Supporting information

Selectivity and Sustainability of Electroenzymatic Process for Glucose Conversion to Gluconic Acid

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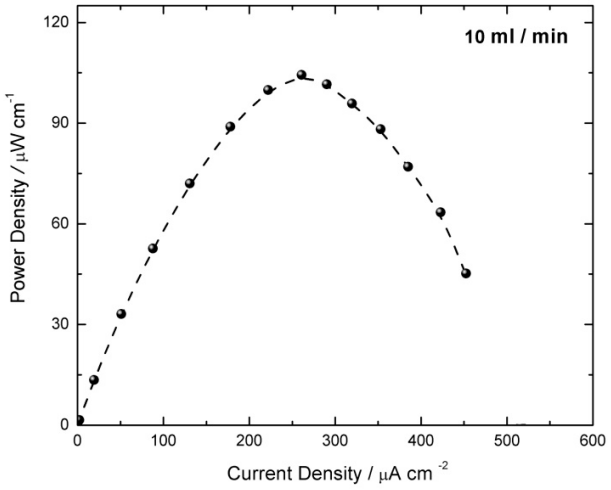
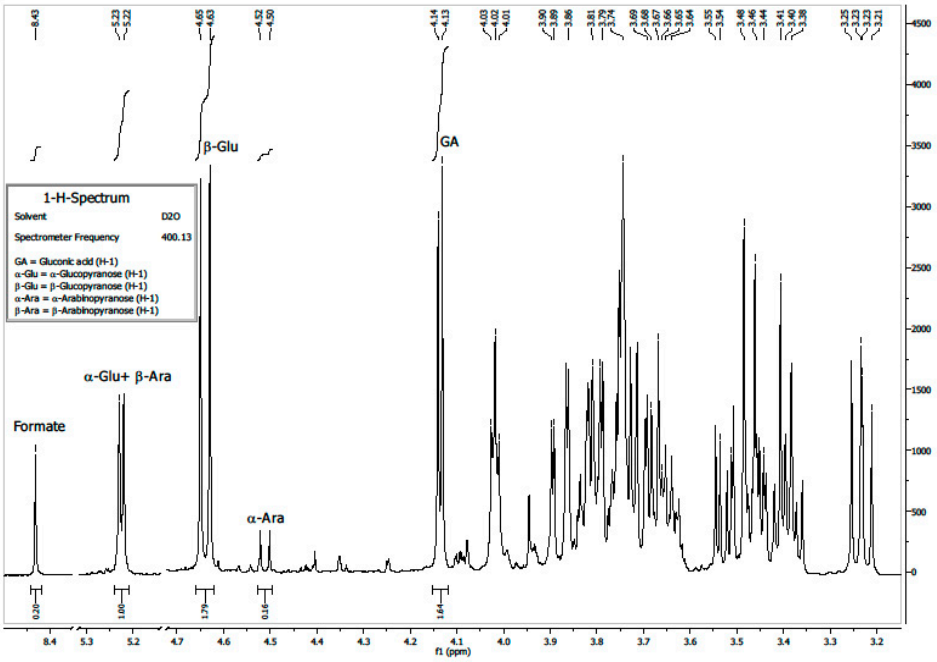
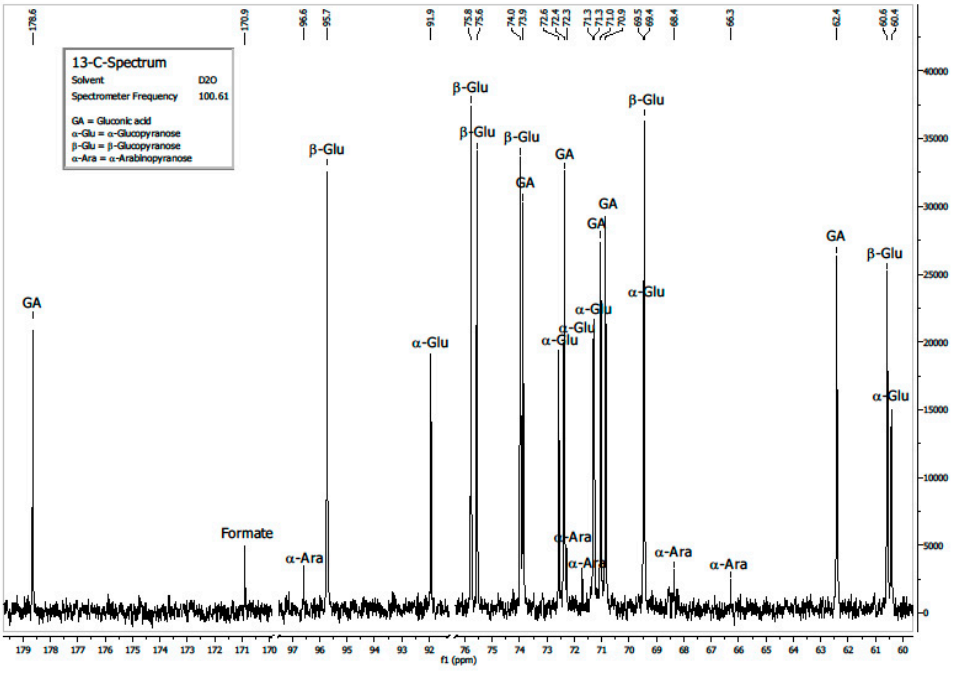


