Electronic Supplementary Material (ESI) for Analyst.

Supplementary material

Detection of Low Glucose Levels in Sweat with Colorimetric Wearable Biosensors

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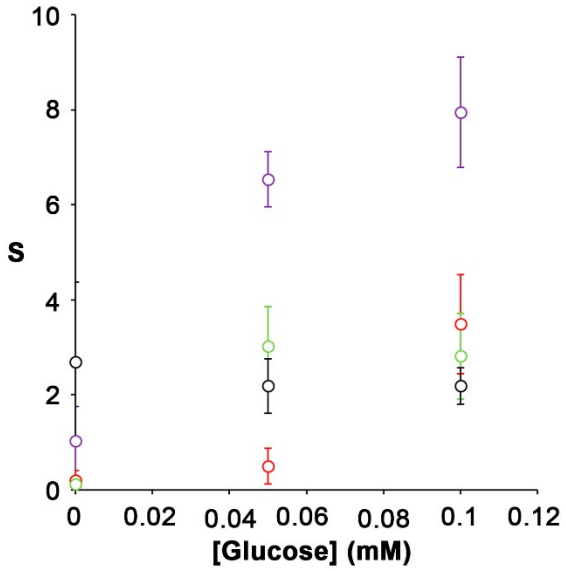

Fig. S1: Optimization of GOX concentration. In a preliminary study we tested 4 different GOX concentrations: 0 μg mL^{-1} (black), 1 μg mL^{-1} (red), 5 μg mL^{-1} (green) and 10 μg mL^{-1} (violet). GOX concentration does affect the sensitivity of the device. The limit of detection for each concentration was 0.07 mM, 0.03 mM and 0.01 mM for 1, 5 and 10 mg mL^{-1} GOx concentrations, respectively. The concentration of HRP and TMB was optimized in a previous paper (reference 17 of the main text).

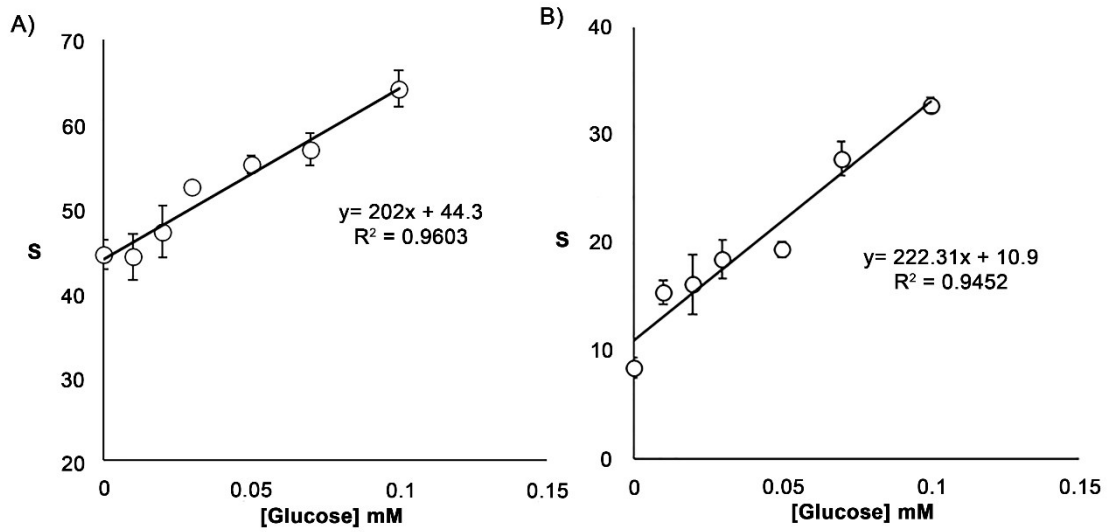

Fig. S2: Comparison between colorimetric signals obtained by photographing the biosensors with a scanner or a smartphone camera, for the same experiment. In (A) photographs were taken with a scanner whereas in (B) they were taken with a smartphone. In (B) a 3 color pattern (black, grey and white) was used to normalize the color scale using Adobe Photoshop. Both methods yielded linear plots. The smartphone-based method yields slightly higher signals and it is more suitable for in-field measurements, as mobile devices are intrinsically portable. Error bars represent the standard deviation (SD) of three replicates (n=3).

