

Supporting Information

Microporous carbon for fast and simple electrochemical detection of imidacloprid insecticide in fruits and water samples

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S1 Effect of pulse amplitude in DPV measurements

Figure S1 shows the differential pulse voltammograms of 0.60 mM IMP at MC/SPE at the pulse width of 0.05 s, the pulse period of 0.5 s, and varied pulse amplitudes in the range of 0.010 – 0.20 V. The peak currents increased with increasing pulse amplitude. However, at the amplitude of 0.20 V, the reproducibility is not sufficiently good for IMP detection. To compromise between the sensitivity and reproducibility, the pulse amplitude of 0.15 V was thus chosen for the analysis.

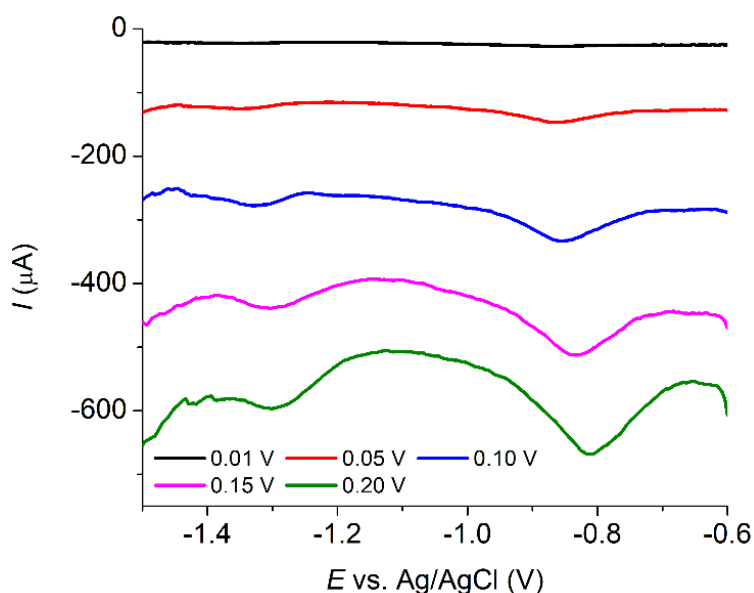


Figure S1: Differential pulse voltammetry at microporous carbon screen-printed electrodes (MC/SPE) of 0.60 mM imidacloprid in PBS pH 7.0 at the pulse width of 0.05 s, the pulse period of 0.5 s, and varied pulse amplitudes.

S2 Electroactive surface area of SPE and MC/SPE

The electroactive surface area of the electrodes were determined by cyclic voltammetry in the solution of 1.0 mM hexaammineruthenium(III) ($[\text{Ru}(\text{NH}_3)_6]^{3+}$ or RuHex), which is a standard outer-sphere redox probe, in the presence of 0.10 M KCl supporting electrolyte at varied scan rates. The electroactive surface areas were then analyzed according to the Randles–Sevcik equation for an electrochemically reversible one-electron transfer process (eqn. 1, main text) to be $7.41 \times 10^{-6} \pm 0.14 \times 10^{-6} \text{ m}^2$ and $2.31 \times 10^{-5} \pm 0.11 \times 10^{-5} \text{ m}^2$ for a bare SPE and MC/SPE, respectively.

