Ultrasensitive Label Free Electrical Detection of Insulin in Neat Blood Serum

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Supporting information

Figures S1 to S5

Figure S1

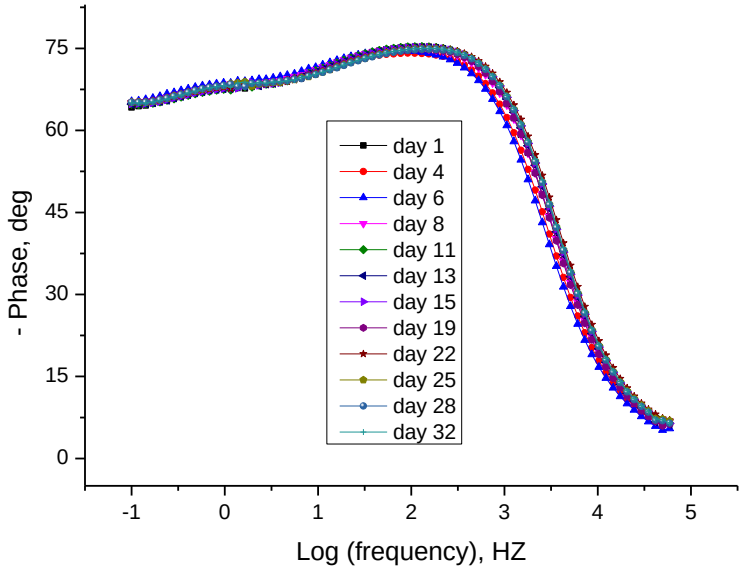

Figure S1 Non-Faradaic EIS Bode phase plots of the electrode modified with PCBMA as recorded at different time intervals in PBS (10 mM, pH 7.4). The excellent interfacial stability is evident (the relative standard deviation of the recorded phase at 0.2 Hz is less than 0.5%).

Figure S2

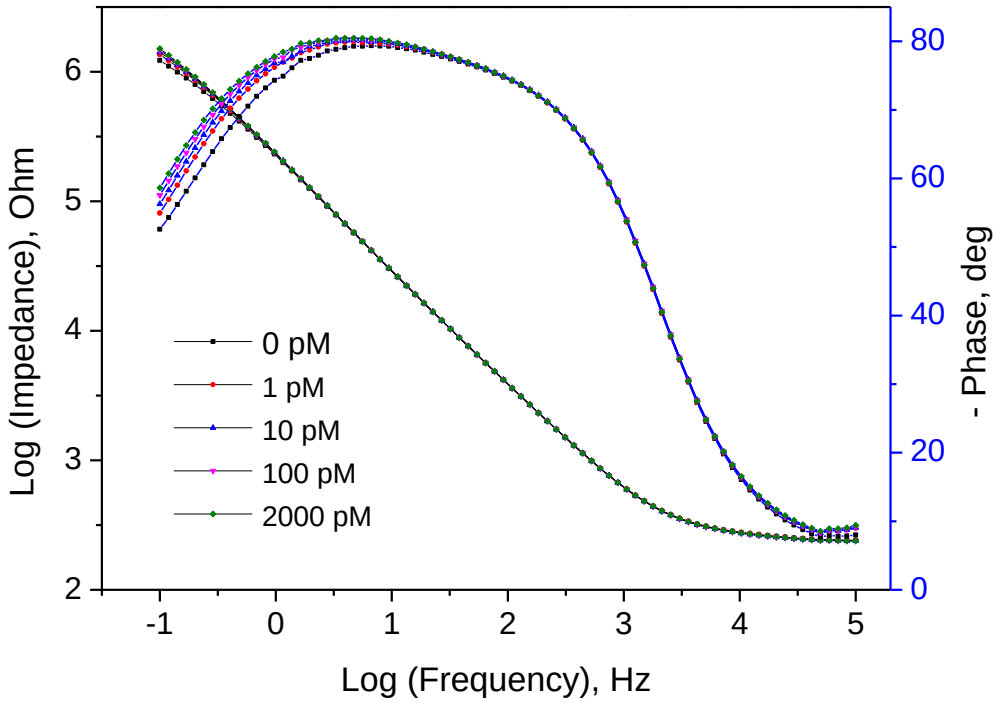

Figure S2 Non-Faradaic EIS Bode plots of the biosensor interfaces after exposure to calibrated concentrations of insulin. Measurements in 10 mM PBS (pH 7.4) across a frequency range of 0.1-100K Hz. Note that, in the lower frequency range, phase change is substantially more significant than the impedance change.