Figure S1 Power curve of the electroenzymatic reactor at 10 ml min^{-1} flow rate, 20 mM glucose and O_2 supplied from the gas phase at the cathode side

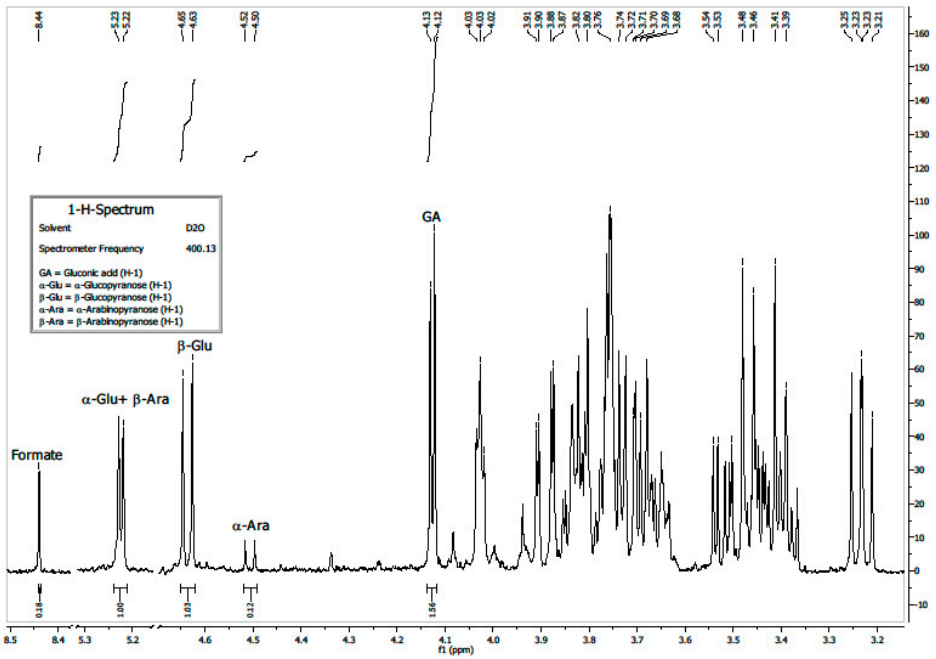


a)

