## **3D** printing pen for patterning electrochemical sensors on a paper

## platform for capsaicin detection

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**Figure S1** – (A) Device mask manufactured in the  $CO_2$  laser, measuring 3.5 cm in height and 4 cm in width. (B) The mask features three electrodes filled with filaments: WE for the graphite filament and CE and RE for the commercial filaments. (C) Fully assembled device, including the rPLA filament barrier to create the reservoir, and a real comparison using a quarter-dollar coin to illustrate its dimensions.



**Figure S2** – SEM images of 3D-printed electrodes using the bespoke CB/graphite/rPLA filament in different magnifications: (A) 5,000X; (B) 15,000X; (C) 25,000X; (D) 50,000X. The surface was polished with a Wetordry 1500 sandpaper.



**Figure S3 – (A)** Reproducibility (N = 7) and **(B)** repeatability (N = 13) studies recorded in the presence of  $[Ru(NH_3)_6]^{3+}$  (1 mM in 0.1 M KCl). Scan rate of 100 mV s<sup>-1</sup>.



**Figure S4** – (A) Cyclic voltammograms (100 mV s<sup>-1</sup>) of 500  $\mu$ M capsaicin (first cycle) in 0.12 M BR buffer with different pH values recorded at CB/graphite/rPLA electrodes in the ePAD. (B) Relation between pH and peak current (I<sub>p</sub>) and (C) peak potential (E<sub>p</sub>) for capsaicin oxidation. (D) Cyclic voltammograms (100 mV s<sup>-1</sup>) of 500  $\mu$ M capsaicin in different supporting electrolytes, i.e. 0.12 M BR buffer pH 1, 0.1 M HCl, and 0.1 M H<sub>2</sub>SO<sub>4</sub>.



**Figure S5** – (A) Cyclic voltammograms of 500  $\mu$ M capsaicin (second and subsequent cycles) in 0.12 M BR buffer pH 1 recorded in different scan rates (50 to 500 mV s<sup>-1</sup>). (B) Linear correlation of peak potential (E<sub>p</sub>) with the natural logarithm of scan rate (ln v).



**Figure S6** – DPVs of 50  $\mu$ M capsaicin (potential step: 8 mV; amplitude: 50 mV) performed in BR buffer pH 1.0 in the CB/graphite/rPLA and the commercial CB/PLA electrodes in the ePAD.