

Supplementary Information

Enhancing electrochemical sensitivity of hydroquinone using hydrophobic deep eutectic solvent-based carbon paste electrode

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Table S1. Optimization of SWAdASV parameters for 1.0×10^{-3} mol L⁻¹ hydroquinone in acetate buffer solution (pH 4.74)

Parameters	studied interval	Optimum value
Accumulation potential, E_{acc} (mV)	0 – 200	150
Accumulation time, t_{acc} (s)	0 – 240	90
Amplitude, a (mV)	10 – 100	70
Frequency, f (Hz)	10 – 90	30
Potential increment, ΔE_s (mV)	1.0 – 10	5.0

Table S2. Inter-day repeatability study using HDES 6.0 electrode for different hydroquinone concentration in 0.1 mol L⁻¹ acetate buffer solution (pH 4.74)

[H ₂ Q] / mol L ⁻¹	<i>I</i> _{ap} / A ^a	% RSD ^a
5.0 × 10 ⁻⁴	(5.6±0.2) × 10 ⁻⁵	6.37
1.0 × 10 ⁻³	(1.1±0.5) × 10 ⁻⁴	7.54
2.0 × 10 ⁻³	(1.7±0.8) × 10 ⁻⁴	6.38

^a Standard deviation was calculated based on results obtained on three consecutive days and at three different electrodes.