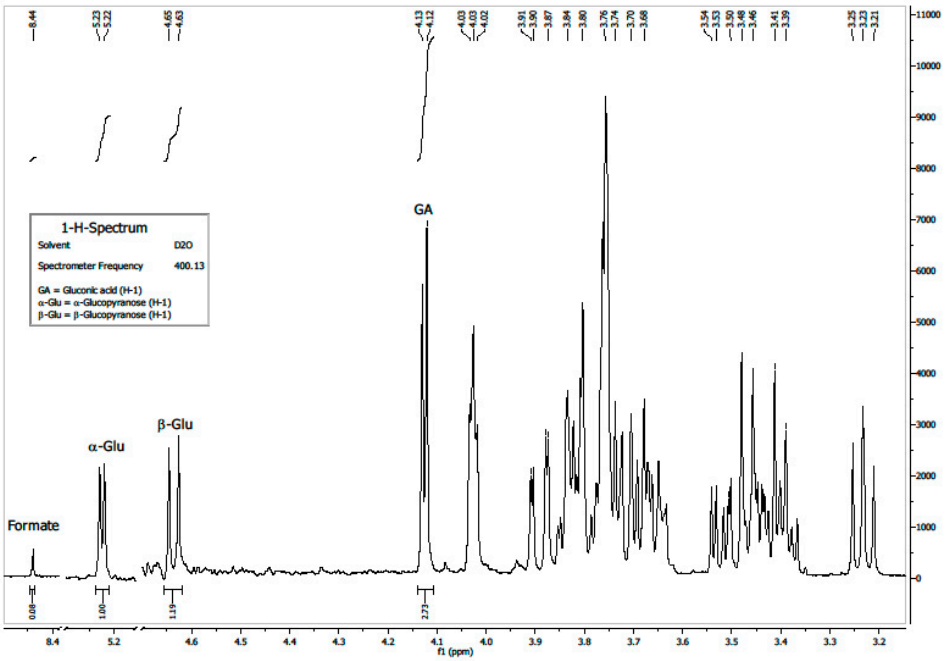


b)

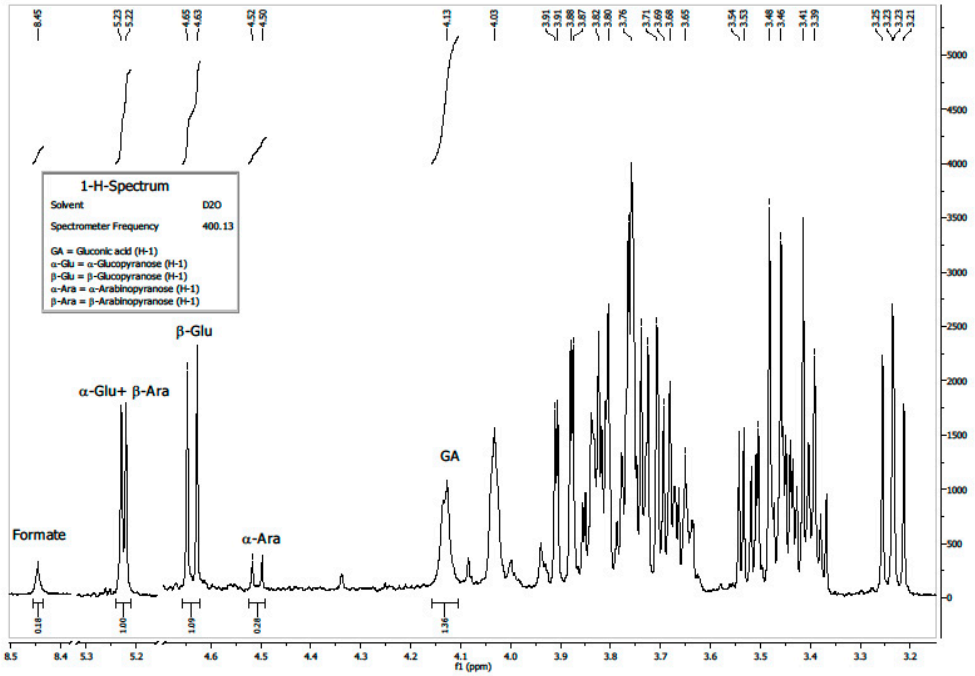
Figure S2 NMR spectra of lyophilized sample for D-arabinose presentation a) ^{1}H spectra b) ^{13}C spectra


