Supplementary Materials

Technological optimization for H_2O_2 electro-synthesis and economic evaluation on electro-Fenton for treating refractory organic wastewater

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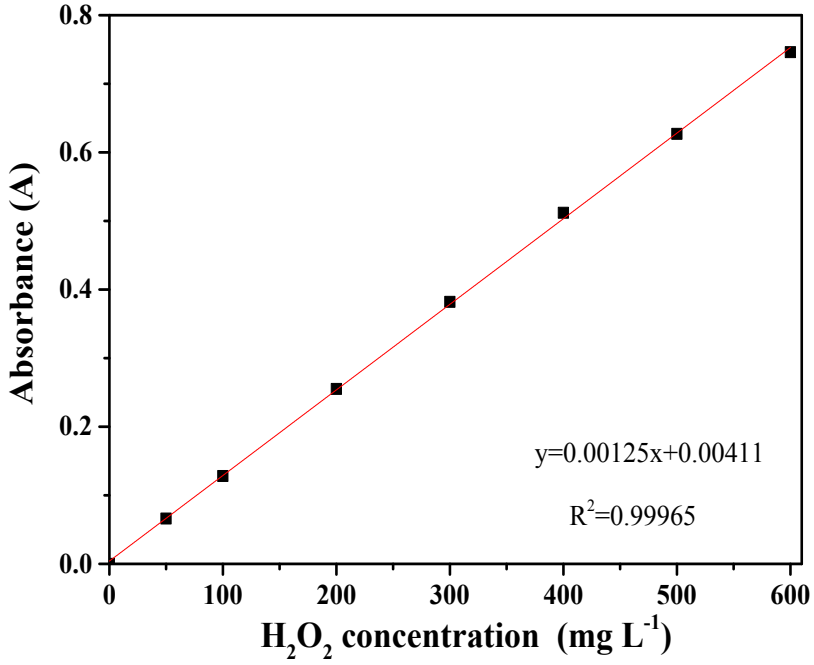

Figure S1. Standard curve of H_2O_2 concentration and absorbance.

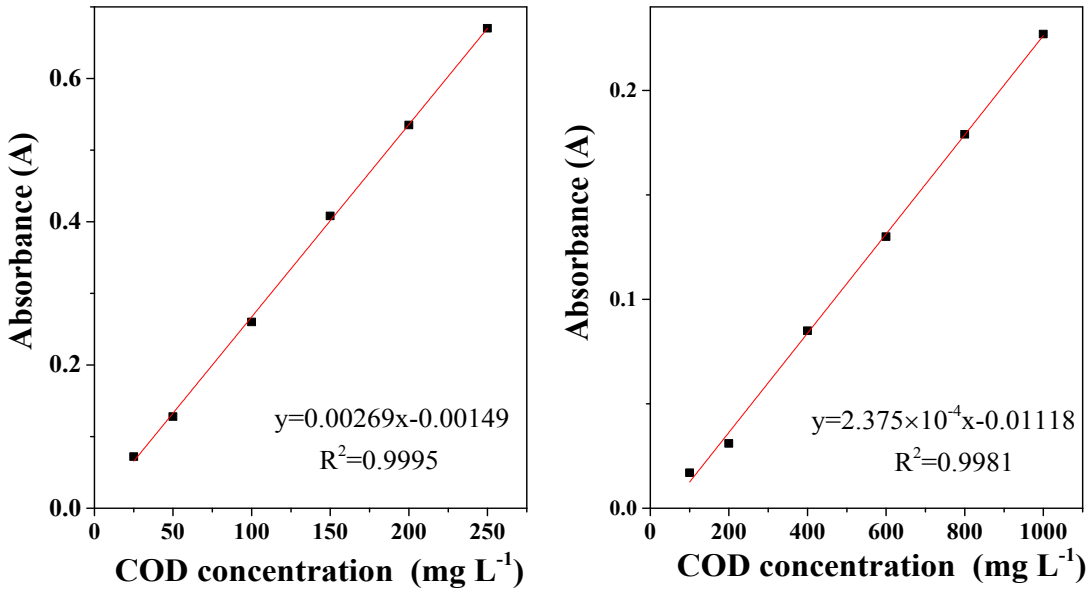

Figure S2. Standard curve of COD concentration and absorbance of (a) Low range (15~250 mg L^{-1}), (b) High range (100~1000 mg L^{-1}).

