

## Supporting Information

### Degradation and Mineralization of Carbamazepine Using an Electro-Fenton Reaction Catalyzed by Magnetite Nanoparticles Fixed on an Electrocatalytic Carbon Fiber Textile Cathode

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Summary:

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**Table S1.** Carbon, oxygen, and nitrogen contents (%) of CNF and FeCNF1 obtained from XPS elemental analysis.

<b>Sample</b>	<b>C</b>	<b>O</b>	<b>N</b>
<b>CNF</b>	82.40	7.93	9.67
<b>FeCNF1</b>	83.14	11.70	5.15

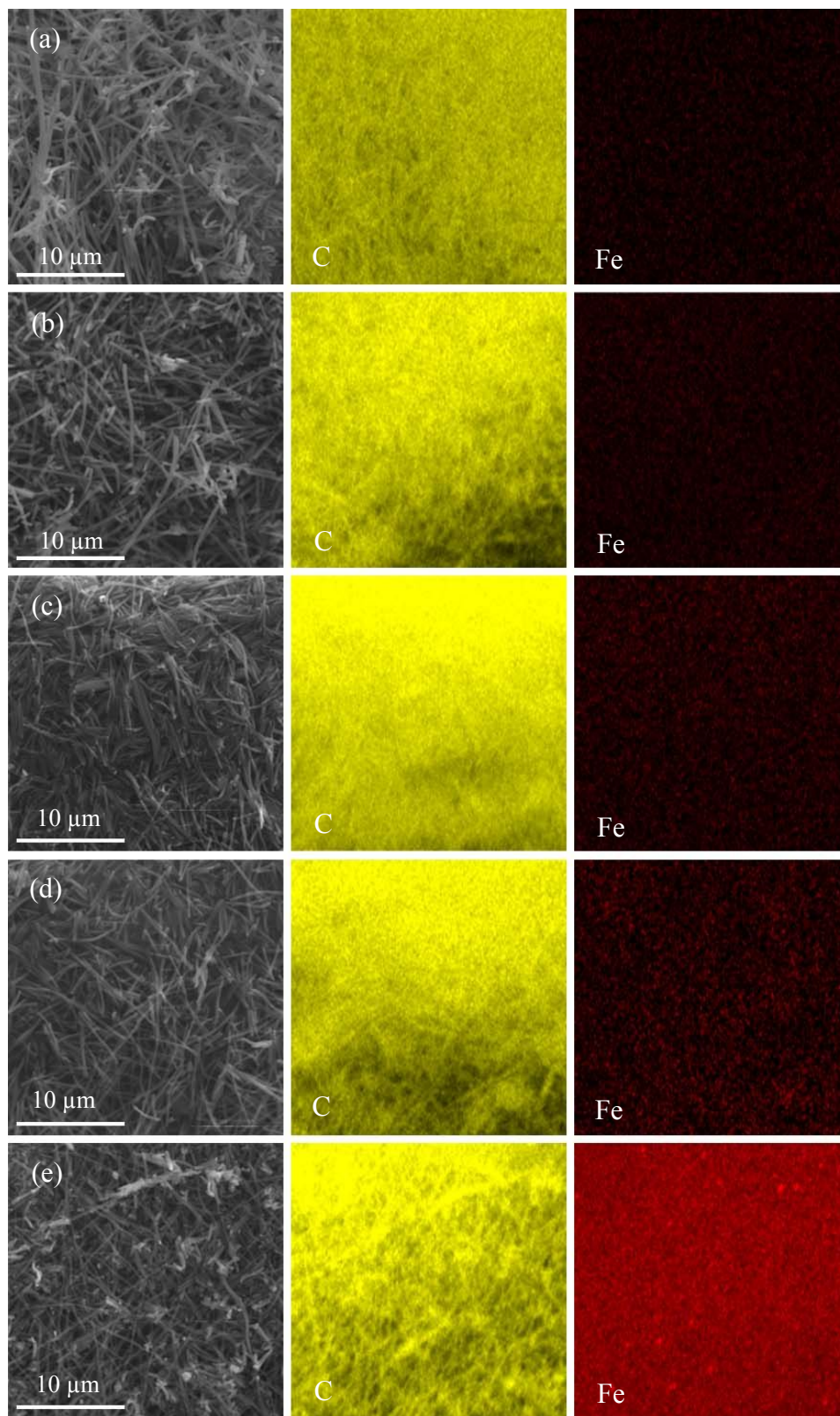
**Table S2.** Elemental composition of the samples.