1-H-Spectrum
Solvent D2O
Spectrometer Frequency 400.13
GA = Gluconic acid (H-1)
α-Glu = α-Glucopyranose (H-1)
β-Glu = β-Glucopyranose (H-1)
α-Ara = α-Arabinopyranose (H-1)
β-Ara = β-Arabinopyranose (H-1)
GA
β-Glu
α-Glu+ β-Ara
Formate
α-Ara
f1 (ppm)

a)

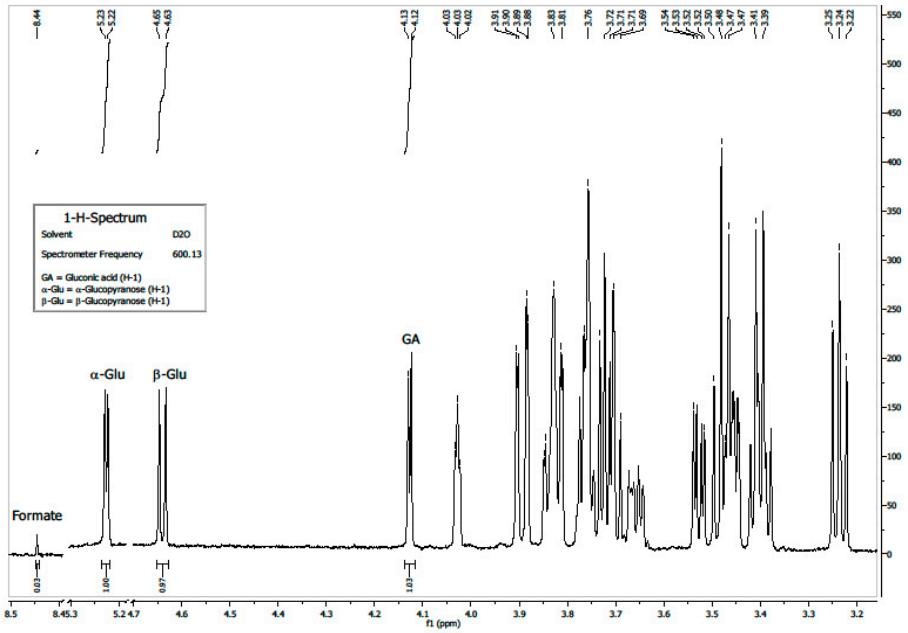

1-H-Spectrum
Solvent D2O
Spectrometer Frequency 400.13
GA = Gluconic acid (H-1)
α-Glu = α-Glucopyranose (H-1)
β-Glu = β-Glucopyranose (H-1)
GA
β-Glu
α-Glu
Formate
f1 (ppm)

b)