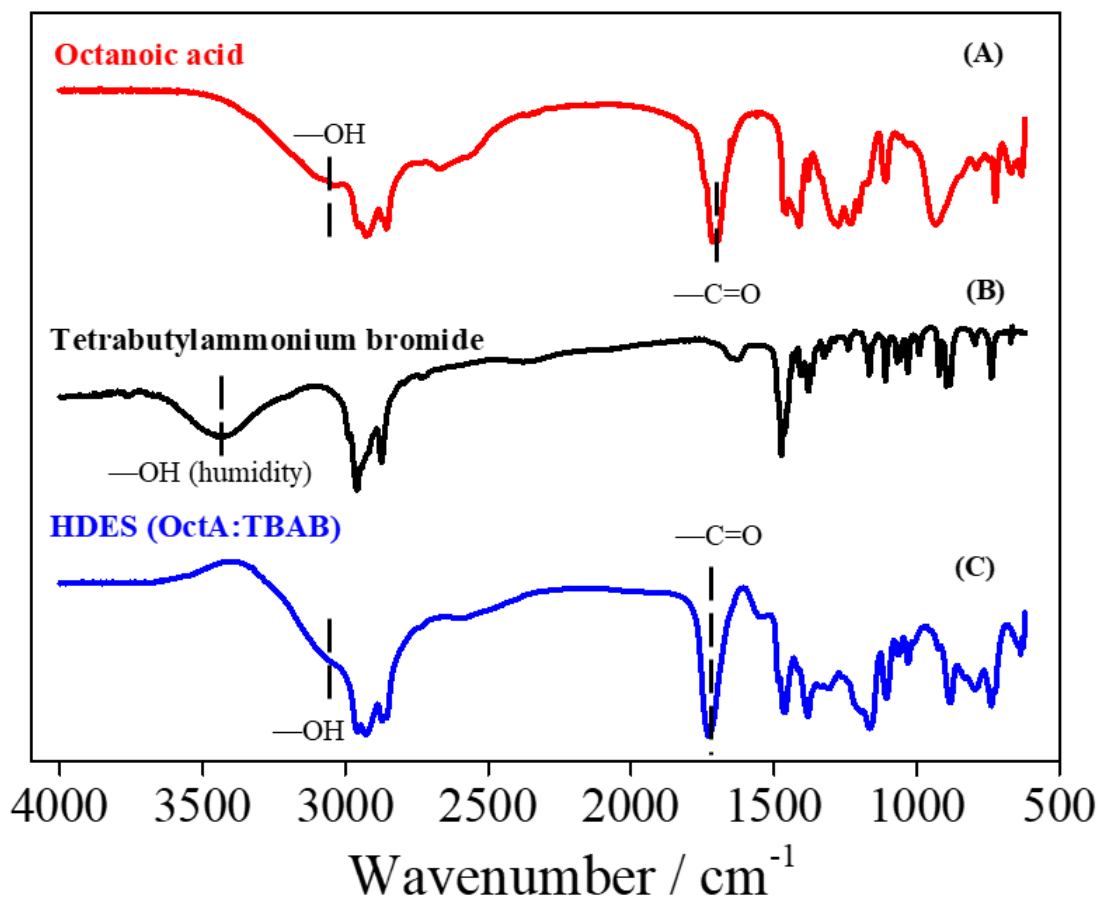


Fig. S1. FT-IR spectra of (A) octanoic acid, (B) tetrabutylammonium bromide, and (C) HDES (OctA:TBAB).

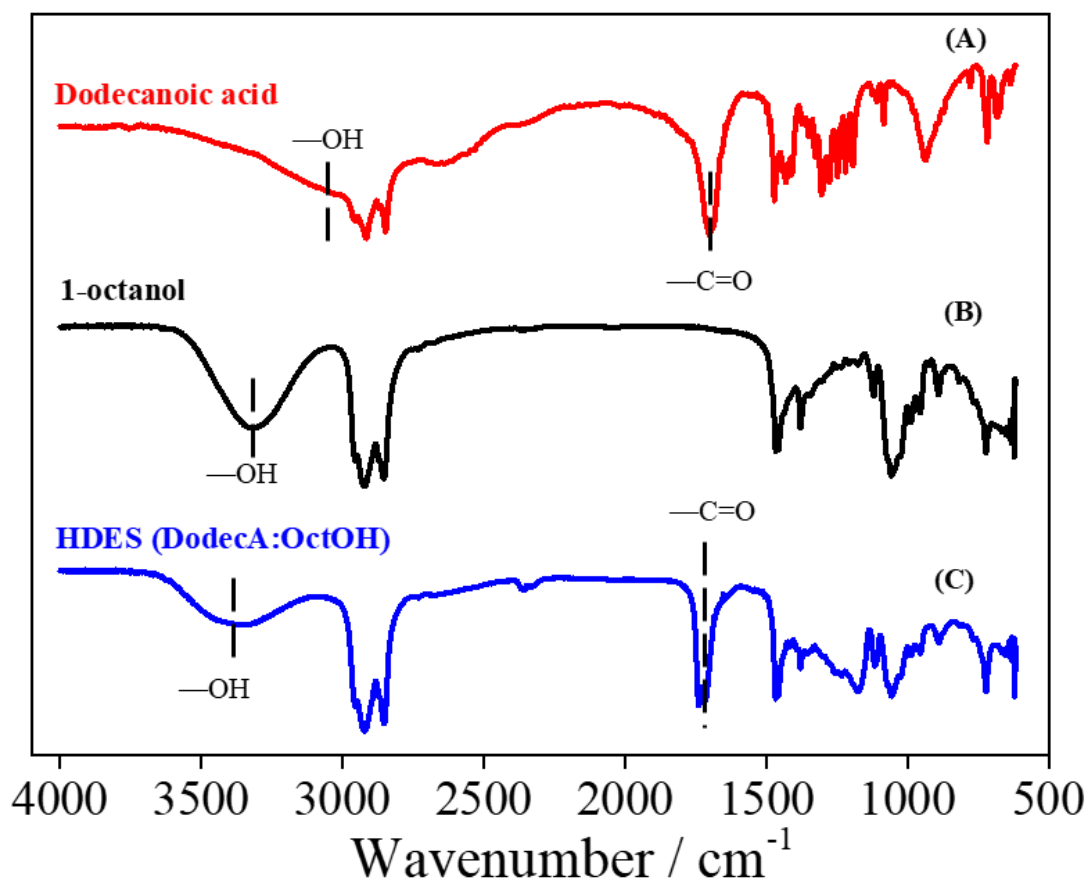


Fig. S2. FT-IR spectra of (A) dodecanoic acid, (B) 1-octanol, and (C) HDES (DodecA:OctOH).