<b>Sample</b>	<b>Major element composition (wt %)</b>		
	<b>C</b>	<b>O</b>	<b>Fe</b>
<b>FeCNF0.1</b>	90.69	9.31	below detection limit
<b>FeCNF0.3</b>	91.60	8.05	0.36
<b>FeCNF0.5</b>	90.03	8.91	1.06
<b>FeCNF1</b>	88.86	9.34	1.79
<b>FeCNF5</b>	85.31	5.49	9.20

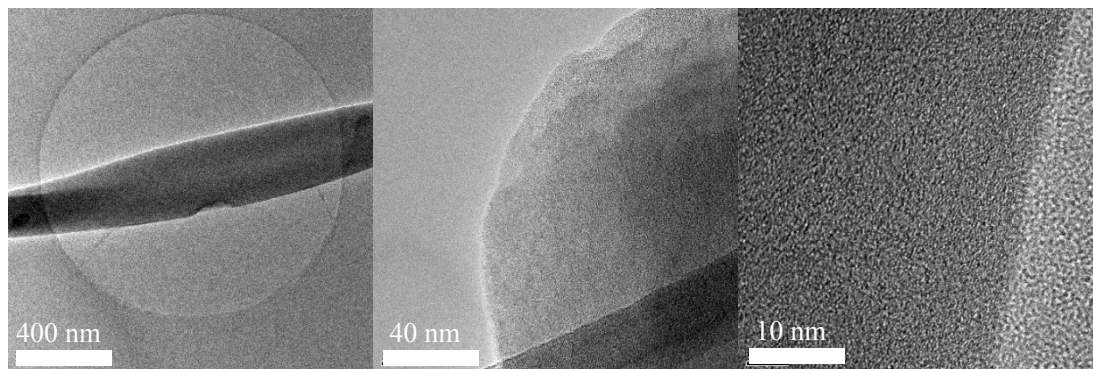
**Table S3.** Pseudo-first-order rate constant and square regression coefficient for electro-Fenton degradation of carbamazepine ( $C_0 = 1\text{ ppm}$ ).

<b>Sample</b>	<b>Reaction conditions</b>		<b><math>K_{app}</math> (<math>\text{h}^{-1}</math>)</b>	<b><math>r^2</math></b>
	<b>potential (V)</b>	<b>electrolyte pH</b>		
<b>FeCNF0.05</b>	-0.345	7	1.79	0.970
<b>FeCNF0.1</b>	-0.345	7	6.85	0.988
<b>FeCNF0.3</b>	-0.345	7	2.43	0.986
<b>FeCNF0.5</b>	-0.345	7	1.35	0.979
<b>FeCNF1</b>	-0.345	7	0.52	0.988
<b>FeCNF0.1</b>	-0.345	4	4.78	0.990
<b>FeCNF0.1</b>	-0.345	10	3.30	0.997
<b>FeCNF0.1</b>	-0.145	7	4.81	0.985
<b>FeCNF0.1</b>	-0.545	7	9.00	0.989