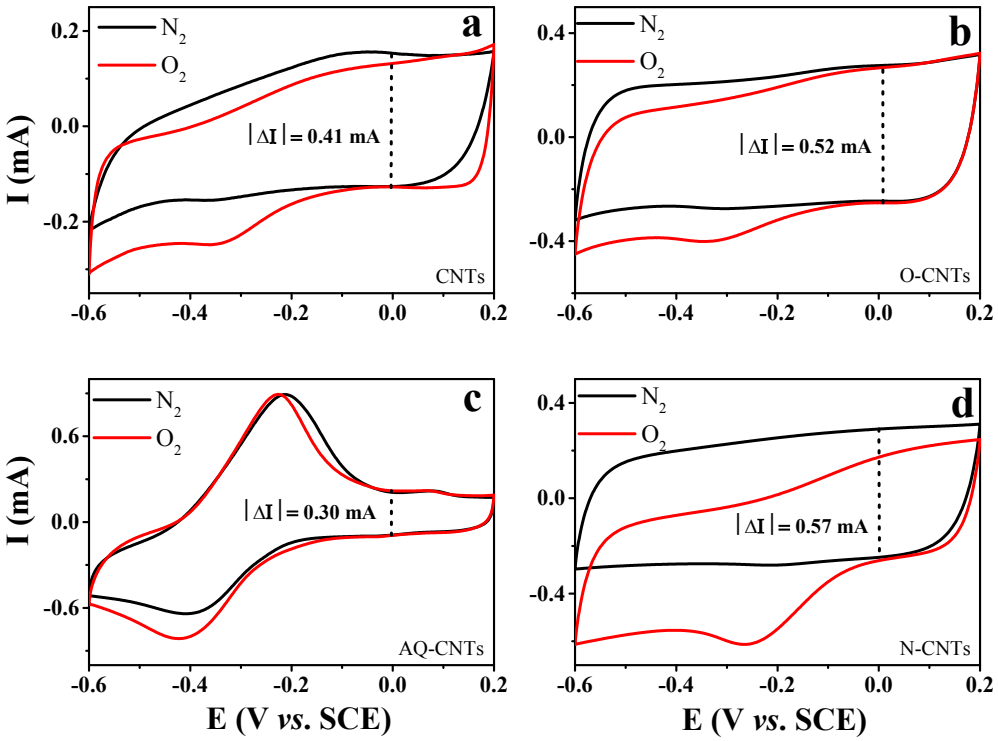

Figure S3. Cyclic voltammograms of (a) CNTs, (b) O-CNTs, (c) AQ-CNTs, and (d) N-CNTs performed in N_2-saturated (in black) and O_2-saturated (in red) 0.1 M Na_2SO_4 (pH: 3) at 50 mV s^{-1}.

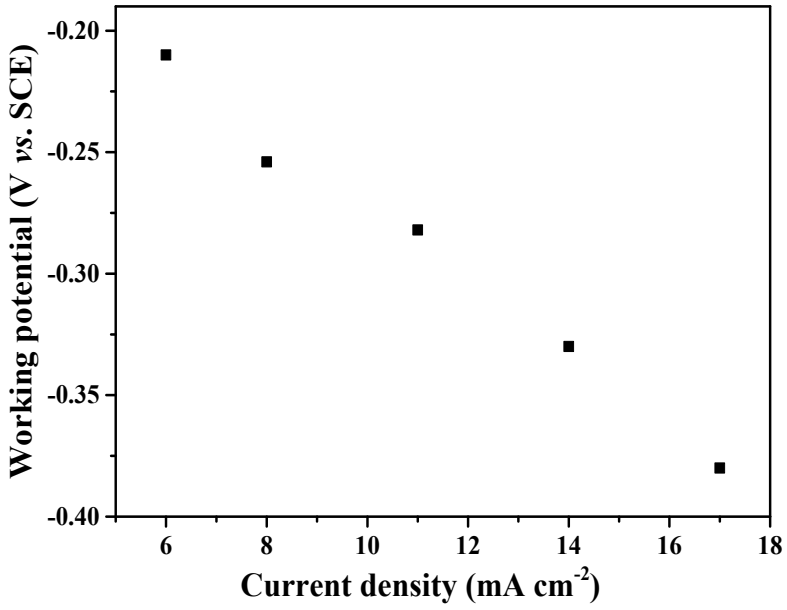

Figure S4. The working potential of GDE measured at different current density.

