Evidence of Short-Range Electron Transfer of a Redox Enzyme on Graphene Oxide Electrodes

Supporting Information

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a) $H_2SO_4/KMnO_4$ 3 h, ultrasonic bath Wash: concentrated HCl Vacuum dryingand distilled water b) FCF-GO GOx solution, 10 $mg mL^{-1}$, in PBS FCF-GO-GOxbioelectrode

S1. Chemical Exfoliation and Enzymatic Immobilization Processes.

Figure S1. Chemical procedure for the production of graphene oxide (GO) directly on flexible carbon fiber (FCF) surfaces and (b) schematic representation of the glucose oxidase (GOx) immobilization process.

S2. Purification of GOx.

GOx was purchased from Sigma-Aldrich and to ensure that there were not any impurities present, the following purification procedure for GOx was employed, utilizing Amicon Ultra-15 Centrifugal Filters with a nominal molecular weight limit (NMWL) of 10 kDa. The sample was added to the filter and was centrifuged at 4000 g for 10 min, after which time two fractions were collected; the insoluble material that remained in the centrifuge tube and the filtrate. After purification, the characteristic absorbance spectrum of GOx was observed (Figure S2).



Figure S2. Electronic spectrum in the ultraviolet (UV)-visible region of GOx solution (0.320 g L^{-1}) in phosphate buffer (0.1 mol L⁻¹, pH 7.5). Temperature: 25 °C.

S3. Characterization of the FCFs and FCF-GO by X-Ray Diffraction.



Figure S3. X-ray diffraction (XRD) patterns corresponding to FCFs (black line) and FCF-GO (red line). Insets show the increase of the (001) peak and the shift of the (002) peak after the formation of GO.

S4. Electrochemical Stability of FCF-GO-GOx Bioelectrodes.



Figure S4. (a) Electrochemical stability experiments of FCF-GO-GOx bioelectrodes with 20 consecutive cycles. Scan rate: 50 mVs^{-1} .

S5. pH Change from 5.5 to 8.0



Figure S5. Cyclic voltammograms of FCF-GO-GOx utilizing phosphate buffer solutions as electrolyte, at differing pH values. Concentration of GOx: 5.0 mg mL^{-1} . Scan rate: 50 mV s^{-1} . Temperature: 25° C.



Figure S6. Cyclic voltammograms of FCF-GO-GOx bioelectrodes at several temperatures. Concentration of GOx: 5,0 mg mL⁻¹. Scan rate: 50 mV s⁻¹. Electrolyte: PBSNa, (a) pH 7.0 and (b) pH 7.5.

S7. Michaelis-Menten Plot.



Figure S7. Michaelis-Menten plot showing the dependence of the glucose concentration as a function of the steady quasi-stationary state current density.

S8. Scan Rate Change from 10 to 2000 mVs⁻¹



Figure S8. Cyclic voltammograms at differing scan rates (10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, and 2000 mVs⁻¹ for (a) FCF-GOx and (b) FCF-GO-GOx. Dependence of anodic and cathodic peak current as a function of log scan rate for (c) FCF-GOx and (d) FCF-GO-GOx.