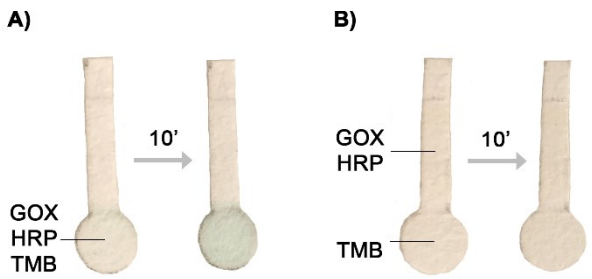

Fig. S3. Spontaneous signal generation when storing enzymes and the chromogen TMB in the same reservoir. In (A) GOX, HRP and TMB were mixed in the same reservoir whereas in (B) enzymes were placed above the detection area. In (A) a spontaneous blue color appears after mixing the reagents in the absence of the analyte. On the contrary, when the enzymes and TMB are spotted into two distinct areas, TMB does not change color. This eliminates an interfering signal that could limit the LOD and dynamic range of the biosensor. In (B) enzymes are carried to the detection area by the sample flow.

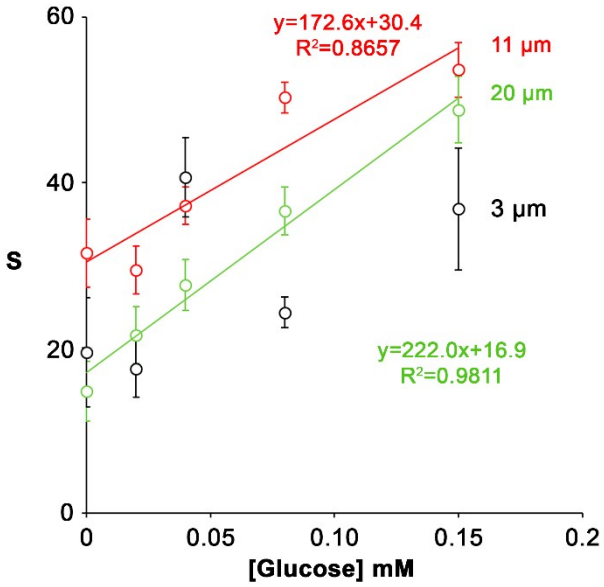

Fig. S4: Effect of the pore size. With paper of 3 µm pore size (black) the signal was not dose-dependent. Results were better with paper of 11 µm pore size (red). When increasing the pore size to 20 µm (green) there was an improvement of the linearity and sensitivity (higher slope of the linear fitting).

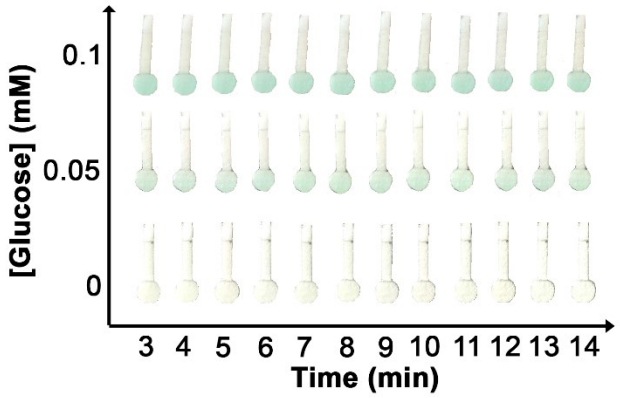

Fig. S5: Pictures of one of the replicates of the experiment showed in Fig. 3A, showing that the color does not change with time.

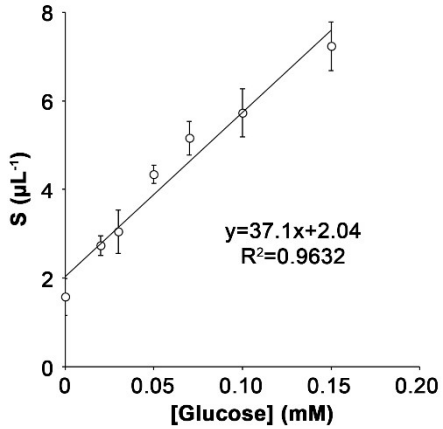

Fig. S6: Calibration curve at 37 ºC used for the quantification of the experiments showed in Fig. 5 and 6.

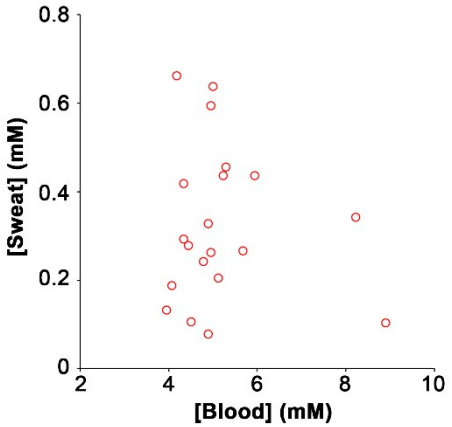

Fig. S7: Correlation of blood and sweat glucose concentrations using the sweat values obtained without volume correction and color normalization. The device is not suitable as an alternative to blood measure when differences in sweat volume and light conditions are not corrected with the companion sensor and color chart.