Supplementary Materials

Nitrogen Doped Porous Biochar/β-CD-MOFs Heterostructures: Bi-functional Material for Highly Sensitive Electrochemical Detection and Removal of Acetaminophen

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1 Reagents

AC, melamine, β-CD, KOH, chitosan, HCl, NaH_2PO_4 and Na_2HPO_4 were purchased from Aladdin (Shanghai, China). Soulangeana sepals were obtained from the botanical garden of Jiangxi Agricultural University (Nanchang, Jiangxi). Phosphate buffered solutions (PBS, 0.1 M) with different pH were prepared with 0.1 M Na_2HPO_4 and 0.1 M NaH_2PO_4. Ultrapure water was used in the experimental.

2 Apparatuses

Scanning electron microscopy (SEM, Hitachi S-4800, Japan) was used to observe the morphology and microstructure of the N-SC/β-CD-MOFs nanocomposites. X-ray diffraction (XRD) patterns of different materials were recorded by the X-ray powder diffractometer (Lab XRD-6100). The surface chemical composition of N-SC/β-CD-MOFs were evaluated by X-ray photoelectron spectroscopy (XPS) on the ESCALAB

250Xi instrument (ThermoFischer, USA). In the adsorption experiment, the concentration of acetaminophen was determined by UV-Vis spectrophotometer (UV-1800, Shimadzu, Japan). All electrochemical experiments were performed on a CHI760E workstation (Shanghai, China) with a conventional three-electrode system, including a saturated calomel electrode as the reference electrode, a platinum sheet electrode as the counter electrode, and a glassy carbon electrode (GCE, 3 mm) as the working electrode.

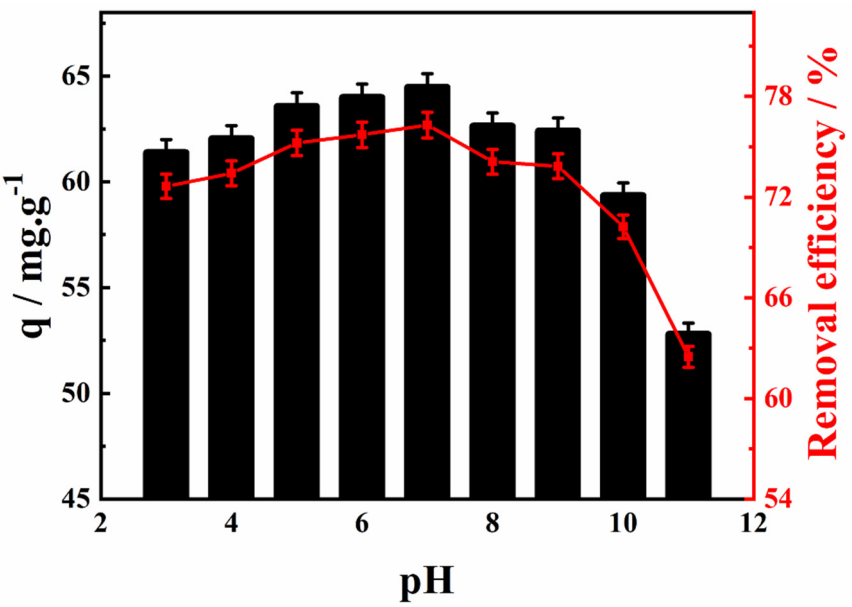

Figure S1. Effect of pH for the adsorption of AC on N-SC/β-CD-MOFs.

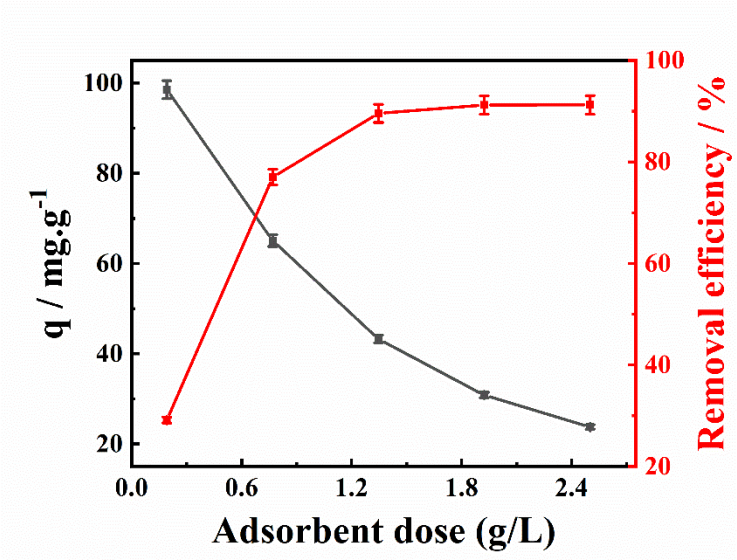

Figure S2. Effect of N-SC/β-CD-MOFs dose towards AC adsorption.