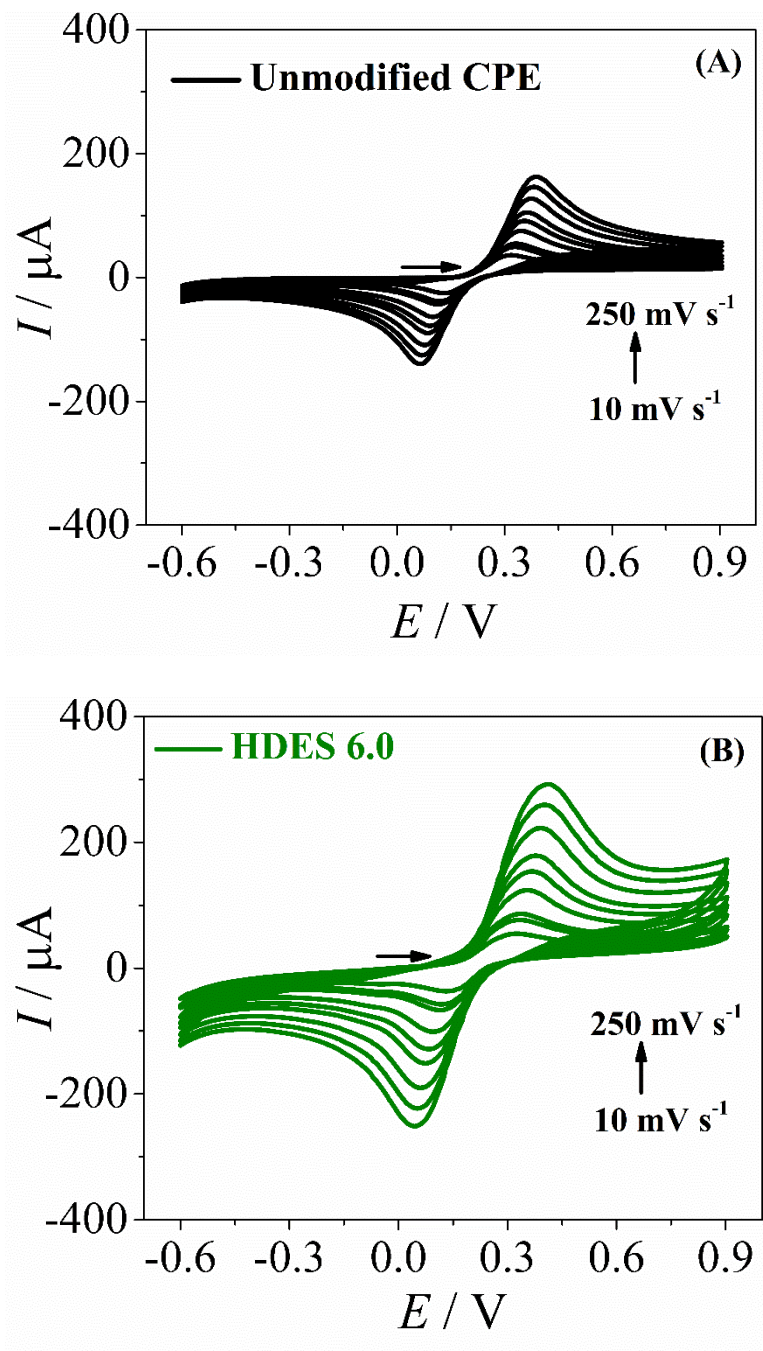


Fig. S3. Cyclic voltammograms for $1.0 \times 10^{-3} \text{ mol L}^{-1}$ H_2Q in 0.1 mol L^{-1} acetate buffer solution (pH 4.74) using (A) unmodified and (B) HDES 6.0 electrodes at different potential scan rates of 10, 20, 25, 50, 75, 100, 150, 200 and 250 mV s^{-1} and an Ag/AgCl /KCl (3.0 mol L^{-1}) reference electrode.

