Electronic Supplementary Information

Sensitive and reliable paper-based glucose sensing mechanisms with smartphone readout using the L*a*b* color space

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Comparison of the color spaces

Color measurements performed by using Digital Color Meter in MacOSX and Color Grab in Android. Canon MF4870dn scanner and Samsung J5 were used for imaging as mentioned in the manuscript. Since the C-Measure application in iosX (iphone 5S) works only in L*a*b mode, comparison of the RGB and L*a*b* color spaces was performed by using android mobile application, Color Grab, running on Samsung J5. Moreover, for a clear representation color spaces were compared only using the data related to quinone method.

A) Color measurement through the scanned images (Computer based measurement)

As mentioned in the manuscript, red color is defined by the positive a* values in L*a*b* color space and mostly a slight change in b* values is observed (Fig S1). In RGB (Red, Green and Blue) color space, red color is defined by all three channels and G and B channels show a notable change in the intensity while the change in R channel is inconsiderable when compared with the changes in G and B channels (Fig S2).

Fig S3 and S4 represent the calibration plots obtained by a* values in L*a*b* and G values in RGB color spaces, respectively. Both plots are highly linear, R^2 value for Fig S3 was found to be 0.988 and for Fig S4, R^2 was 0.993. LOD value for Fig S3 was calculated as 1.18 mM and for Fig. S4 LOD was 0.91 mM. L*a*b* and RGB color spaces showed similar analytical performances by using scanned

images of the paper-based platforms. Due to the constant and well-adapted illumination conditions of the scanner, there was no considerable difference between the color spaces.

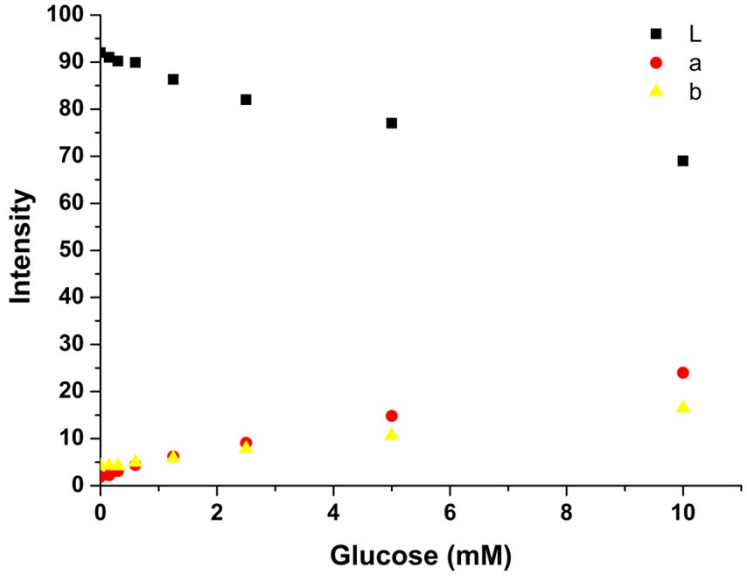

Figure S 1. L*a*b* color profiles of the glucose assay (quinone method)

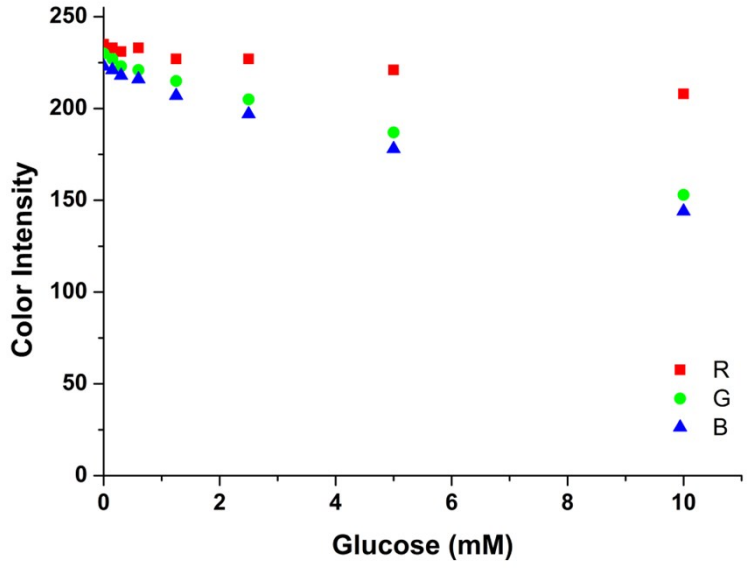

Figure S 2. RGB color profiles of the glucose assay (quinone method)