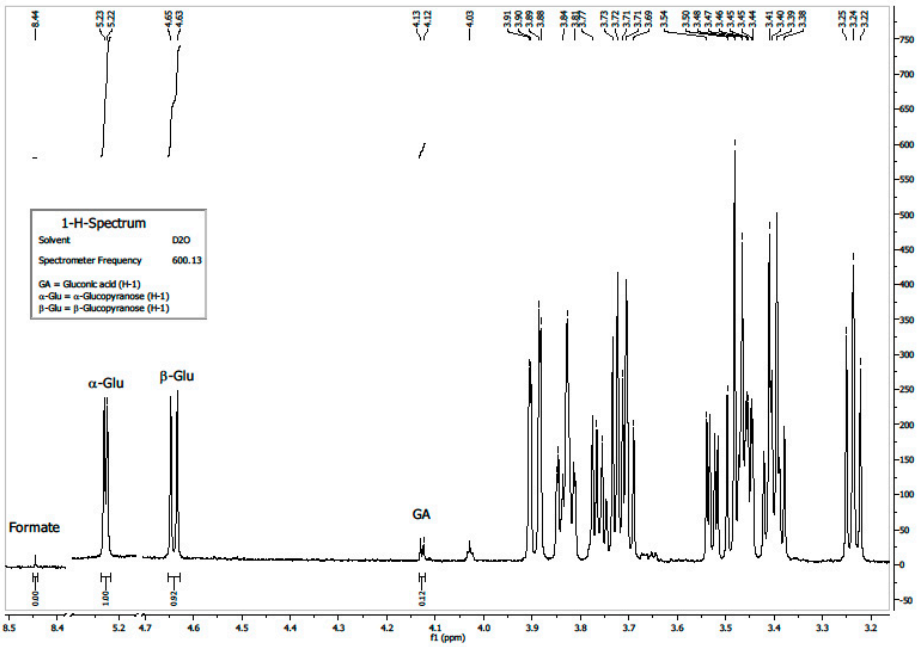


c)

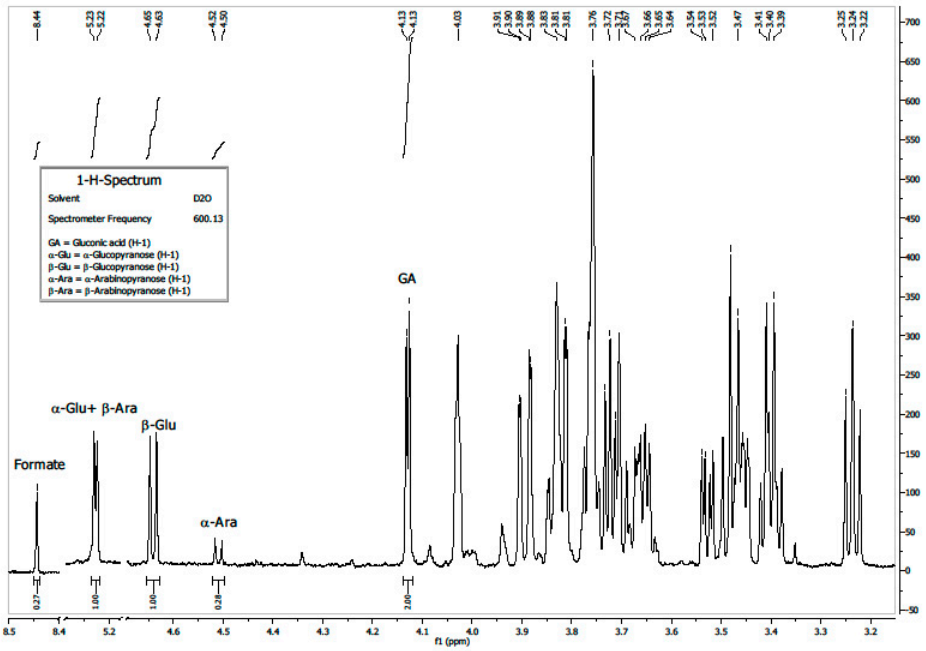
Figure S3 NMR analysis of reaction solutions after 7h in electroenzymatic reactors tested at three different flow rates a) 10 ml min^{-1}, b) 5 ml min^{-1} and c) 2 ml min^{-1}


1-H-Spectrum
Solvent D2O
Spectrometer Frequency 600.13
GA = Gluconic acid (H-1)
α-Glu = α-Glucopyranose (H-1)
β-Glu = β-Glucopyranose (H-1)
α-Glu
β-Glu
GA
Formate
f1 (ppm)