Figure S3

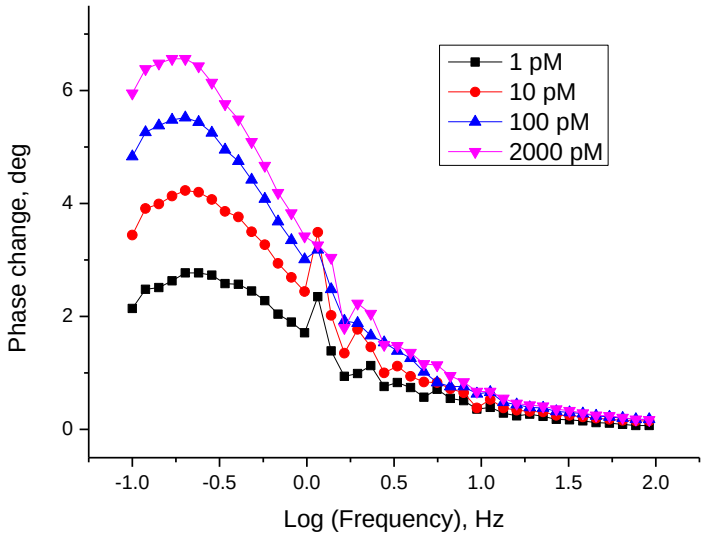

Figure S3 Neat phase changes of the biosensor interfaces after exposure to different concentrations of insulin. Data recorded in PBS (10 mM, pH 7.4) with the highest response at 0.2 Hz [log(0.2) = - 0.7]. The fluctuation in the middle of the curves is a potentiostat artefact that does not impact measurements.

Figure S4

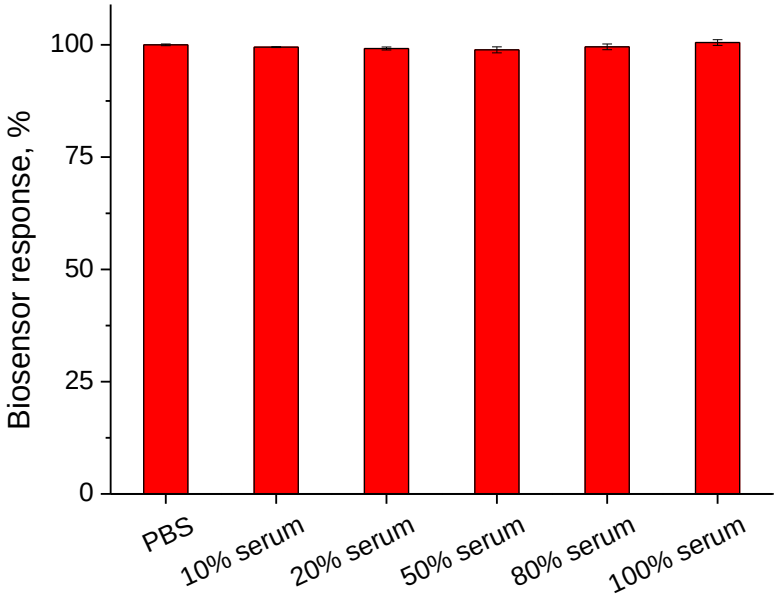

Figure S4 Biosensor response to 50 pM insulin in progressively increasing serum concentration with the response in pure PBS taken as 100%. The response is based on the EIS phase change before and after insulin spiking, and the assay erors are within 2%. Error bars represent the standard deviations of three measurement repeats.

Figure S5

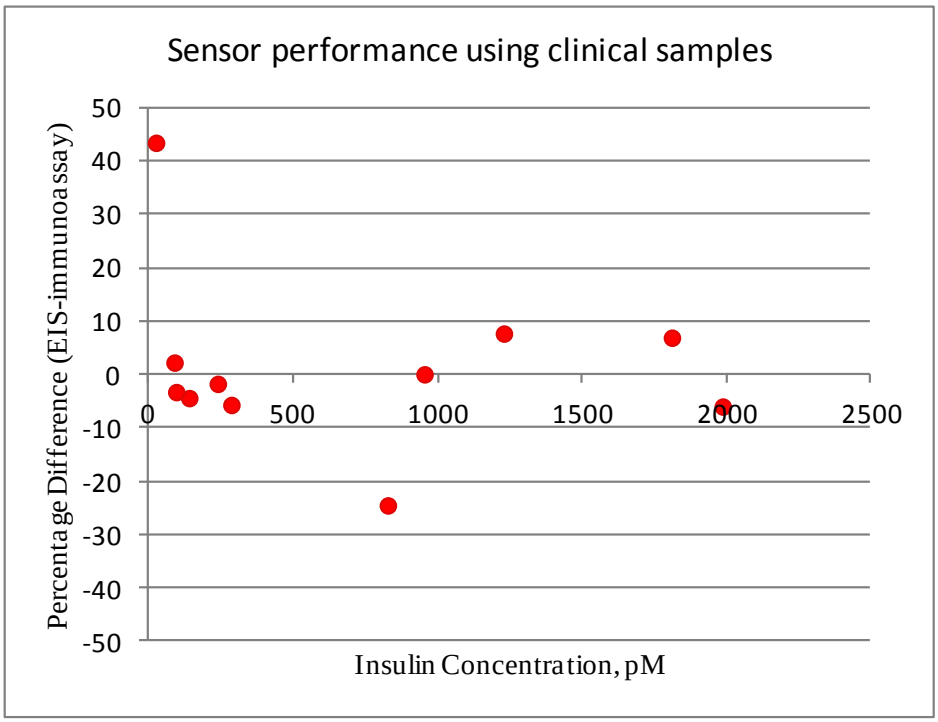

Figure S5 Bland Altman plot of biosensor performance, compared to a clinical standard chemiluminescence assay. The data shown here was acquired at both macro disk gold electrodes and screen printed microelectrode arrays. Although the performance of the latter is slightly worse (in that agreement with chemiluminescence is poorer), it remains within 10% across all samples bar one associated with very low insulin.