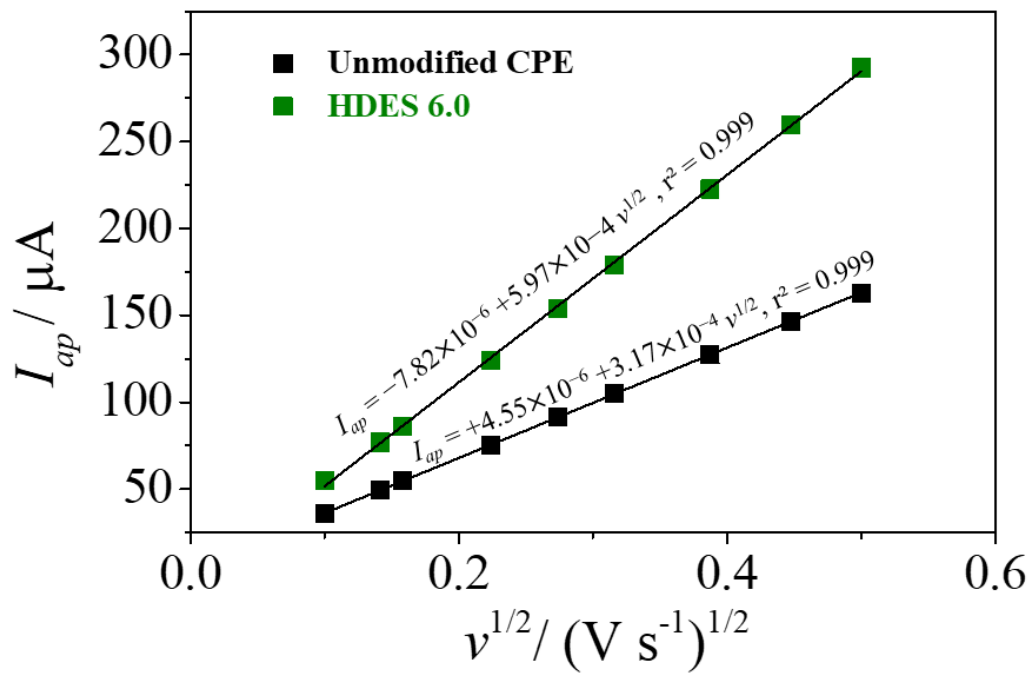


Fig. S4. I_{ap} vs. $v^{1/2}$ curves for unmodified (■) and HDES 6.0 (■) electrodes. Insert: linear equations.