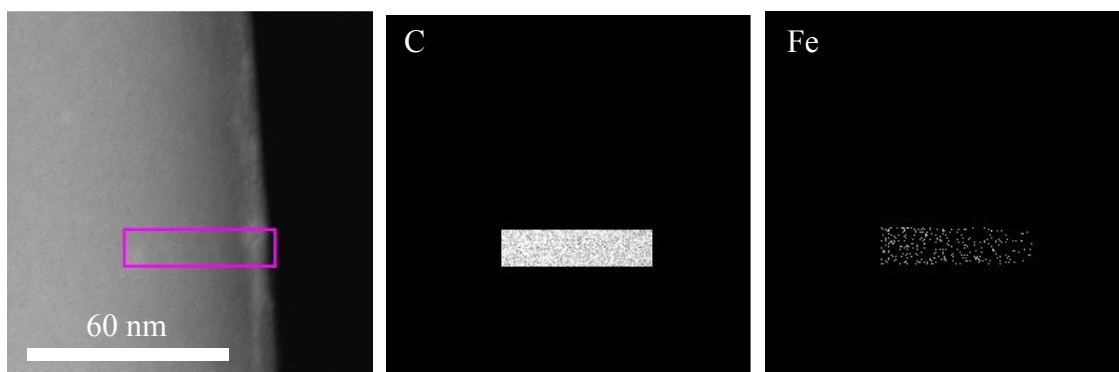
**Figure S1.** SEM-EDS elemental analysis of grinded (a) FeCNF0.1, (b) FeCNF0.3, (c) FeCNF0.5, (d) FeCNF1, and (e) FeCNF5.



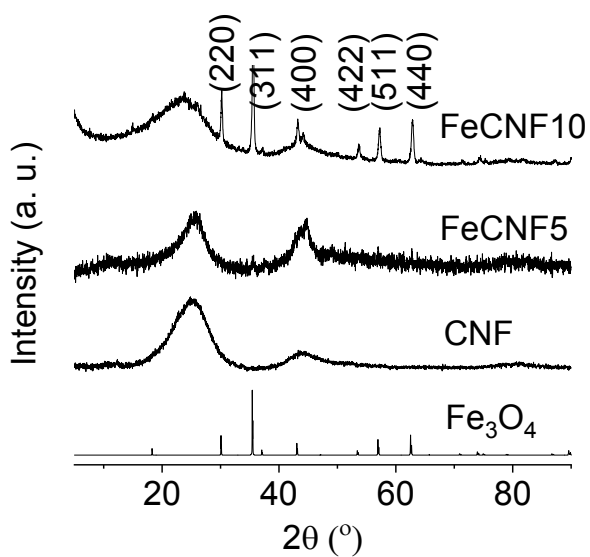
**Figure S2.** TEM images of FeCNF1 at different magnification.



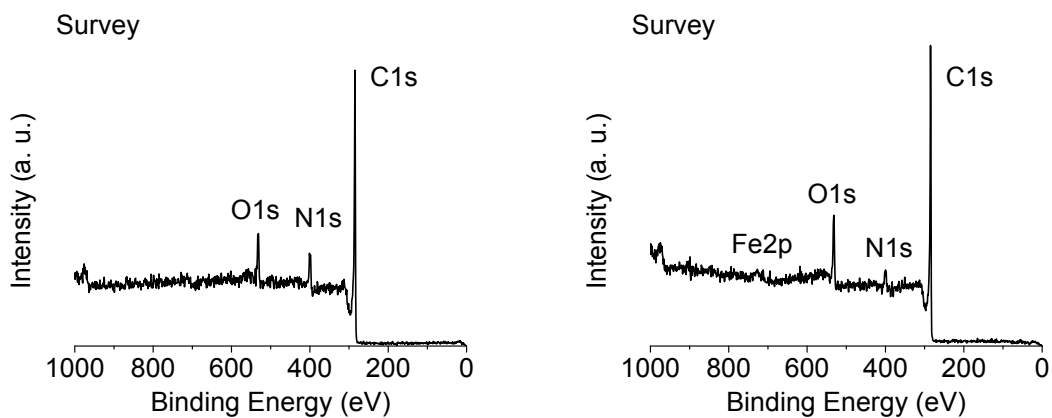
**Figure S3.** TEM images of FeCNF1 and TEM-EDS mapping for C, Fe elements.