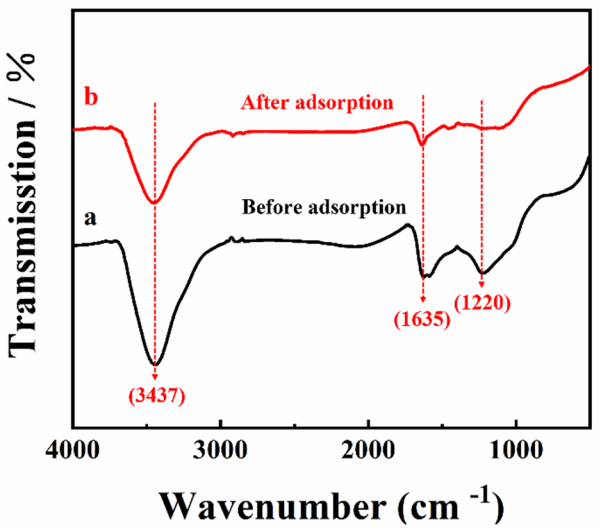

Figure S3. FTIR spectrum of N-SC/β-CD-MOFs before and after adsorption of AC.

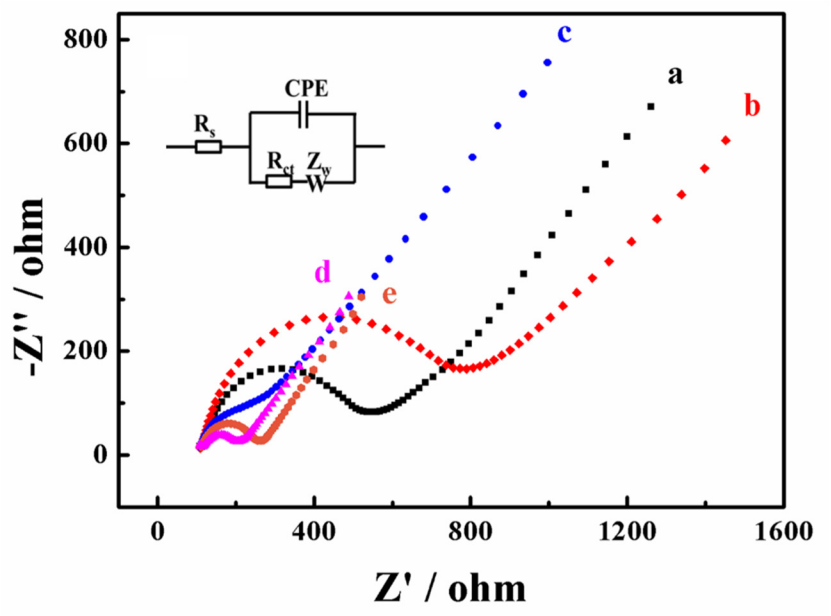

Figure S4. Nyquist plot of bare GCE (curve a), β-CD-MOFs/GCE (curve b), SC/GCE (curve c), N-SC/GCE (curve d) and N-SC/β-CD-MOFs/GCE (curve e) in 0.1 M KCl containing 5.0 mM $[Fe(CN)6]^{3-/4-}$.

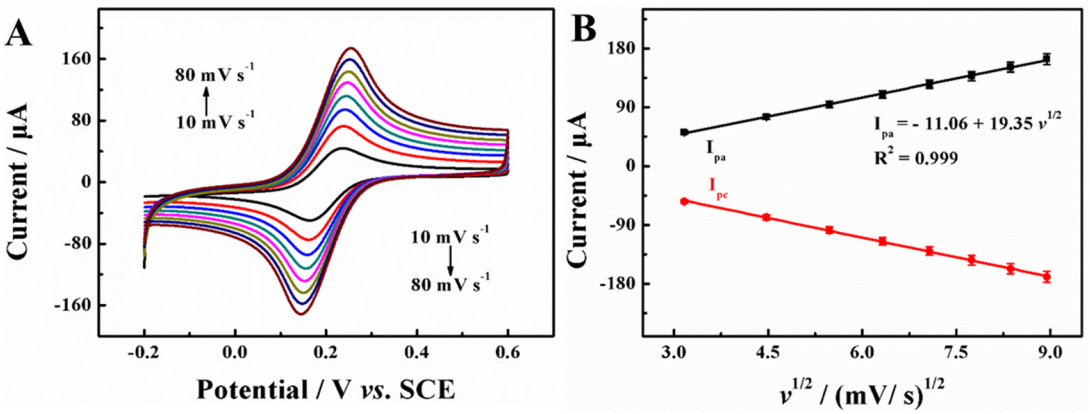

Figure S5. (A) CV curves of N-SC/β-CD-MOFs/GCE in 0.1 M KCl containing 5 mM $[Fe(CN)_6]^{3-/4-}$ under different scan rates; (B) The fitting curve of the peaks current *vs*. the square root of scan rates.