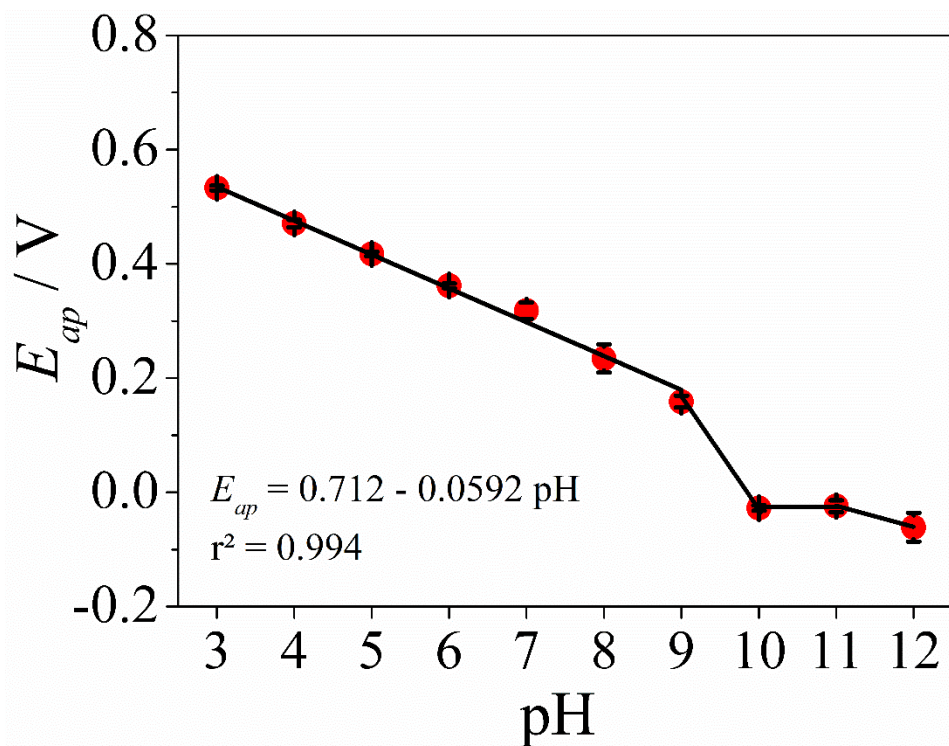


Fig. S5. E_{ap} vs. pH curve using HDES 6.0 electrode for $1.0 \times 10^{-3} \text{ mol L}^{-1} \text{ H}_2\text{Q}$ in 0.04 mol L^{-1} Britton-Robinson buffer solution at pH of 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, and 12.0. SWV parameters: f : 30 Hz, a : 70 mV, ΔE_s : 5.0 mV. ($n=3$).

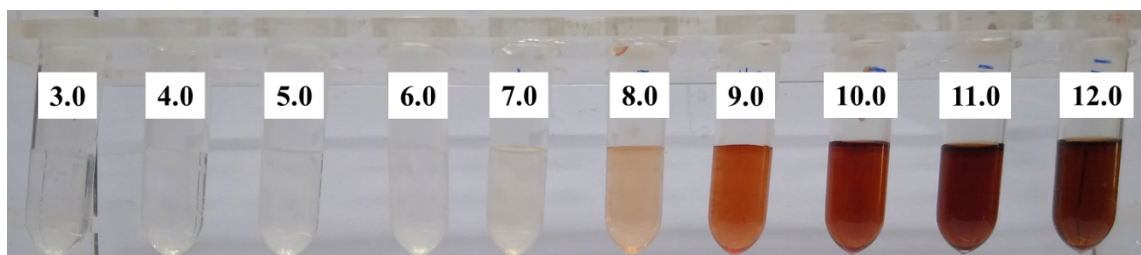


Fig. S6. Photograph after 20 min of $1.0 \times 10^{-3} \text{ mol L}^{-1}$ H_2Q solution preparation at different pH: 3.0; 4.0; 5.0; 6.0; 7.0; 8.0; 9.0; 10.0; 11.0 and 12.0 in 0.04 mol L^{-1} Britton-Robinson buffer solution and $T = 25 \pm 1 \text{ }^\circ\text{C}$.