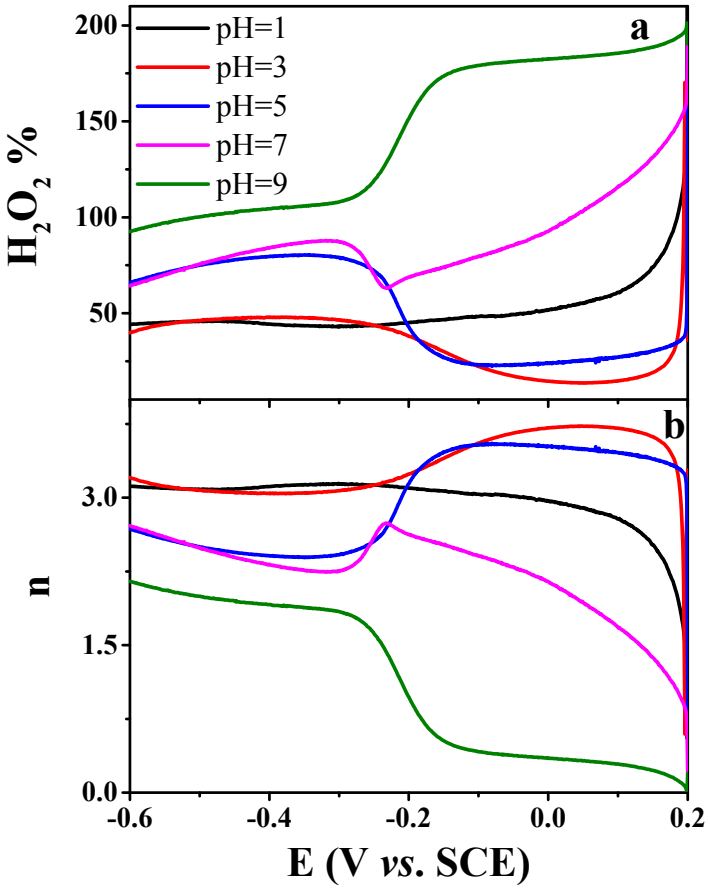

Figure S5. (a) H_2O_2 selectivity and (b) number of transferred electrons (*n*) for oxygen reduction reaction on O-CNTs measured on RRDE (1600 rpm) during linear scanning voltammetry (LSV) scanning at 5 mV s^{-1} in 0.1 M Na_2SO_4 at different pH.

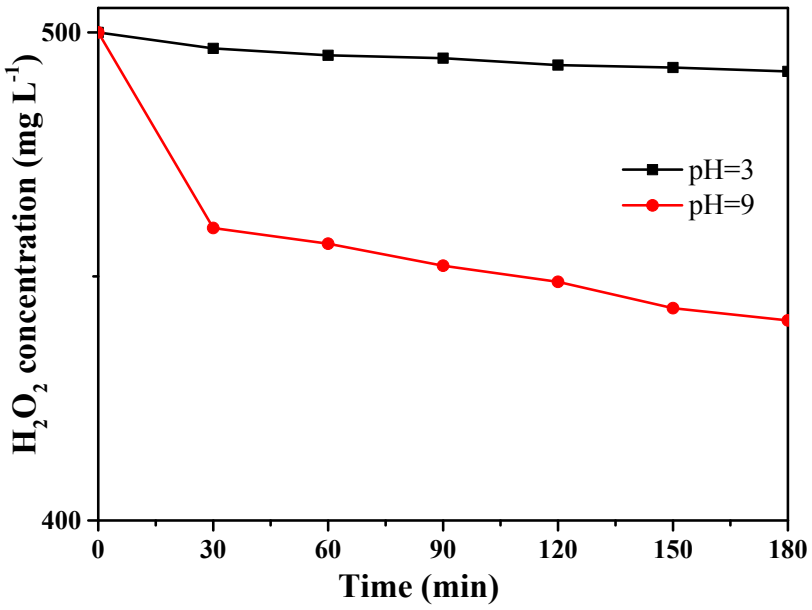

Figure S6. H_2O_2 concentration varying with time at pH 3 and 9.

Table S1. H_2O_2 yield collected from published paper.

Cathode material	pH	j or E	Gas flow rate (L min^{-1})	H_2O_2 yield (mg L^{-1} h^{-1})	H_2O_2 yield (mg h^{-1} cm^{-2})	Ref.
MC	3	150 mA cm^{-2}	-	92.2	14.3	1
TBAQ-CNT	3	7.1 mA cm^{-2}	0.4 (air)	100.4	4.24	2
CNTs	3	-0.5 V vs. SCE	0.4 (O_2)	24	0.6	3
TBAQ-CB	-	-1.0 V vs. SCE	-	200	4	4
CoPc	3	-0.4V vs. Ag/AgCl	-	220	4.97	5
Ta_2O_5-C	2	-0.1V vs. Ag/AgCl	0.6 (air)	14	1.64	6
N-G@CNT	3	-0.2 V vs. SCE	-	10.5	0.26	7
FePc	-	-1.0 V vs. Ag/AgCl	-	160	3.6	8
O-CNTs	3	14 mA cm^{-2}	0.6 (O_2)	304	6.7	This work