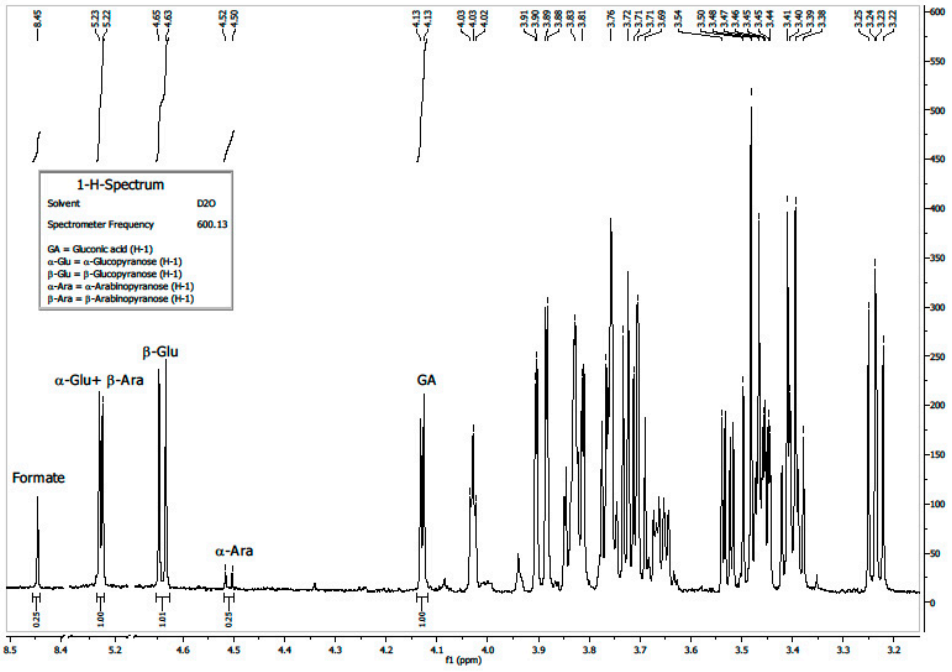
a)


1-H-Spectrum
Solvent D2O
Spectrometer Frequency 600.13
GA = Gluconic acid (H-1)
α-Glu = α-Glucopyranose (H-1)
β-Glu = β-Glucopyranose (H-1)
α-Glu
β-Glu
GA
Formate
f1 (ppm)

b)



c)



d)

Figure S4 NMR analysis of reaction mixtures after 7h of enzymatic electrodes operation in half-cell experiments, a) and b) anode at different potentials; c) and d) cathode, at different potentials, Conditions presented in Table 2