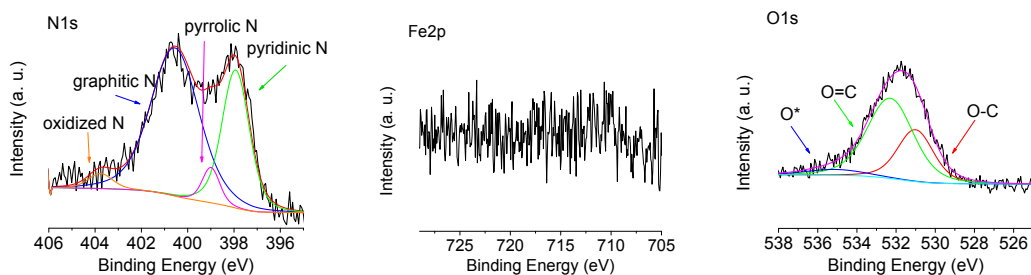
**Figure S4.** PXRD spectrum of Fe<sub>3</sub>O<sub>4</sub>-NP@CNF, CNF, and calculated Fe<sub>3</sub>O<sub>4</sub>.



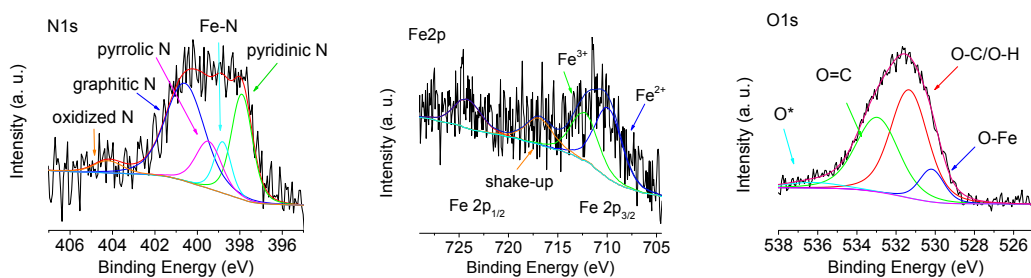
**Figure S5.** XPS survey spectrum of CNF (left) and FeCNF1 (right).



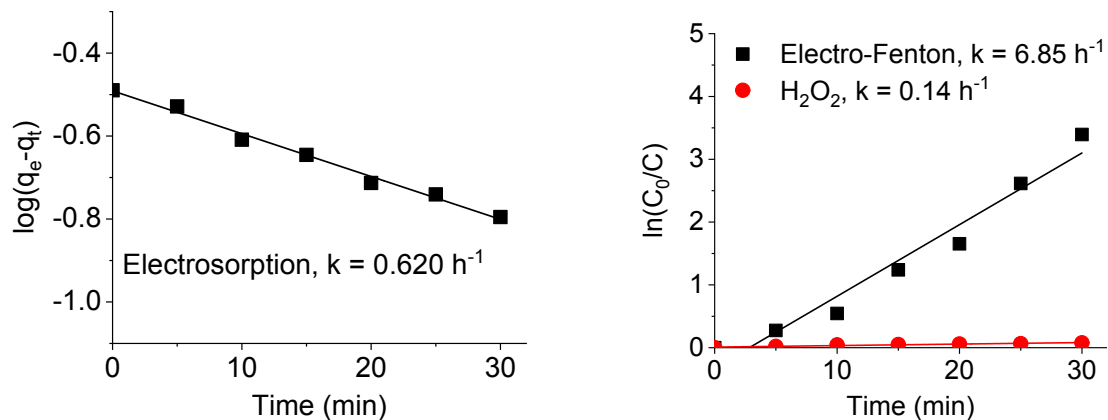
**Figure S6.** High resolution XPS spectrum of CNF.



