Supplementary Information for

From Glow-Sticks to Sensors: Single-Electrode Electrochemical Detection for Paper-Based Devices

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Composition of the luminophore contained in the selected glow sticks. In order to rationally approach the utilization of the proposed glow sticks, the chemical composition and optical properties of the dye contained were investigated. Preliminary information, used to approximate the conditions for the separation and the detection were performed by thin-layer chromatography and allowed us to confirm the presence of two dyes (attributed to 9,10-diphenylanthracene that emits blue light and 2,4-di-tert-butylphenyl 1,4,5,8-tetracarboxynaphthalene diamide emits deep red light).[44]

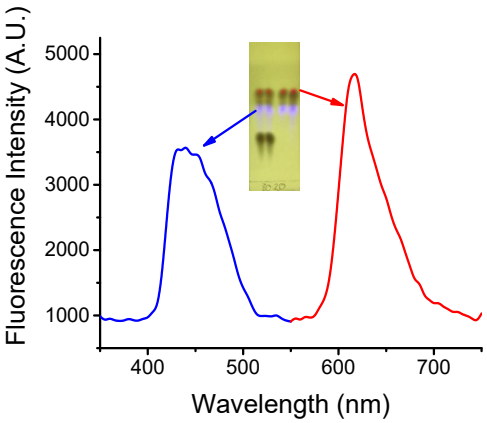

Figure SI 1: TLC (picture collected under UV light, 365 nm) and H_2O_2-induced emission spectra of the dyes contained in the glow stick.

The results were complemented by determining the luminescence response of the dye when exposed to H_2O_2. In this case, the sample was introduced in a fluorimeter (Quantamaster, Photon Technology International, Inc.; without excitation) and the emission was collected to identify two main bands in the blue and red (Figure SI 1), combination that *looks pink* to the naked eye and purple to the camera in the cell phone. Additional results collected by a combination of HPLC-MS (Agilent 6545 LC/Q-TOF systems, Agilent

Technologies, Santa Clara, CA) (that will not be discussed in the manuscript) confirmed the presence of at least 5 additional compounds, including butyl benzoate, butyl citrate, tributyl acetylcitrate, tri-*n*-butyl aconitate and bis[3,4,6-trichloro-2-(pentyloxycarbonyl)phenyl] oxalate.

Additional details about the detection procedure. To limit the effect of stray light, an *ad-hoc* box was built using black plexiglass to fix the position of the smartphone with respect to the single electrode. As shown in Figure SI 3 (left), the box allowed placing the camera 85 mm away from the surface of the device, which was determined as the minimum distance required to focus on the surface of the electrode. The box was mounted on a plexiglass base (Figure SI 3, right), that fixed the position of the microscope slide with respect to the cell phone's camera.

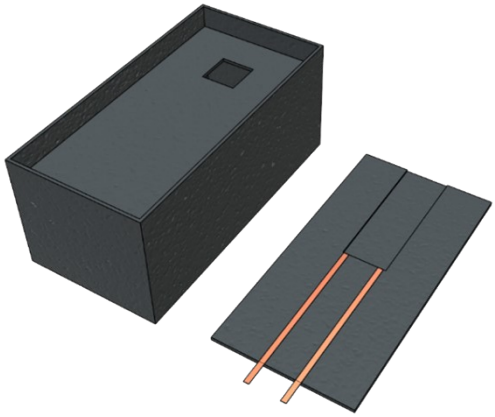

Figure SI 2. Schematic model of smartphone base and electrode contacts. The distance between the camera and the electrode was fixed at 85 mm.

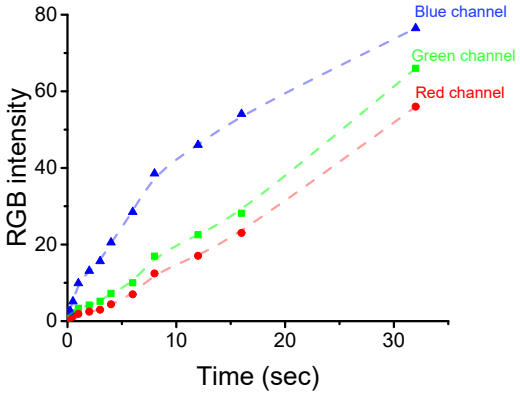

Figure SI 3: Signal intensity as a function of time exposure. Conditions: 2.5 µL sample volume, applied voltage 25 volts, device length 12 mm.