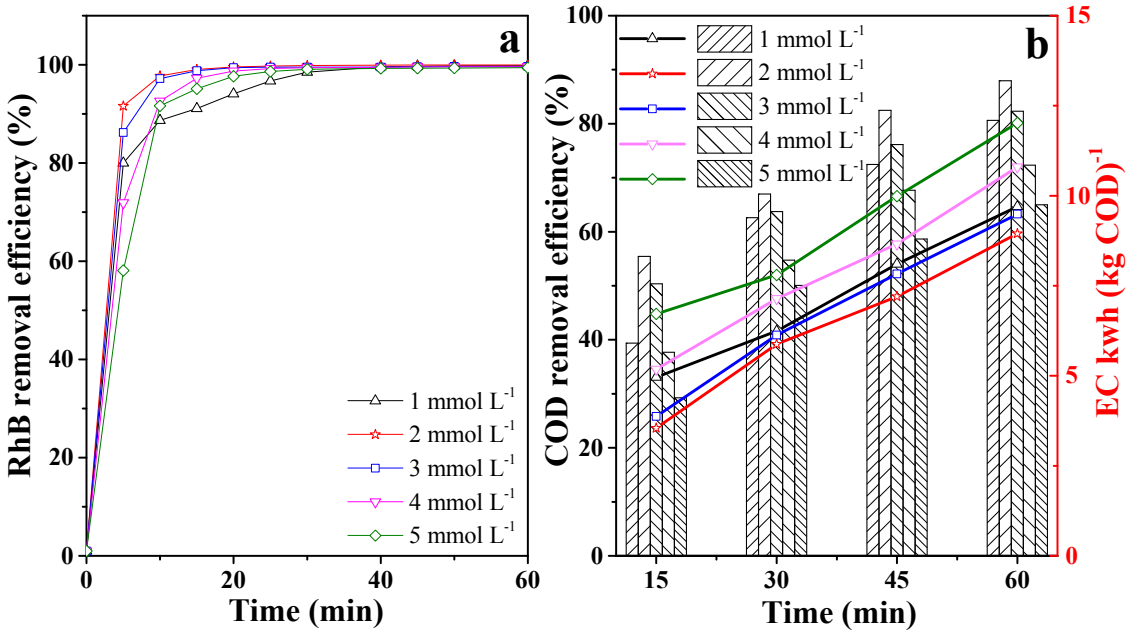

Figure S7. (a) RhB removal efficiency and (b) COD removal efficiency and energy consumption at different Fe^{2+} concentration. Conditions: 0.1 mol L^{-1} Na_2SO_4, pH=3, [RhB]: 200 mg L^{-1}, current density: 14 mA cm^{-2}, O_2 flow rate:0.6 L min^{-1}.