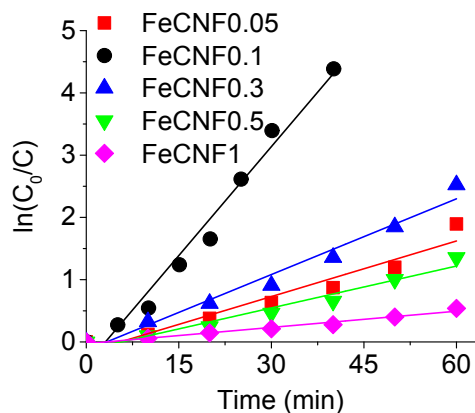
**Figure S7.** High resolution XPS spectrum of FeCNF1.



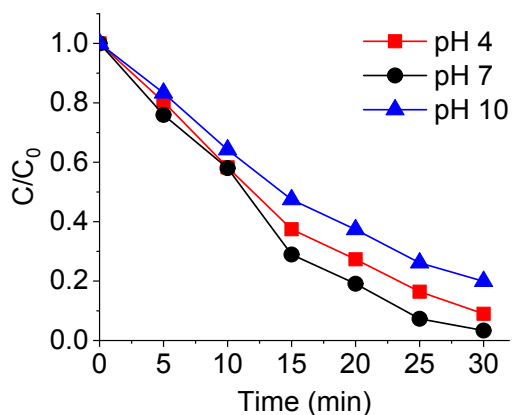
**Figure S8.** Kinetics of carbamazepine removal at pH 7 by (a) electrosorption on CNF and (b) electro-Fenton (FeCNF0.1, -0.345 V) and H<sub>2</sub>O<sub>2</sub> degradation.



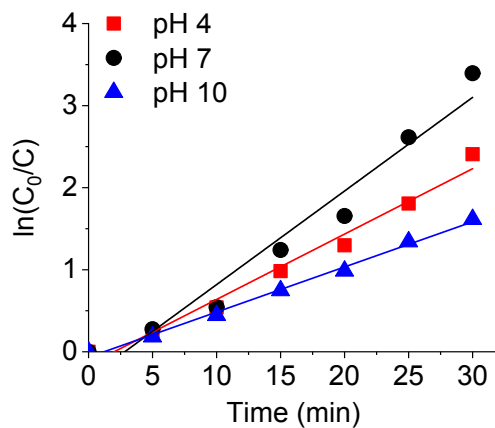
**Figure S9.** Kinetics of carbamazepine removal by electro-Fenton process using Fe<sub>3</sub>O<sub>4</sub>@CNF electrodes at pH 7.



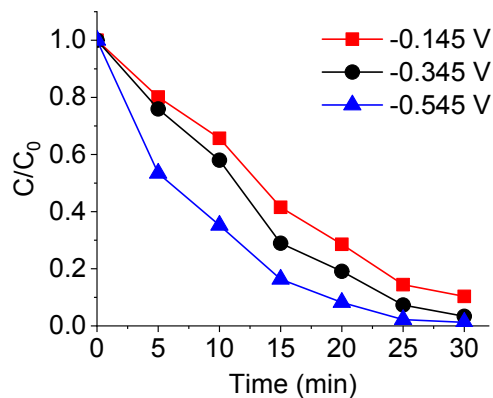
**Figure S10.** Electrolyte pH effect on electro-Fenton removal efficiency of carbamazepine (FeCNF0.1, -0.345 V).



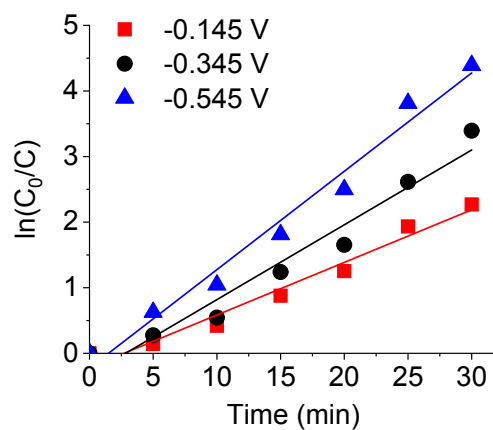
**Figure S11.** pH effects on carbamazepine removal kinetics by electro-Fenton process using  $\text{Fe}_3\text{O}_4@\text{CNF}$  electrodes (FeCNF0.1, -0.345 V).