Electric field: In order to estimate the electric field present, the potential difference developed for each electrode was measured using a multimeter. These values were used to calculate a potential difference of 9.04 $V.cm^{-1}$ (Figure SI 4) that was ultimately selected as the optimum value and was used for the remaining experiments.

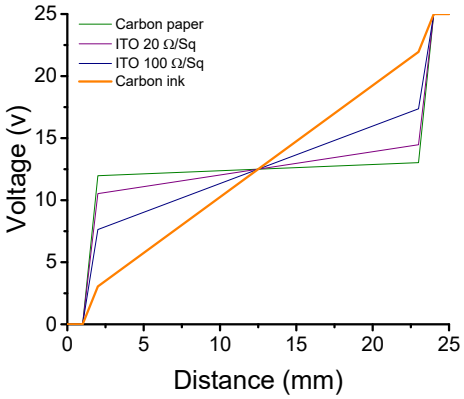

Figure SI 4: Electric field gradient for the different electrodes studied.

Analysis of real samples: For these experiments, oil samples (20 mL) were placed in a convection oven (80 ^{o}C) and aliquots were taken at different intervals (12 h apart). The results (Figure SI 5) showed that longer incubation periods led to higher ECL responses (see orange bars), confirming the formation of the peroxides in the oil samples. These findings were validated by analyzing the same samples by the mFOX method (see purple bars).[55]

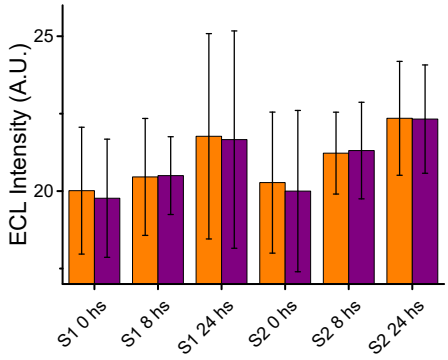

Figure SI 5: ECL intensity of edible oils after heating process. Conditions: 2.5 µL sample volume, voltage applied 25 volts, 1.2 mm paper length.

The response after addition of standard solutions of glucose was evaluated against the curve developed with H_2O_2 (shown in Figure 5) showing a clear overlap between both curves (Figure SI 6) and confirming the utility of the proposed system towards the analysis of H_2O_2.

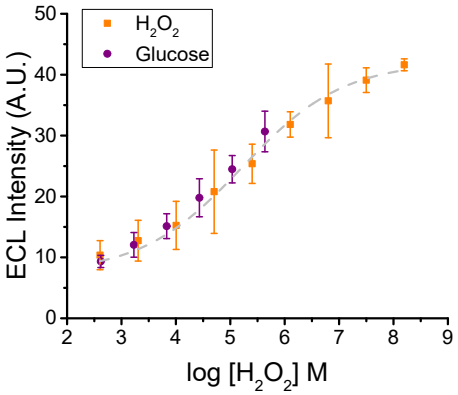

Figure SI 6: Dependence of the ECL intensity with the concentration of H_2O_2 or glucose (upon glucose oxidase treatment). Conditions: 2.5 µL sample volume, voltage applied 25 volts, 1.2 mm paper length.

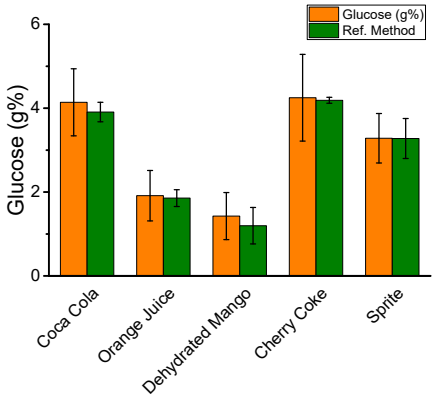

Figure SI 7: Determination of glucose in soft drinks and fruit juice using the proposed SEES biosensor (orange bars) or the reference method (green bars). Conditions used for the SEES sensor: 2.5 µL sample volume, voltage applied 25 volts, 1.2 mm paper length.

The proposed system was applied to determine glucose in different samples, including three different soft drinks, fresh fruit juice and a sample of dehydrated fruit. These samples were either diluted (x1000 times, for the soft drinks) or vortexed for 10 min in buffer (citrate, pH = 6.0). Results from each of these samples (which are presented in Figure SI 7). Results from each of these samples were validated using a colorimetric method based on a reaction using glucose oxidase and iodine (reading the absorbance at 353 nm).[56]