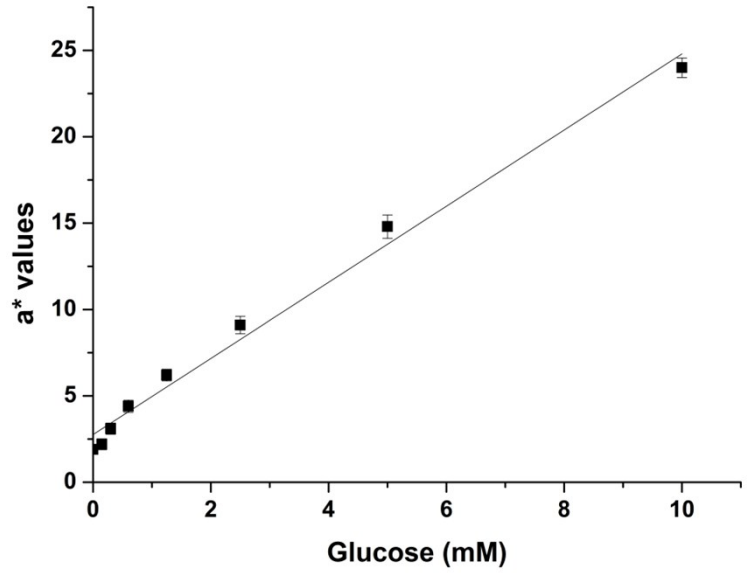

Figure S 3. Calibration plot for Glucose assay representing a* values of L*a*b* color space (Scanned image, Digital Color Meter, MacOSX) (n=5)

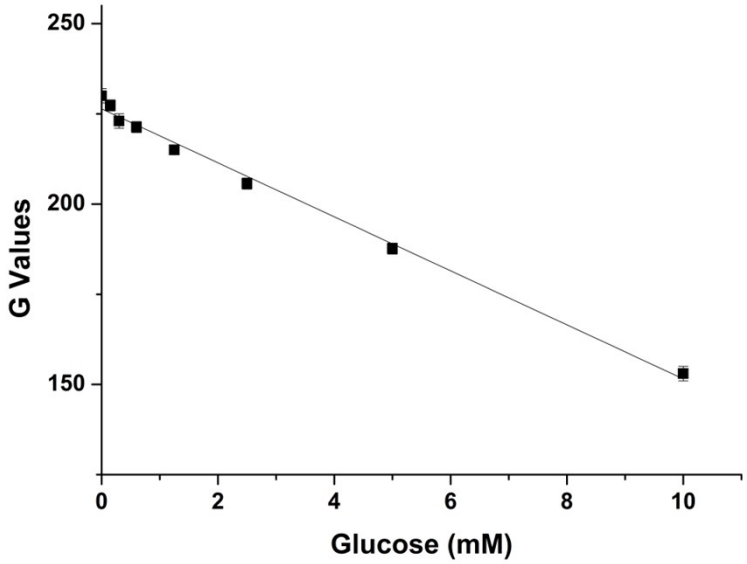

Figure S 4. Calibration plot for Glucose assay representing G values of RGB color space (Scanned image, Digital Color Meter, MacOSX) (n=5)

B) Color measurement by using smartphone

For the smartphone-based color measurement, the images of the paper-based assay platforms were captured with the smartphone camera. The color values were obtained using Color Grab application. Images were captured at ambient lighting conditions without using any additional light source or

without using any specialized setup. For a better visual investigation, one scanned image and two smartphone captured images were depicted in Fig. S5. As it can be seen, background of the scanned image is well illuminated. On the contrary, the smartphone captured images seems to be underexposed and thus the background is too grey.

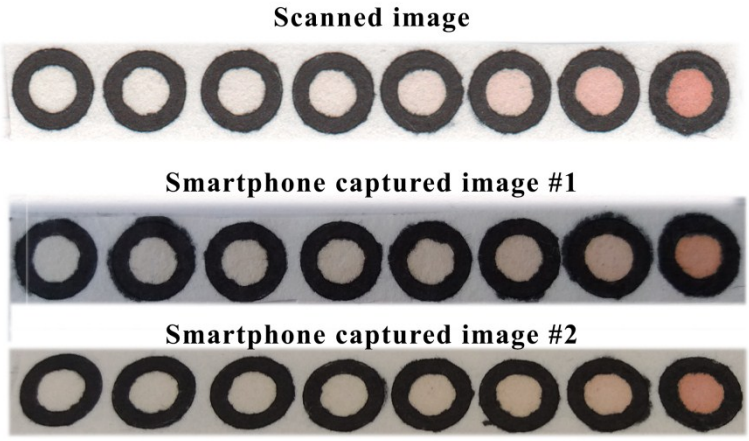

Figure S 5. Scanned and smartphone captured images of the glucose assay platforms (from left to right, glucose concentration increases. 0, 0.15, 0.30, 0.60, 1.25, 2.50, 5.0 and 10 mM)