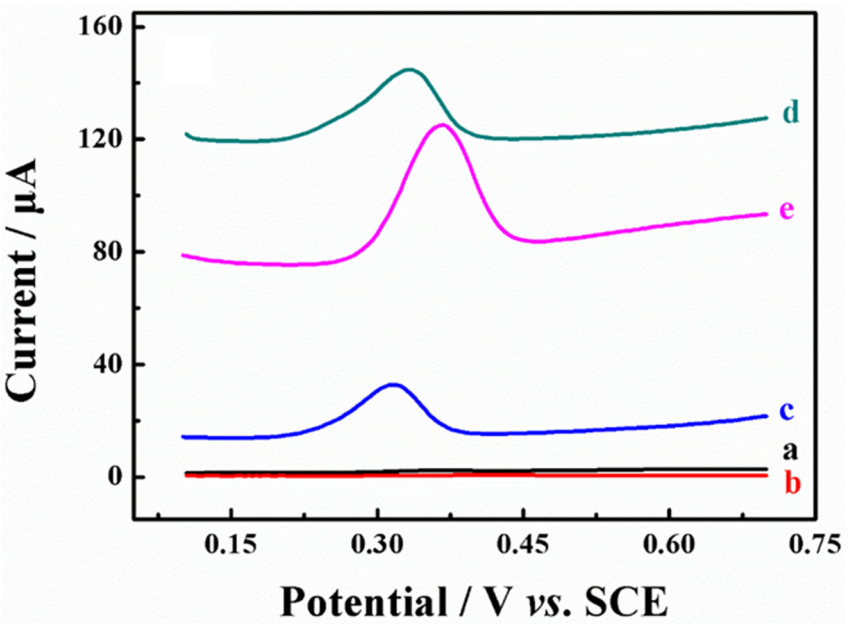

Figure S6. DPVs behaviors of 20.0 μM AC in 0.1 M PBS (pH=7.0) on bare GCE (a), β-CD-MOFs/GCE (b), SC/GCE (c), N-SC/GCE (d) and N-SC/β-CD-MOFs/GCE (e). (pulse width is 0.05 s, amplitude is 50 mV and accumulation time is 180 s).

Table S1. Comparison of adsorption capacities of different adsorbents for AC.

Adsorbent	Adsorption equilibrium time (min)	Adsorption capacity (mg/g)	Isotherm type	References
Pyrolyzed pulp mill sludge	80	19.74	Langmuir	[1]
Oak fruits	100	45.45	Langmuir	[2]
Carbon nanotubes	60	1.99	Langmuir	[3]
Natural Jordanian zeolite	80	55.60	Langmuir	[4]
Seed husks (M.oleifera)	450	17.48	Langmuir	[5]
Polymeric resin	1000	6.90	Langmuir-Freundlich	[6]
Activated Coconut shell	1800	38.20	Experimental	[7]
N-SC/β-CD-MOFs	30	66.43	Langmuir	This work

Table S2. Comparison of the detection performance of AC by N-SC/β-CD-MOFs/GCE and other electrochemical sensors.

Modified electrodes	Method	Linear range (μM)	LOD (nM)	Reference
Au@Fe_3O_4@rGO/GCE	DPV	0.01-0.28	5.0	[8]
P-NC [a]/GCE	DPV	3-110	500	[9]
Pd-MWCNTs [b]/GCE	DPV	0.5-100	130	[10]
PB-MWCNTs-COOH/ZIF-67/GCE	DPV	0.01-70.0	3.3	[11]
P-RGO [c]/GCE	DPV	1.5-120	360	[12]
N-SC/β-CD-MOFs/GCE	DPV	0.001-30.0	0.3	This work

a P-NC: nitrogen-rich porous carbon;

b MWCNTs: The negatively charged carboxylated multi-walled carbon nanotubes;

c P-RGO: Phosphorus-doped graphene.

Table S3. Detection of AC in lake water samples with N-SC/β-CD-MOFs/GCE (n=5).

Samples	Added (μM)	Found (μM)	RSD (%)	Recovery (%)
1	0	-	-	-
2	1.0	0.95 ± 0.15	3.25	95.0
3	3.0	2.87 ± 0.18	2.82	95.7
4	5.0	5.21 ± 0.14	2.27	104.2
5	10.0	9.93 ± 0.23	2.98	99.3

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