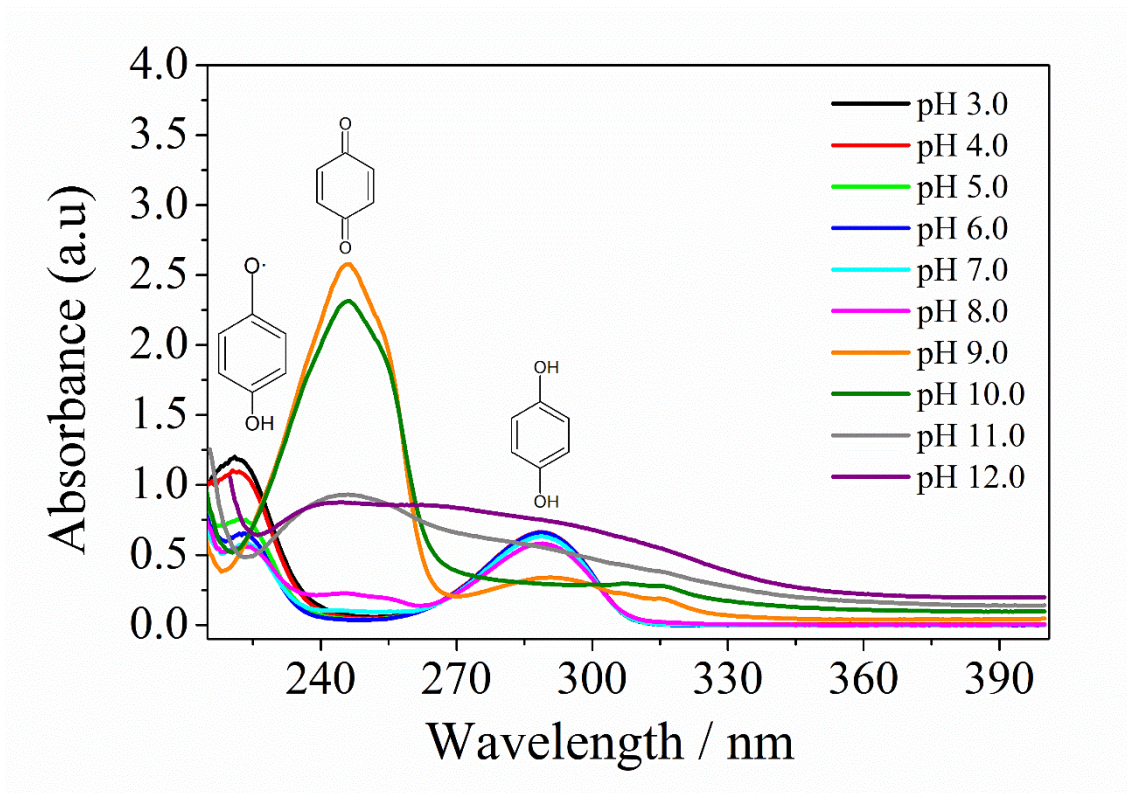


Fig. S7. UV-Vis spectra of $2.5 \times 10^{-4} \text{ mol L}^{-1}$ H_2Q in 0.04 mol L^{-1} Britton-Robinson buffer solution at different pH (3.0 to 12.0) and $T = 25 \pm 1 \text{ }^\circ\text{C}$. Wavelength of maximum absorbance (λ_{max}): hydroquinone: 290 nm; *p*-benzoquinone: 246 nm and semiquinone: 220 nm.

