

One-step synthesis of high-performance N/S co-doped porous carbon material for environmental remediation

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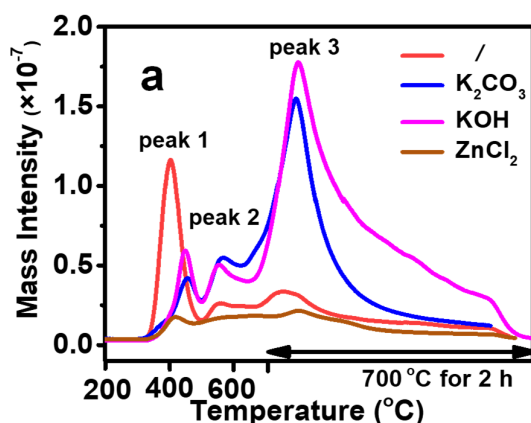


Figure S1. (a) Different inorganic activator on the release curves of CO during the preparation process of NSC materials. The activation conditions were set to be 700 °C, and inorganic activator, KSCN and biomass with weight ratio of 1:1:1.

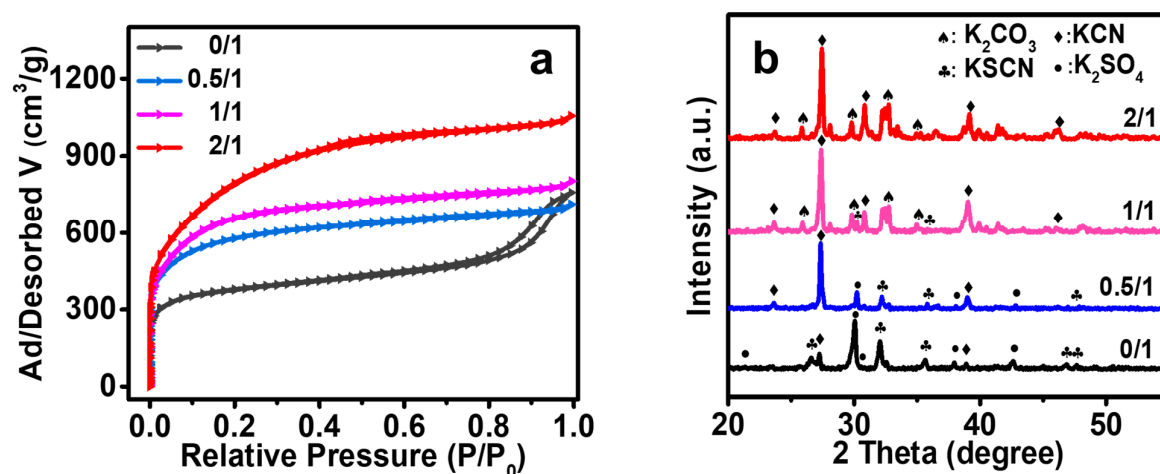


Figure S2. (a) N₂ adsorption-desorption isotherms of NSC materials, (b) XRD patterns of the unwashed NSC materials. The activation conditions were set to be 700 °C, KSCN and biomass with mass ratio of 1:1, various mass ratio between K₂CO₃ and biomass.

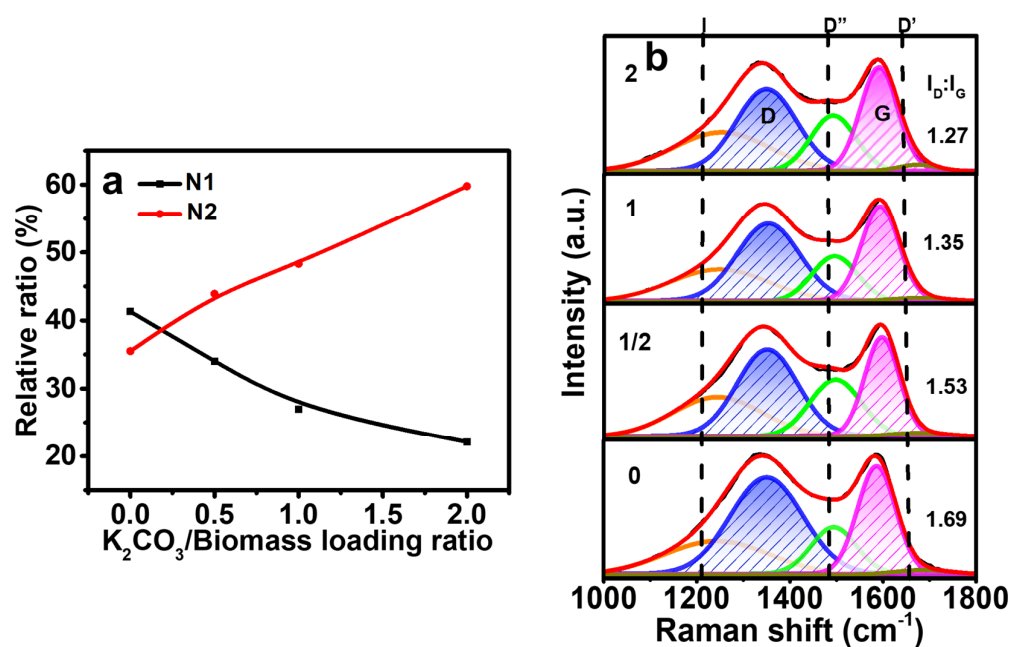


Figure S3. (a) Relative ratio of pyridinic N (N1) and pyrrolic N (N2) for NSC materials, (b) Raman spectrum of NSC materials was fitted using the five Gaussian peaks (color lines). The activation conditions were set to be 700 °C, KSCN and biomass with weight ratio of 1:1, various weight ratio between K₂CO₃ and biomass.