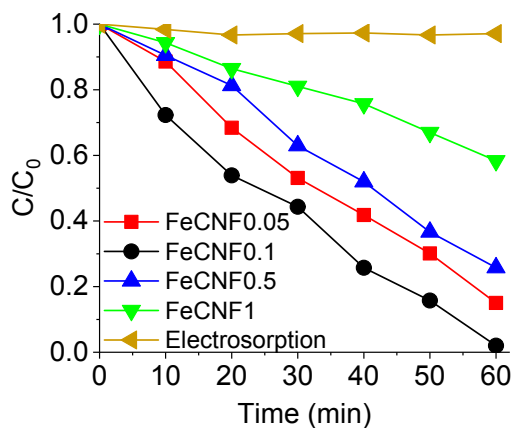
**Figure S12.** Potential effect on electro-Fenton removal efficiency of carbamazepine (FeCNF0.1, -0.345 V).



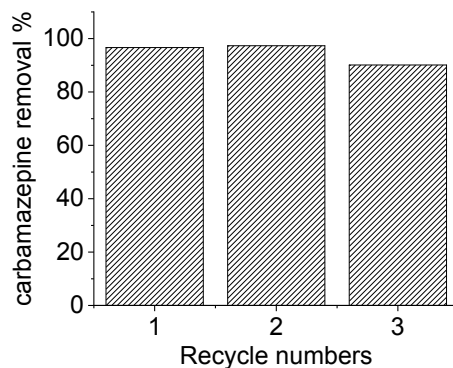
**Figure S13.** Potential effects on carbamazepine removal kinetics by electro-Fenton process using  $\text{Fe}_3\text{O}_4@\text{CNF}$  electrodes (FeCNF0.1, pH 7).



**Figure S14.** Effect of  $\text{Fe}_3\text{O}_4$  doping concentration on TPA probe removal rate (-0.345 V, pH 7).



**Figure S15.** Effect of  $\text{Fe}_3\text{O}_4$  doping concentration on TPA probe removal rate (FeCNF0.1, -0.345 V, pH 7).



**Figure S16.** CV curves of FeCNF0.01 (left), FeCNF0.1 (middle), and FeCNF1 (right) at pH 7 with a scan rate of 10 mV/s.

