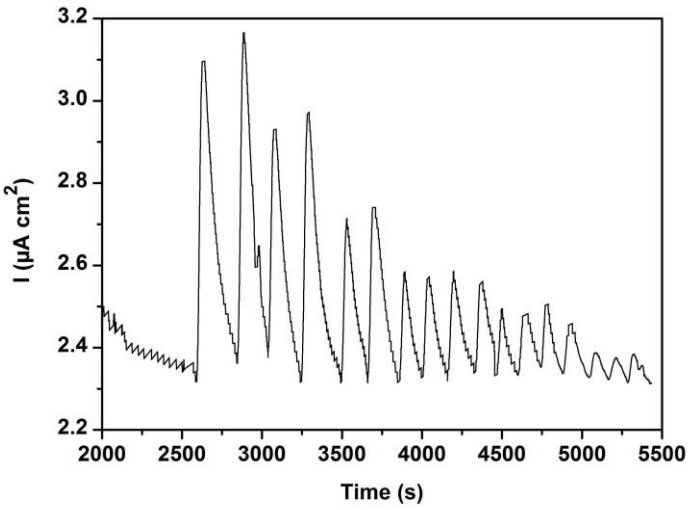

Fig.4S: Amperogram obtained by FIA with a GN/FAD/apo-GOx/Nafion/SPCE; Conditions: flow rate of 0.8 $mL \cdot min^{-1}$; carrier 0.1 $mol \cdot L^{-1}$ buffer at pH 7.5; working potential +0.475 V; injections of 100 µL of glucose with concentrations 2000, 1000, 500, 250, 100, and 50 $mg \cdot L^{-1}$.

References

[1] Li J, Yang Z, Tang Y, Zhang Y, Hu X (2013) Carbon nanotubes-nanoflake-like SnS_2 nanocomposite for direct electrochemistry of glucose oxidase and glucose sensing. Biosens Bioelectr 41:698–703. doi: 10.1016/j.bios.2012.09.059