This can be explained by the ambient lighting conditions, insufficient automatic white balance capability of the smartphone or shadowing during image capturing. Despite all, L*a*b* color space allows to get promising results. It was possible to get a linear calibration curve (Fig. S6) with the color values (a* values) obtained with the smartphone captured images #1 and #2 given in Fig. S5. As it can be seen from Fig. S6, calibration curve is highly linear and the R^2 value was calculated as 0.996. On the contrary, the RGB color space increased the inconsistency of the assay and the linearity of the G values decreased due to the lightening conditions discussed previously. The calibration curve obtained with the G values was given in Fig. S7. The curve showed a nonlinear nature and the R^2 value was calculated as 0.925.

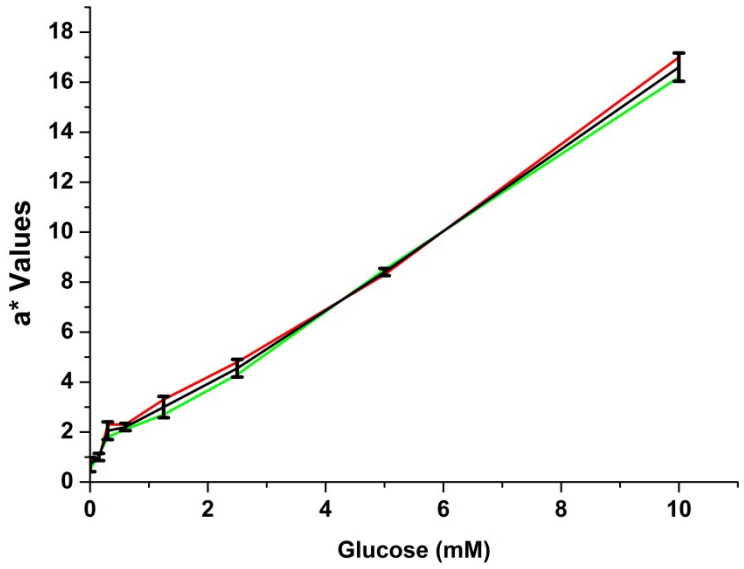

Figure S 6. Calibration plot for glucose assay representing a* values of L*a*b* color space (Samsung J5, Color Grab, Android) (Red solid line: image #1, Green Solid line: image #2 and Black solid line: average values from the images #1 and #2).

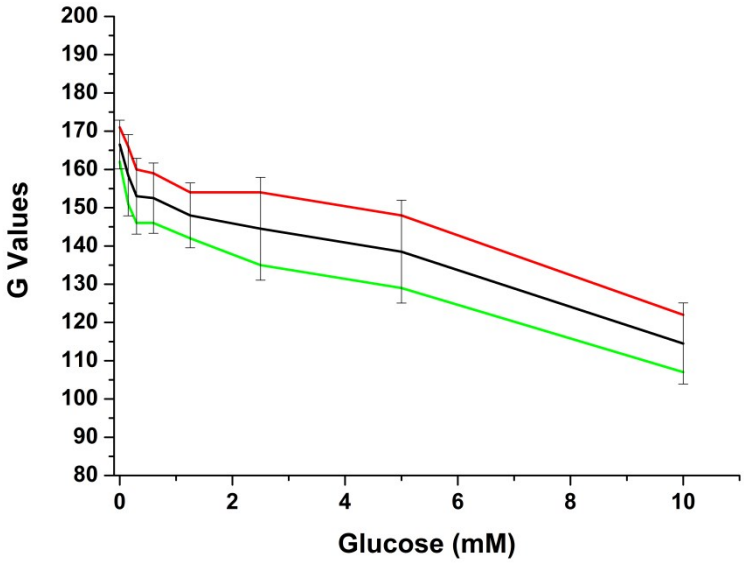

Figure S 7. Calibration plot for glucose assay representing G values of RGB color space (Samsung J5, Color Grab, Android) (Red solid line: image #2, Green Solid line: image #1 and Black solid line: average values from the images #1 and #2).