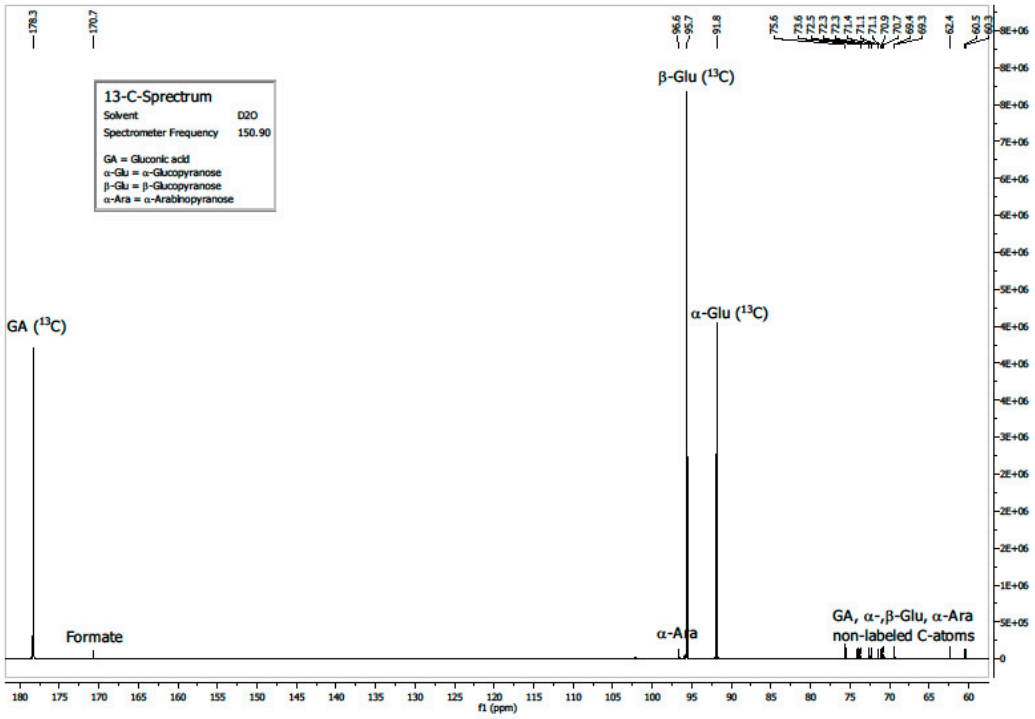
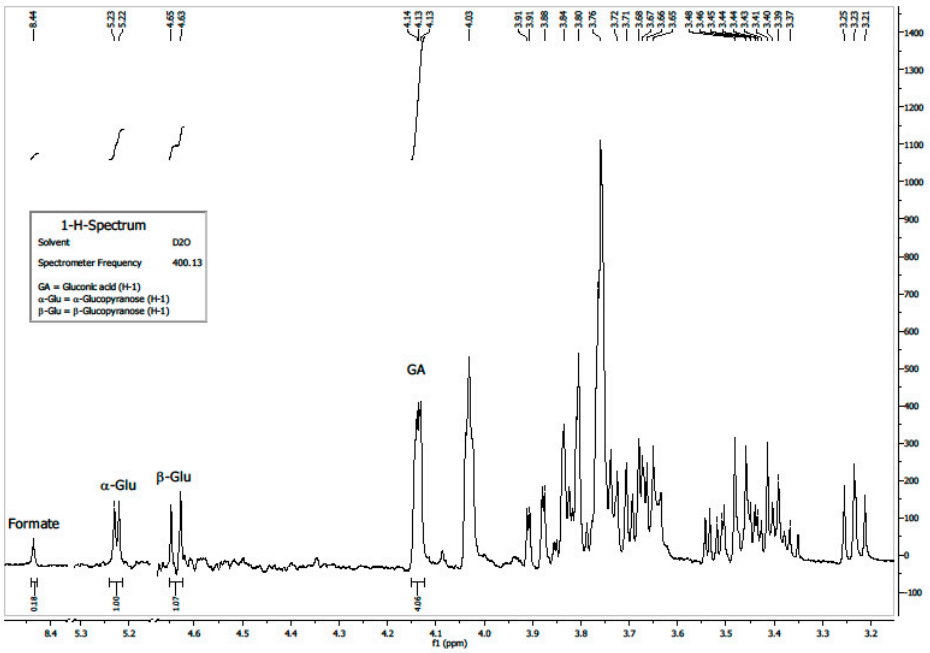
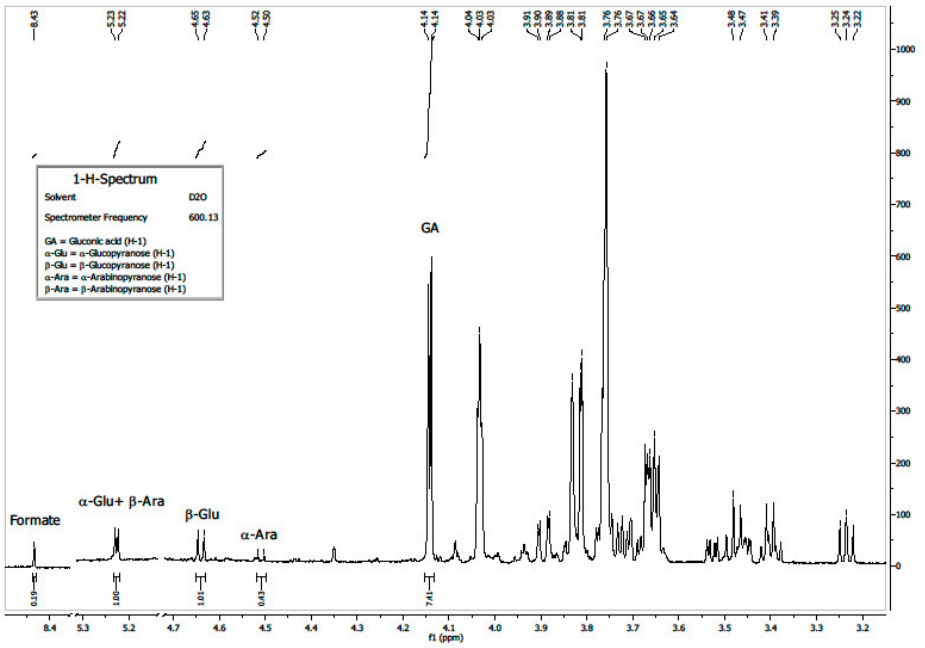