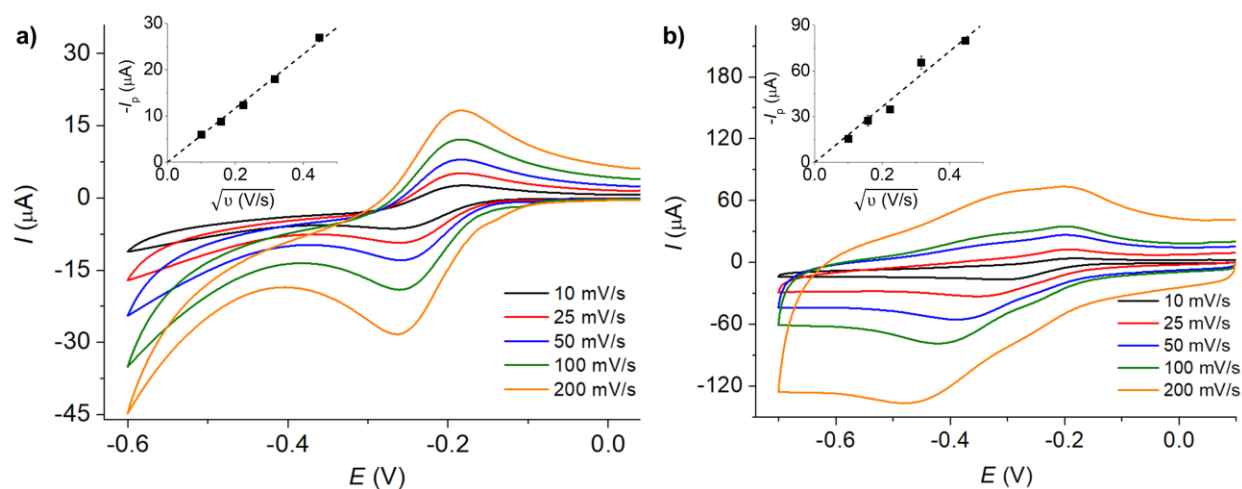


Figure S2: Cyclic voltammetry of 1.0 mM $[\text{Ru}(\text{NH}_3)_6]^{3+}$ in 0.10 M KCl at **a)** bare SPE and **b)** MC/SPE at varied scan rates. The inlays show the plots of peak currents (I_p) vs. square root of scan rates (\sqrt{v}). The data points and error bars represent the mean values and standard deviation ($n = 3$), respectively.

S3 EIS analysis of SPE and MC/SPE

Electrochemical impedance spectroscopy (EIS) was performed at bare SPE and MC/SPE (Figure S3) in the solution of 1.0 mM $\text{Fe}(\text{CN})_6^{3-/4-}$ and 0.10 M KCl in the frequency range of 1 – 10^5 Hz, and the amplitude of 5 mV. The data were fitted with a Randles circuit model (Figure S3, inlay). The charge transfer resistances (R_{ct}) of SPE and MC/SPE were determined to be 16.9 ± 0.6 k Ω and 0.021 ± 0.009 Ω , respectively. The double layer capacitances (C_{dl}) of SPE and MC/SPE were 1.17 ± 0.07 μF and 56.0 ± 1.3 μF , respectively.

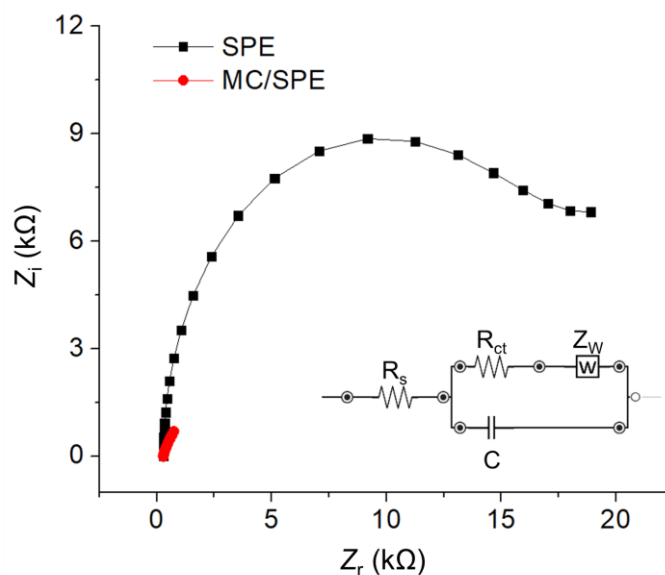


Figure S3: EIS spectra of bare SPE vs. MC/SPE in 1.0 mM $\text{Fe}(\text{CN})_6^{3-/4-}$ and 0.10 M KCl in the frequency range of 1 – 10^5 Hz, and the amplitude of 5 mV.