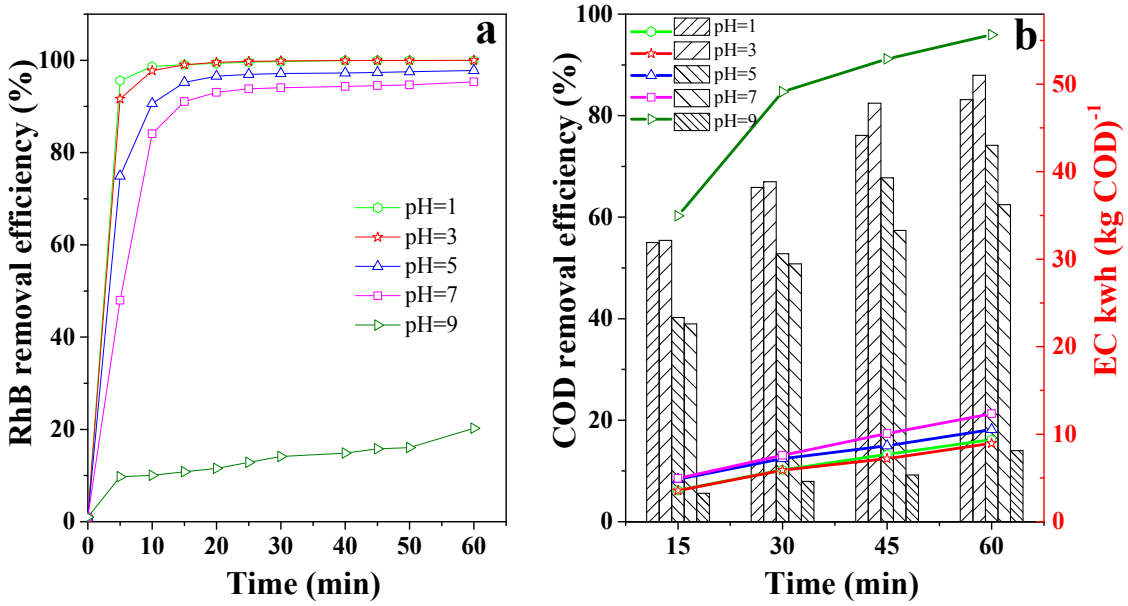

Figure S8. (a) RhB removal efficiency and (b) COD removal efficiency and energy consumption at different solution pH. Conditions: 0.1 mol L^{-1} Na_2SO_4, [Fe^{2+}]: 2 mM, [RhB]: 200 mg L^{-1}, current density: 14 mA cm^{-2}, O_2 flow rate:0.6 L min^{-1}.

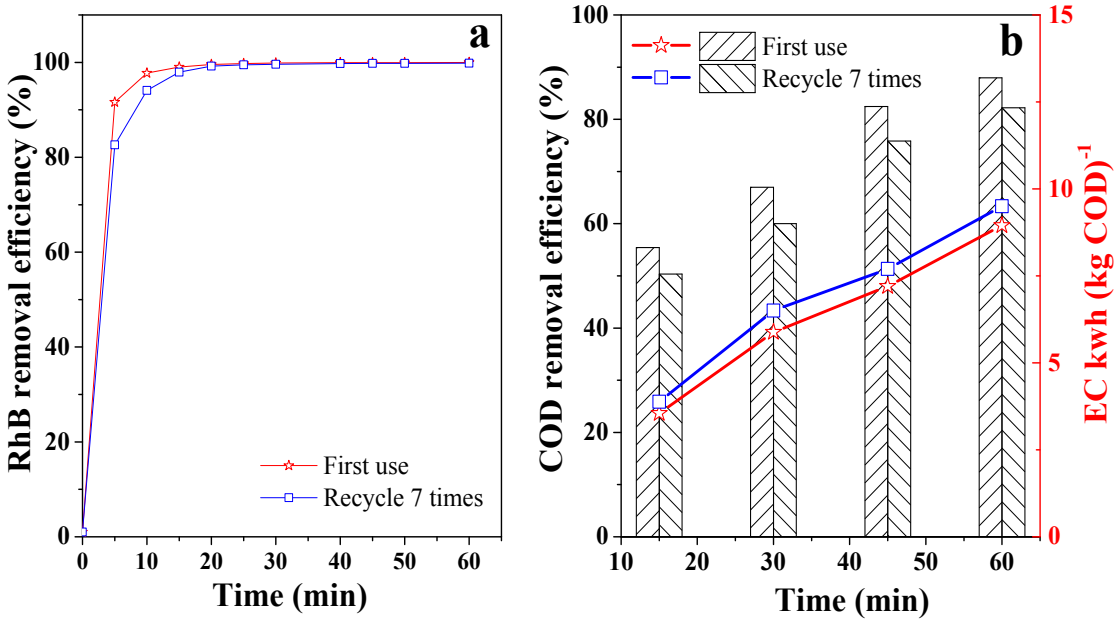

Figure S9. The reusability of GDE evaluated after 7-time runs in electro-Fenton treatment of RhB wastewater. Conditions: 0.1 mol L^{-1} Na_2SO_4, [Fe^{2+}]: 2 mM, pH=3, [RhB]: 200 mg L^{-1}, current density: 14 mA cm^{-2}, O_2 flow rate: 0.6 L min^{-1}.

Table S2. The necessary data for calculation of energy consumption.

Reaction time (min)	slot voltage (V)	Current (A)	Initial COD (mg L^{-1})	COD at time *t*(mg L^{-1})	Solution volume (L)
15				117.7	
30	3.3	0.25	264	87.2	0.4
45				50	
60				31.8	

Table S3. Data comparison for energy consumption and COD removal efficiency.

wastewater	j ($mAcm^{-2}$)	pH	[Fe^{2+}]	COD removal efficiency(%)	EC (kWh kg_{COD}^{-1})	Ref.
DMP	-	3	-	-	20~40	9
RhB	20	3	0.3 M	79	80	10
landfill leachate	15	3	560 mg L^{-1}	71±6	207±20	11
RhB	-	6.2	3 mM	-	17	12
RhB	14	3	2 mM	88	9	This work

Reference:

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