Figure S5 NMR spectra with labeled glucose (^{13}C spectra)



a)



b)

Figure S6 NMR results for electroenyzmatic reactors operated at two different conditions of cell potential and time, 5 ml min $^{-1}$ a) cell potential -0.1 V, time 16 h and b) cell potential variation between -0.1 to 0.05, time 21h, Conditions presented in Table 3

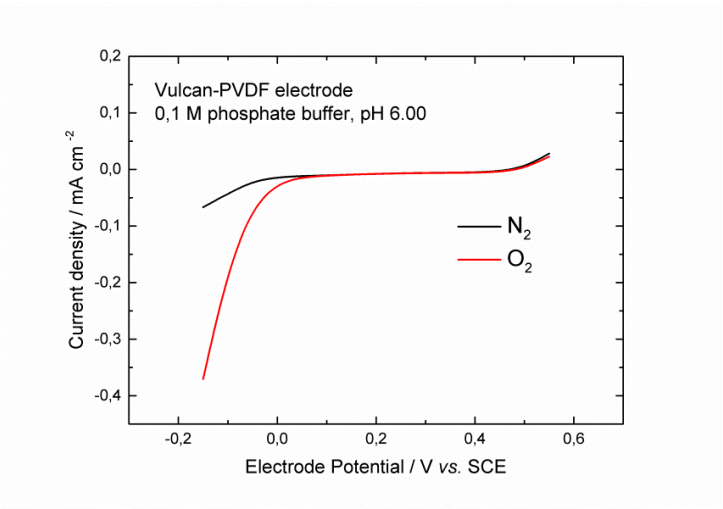


Figure S7 Polarization curves of Vulcan nanomaterial in the presence and absence of oxygen

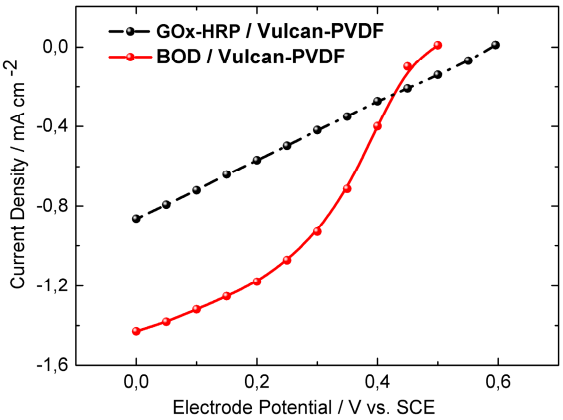


Figure S8 Comparison of BOD and GOx-HRP enzymatic electrode obtained in half-cell system, 20 mM glucose, Conditions for BOD-electrode: pH 7.00, 37 °C, for GOx-HRP: pH 6.00, 22 °C; 400 rpm, O_2