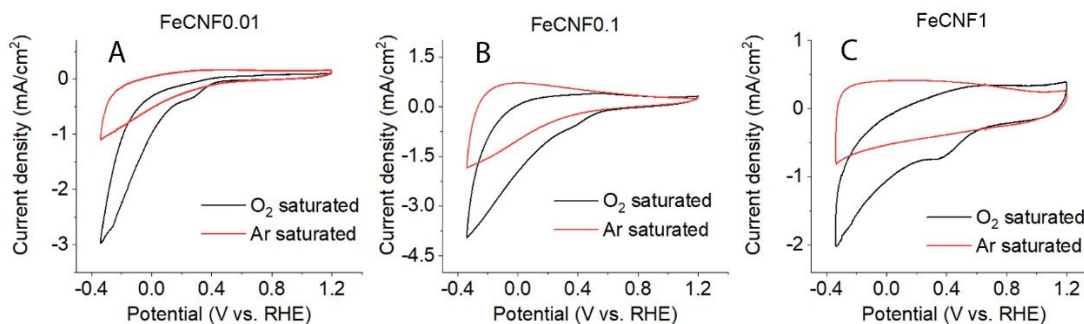
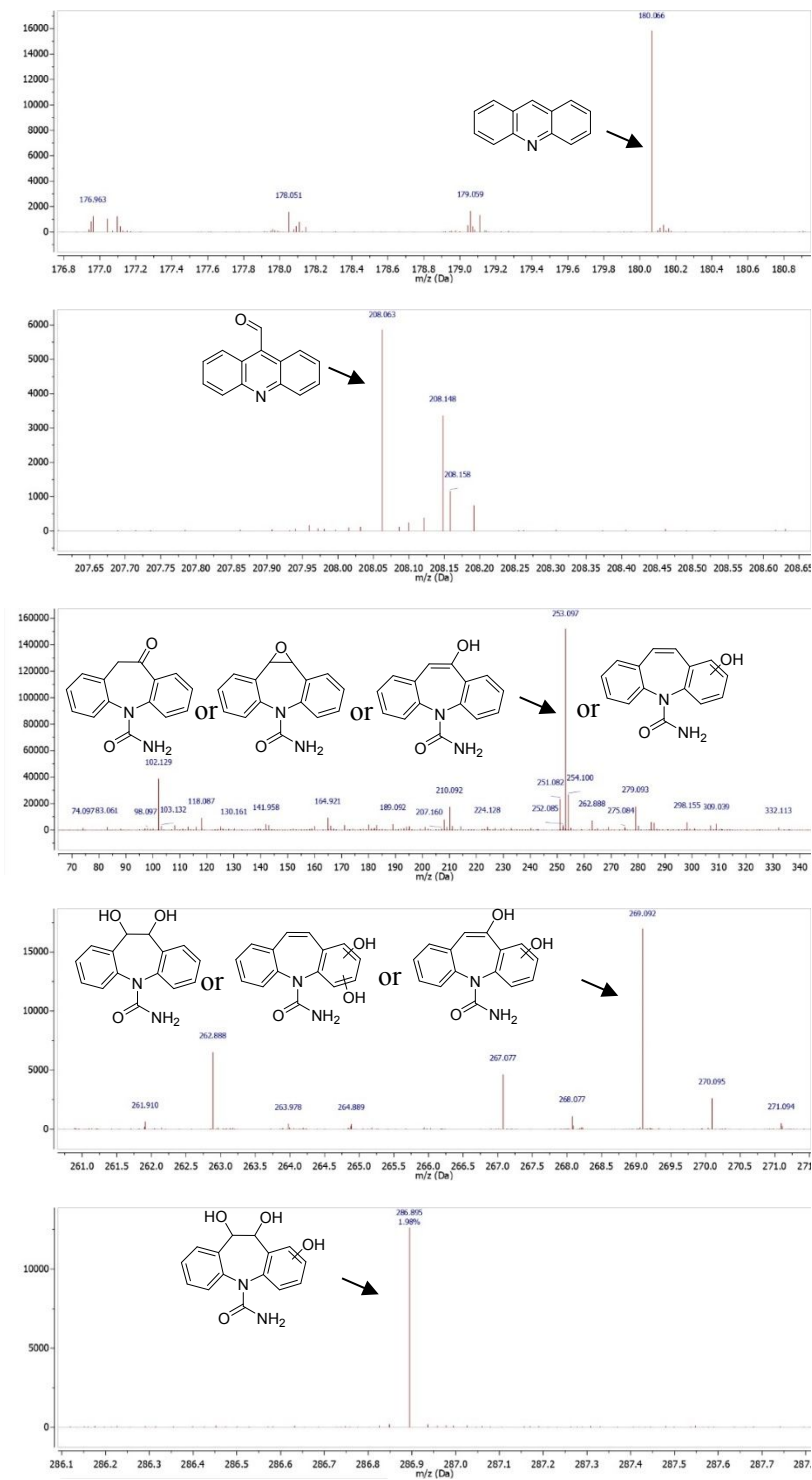
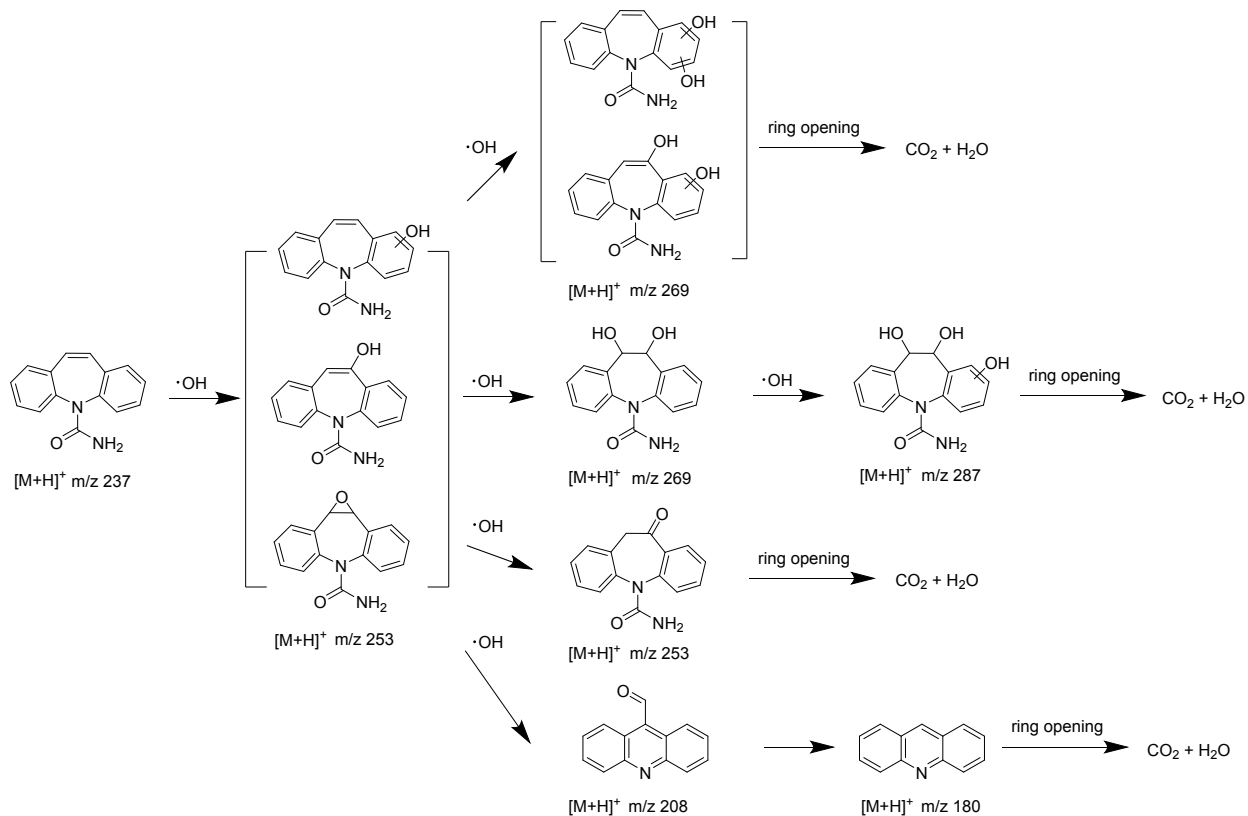




Figure S17. Intermediates detected during the electro-Fenton degradation of carbamazepine.

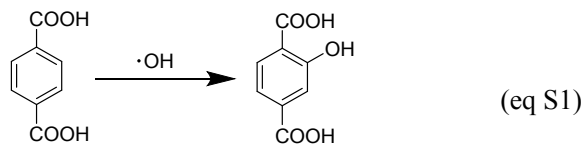


**Figure S18.** Proposed degradation pathway for carbamazepine in the electro-Fenton process.



### ·OH Measurement

Terephthalic acid (TPA) reacts with hydroxyl radical ( $\cdot\text{OH}$ ) to generate hydroxylterephthalic acid (HTPA) through the following reaction:



The concentration of  $\cdot\text{OH}$  can be determined by monitoring the TPA concentration:

$$[\cdot\text{OH}] = [\text{TPA}]_{\text{initial}} - [\text{TPA}]_{\text{final}} \quad (\text{eq S2})$$