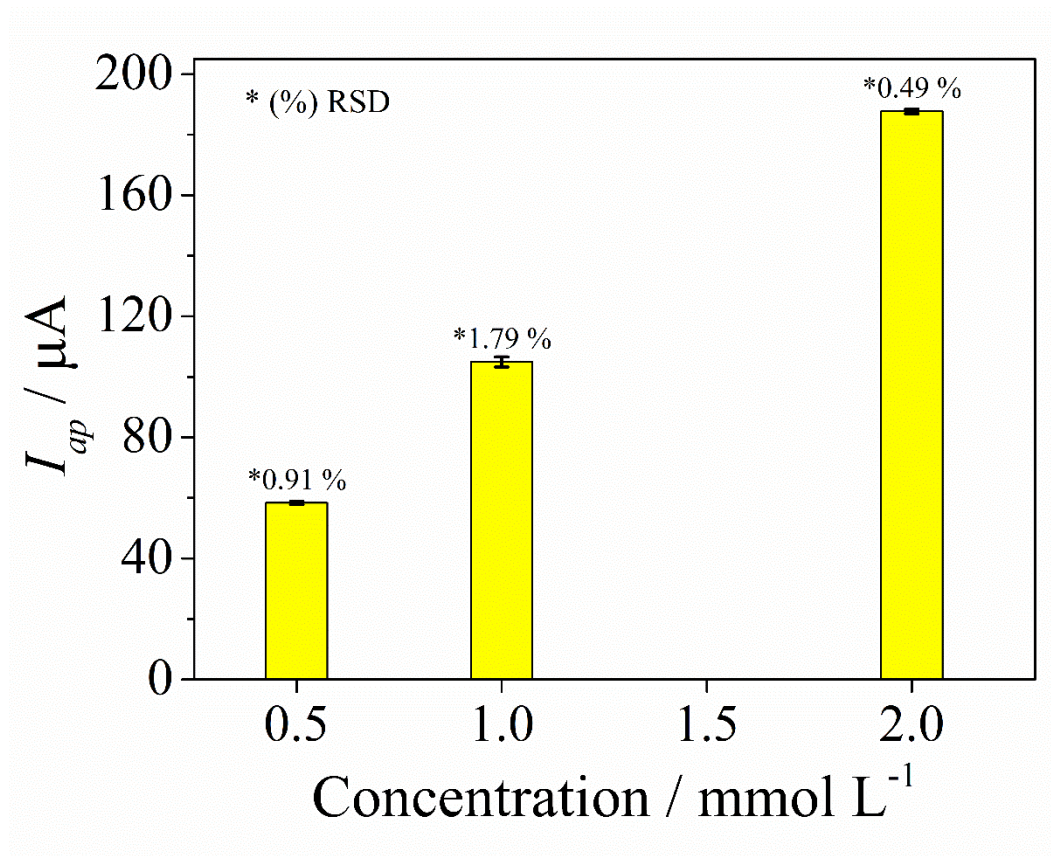


Fig. S8. Intra-day repeatability study using HDES 6.0 electrode for different concentrations of H_2Q : 5.0×10^{-4} , 1.0×10^{-3} , and 2.0×10^{-3} mol L^{-1} in 0.1 mol L^{-1} acetate buffer solution (pH 4.74).

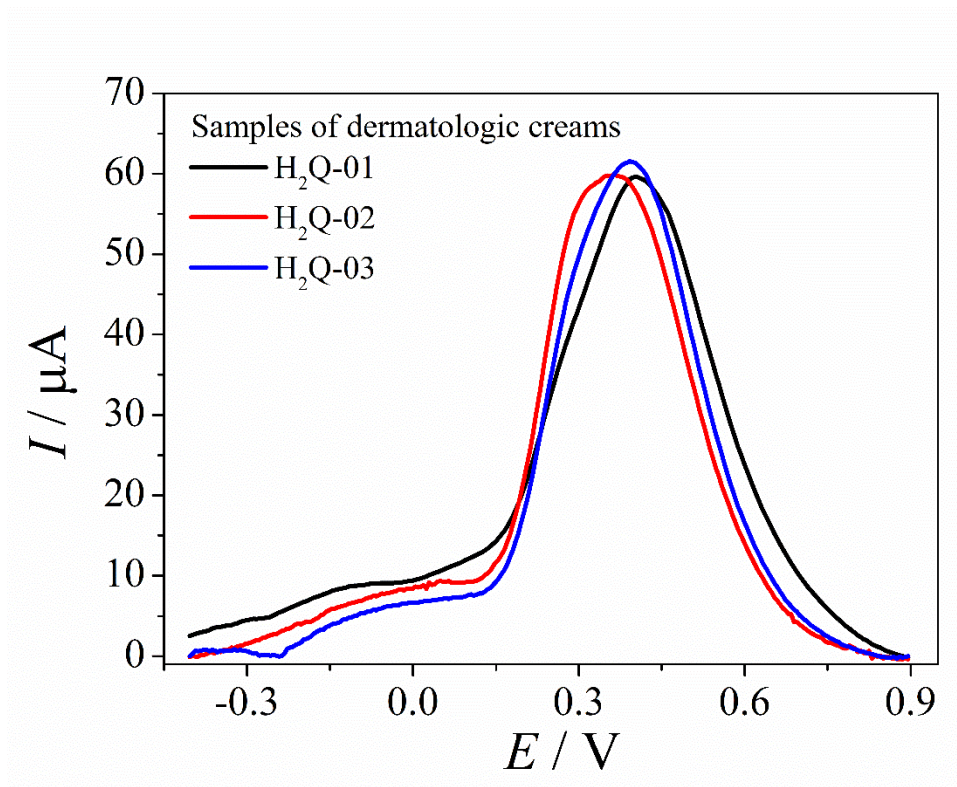


Fig. S9. Square-wave voltammograms for hydroquinone obtained in triplicate (average of 3 determinations) for three dermatologic cream samples: H₂Q-01 (—), H₂Q-02 (—), and H₂Q-03 (—) in 0.1 mol L⁻¹ acetate buffer solution (pH 4.74) using HDES 6.0 electrode. SWAdASV parameters: E_{acc} : 150 mV, t_{acc} : 90 s, f = 30 Hz, ΔE_s = 5.0 mV, and a = 70 mV, with Ag/AgCl/KCl (3.0 mol L⁻¹) employed as reference electrode.