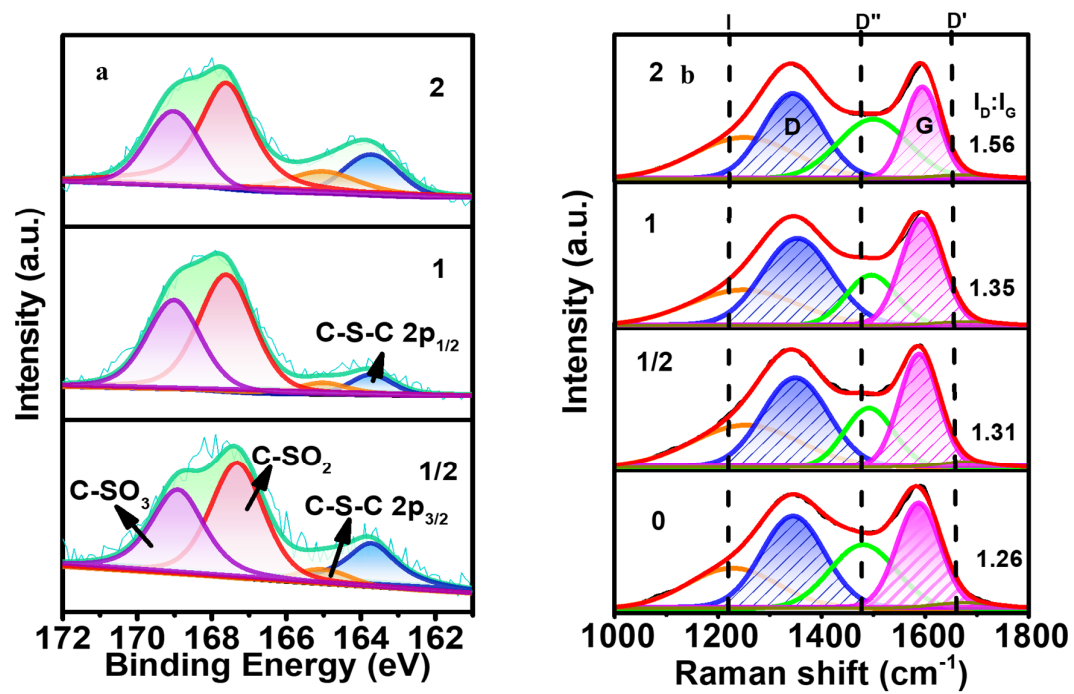


Figure S4. (a) S 2p XPS spectra for different KSCN loading content induced NSC materials, (b) Raman spectrum of NSC materials was fitted using the five Gaussian peaks (color lines) The activation conditions were set to be 700 °C, K₂CO₃ and biomass with weight ratio of 1:1, various weight ratio between KSCN and biomass.

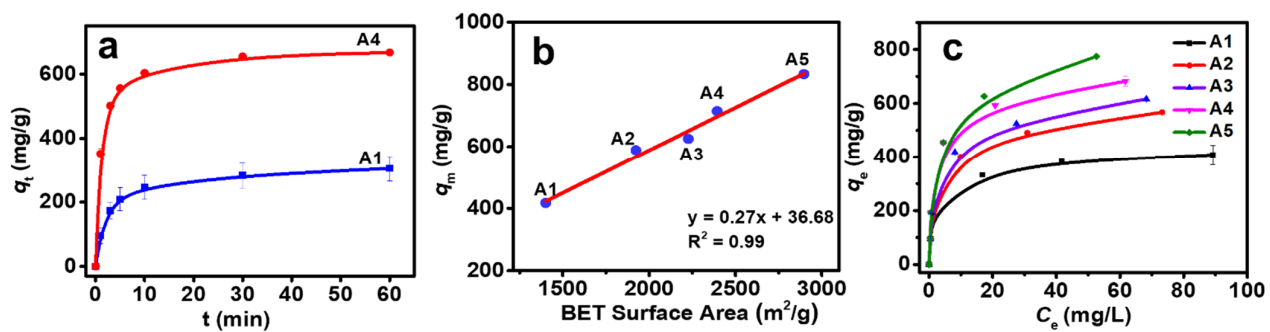


Figure S5. (a) Adsorption kinetics of CAP onto selected NSC, (b) Correlations of the resultant NSC between maximum adsorption capacity (q_m) and BET surface area, (c) Adsorption isotherms of CAP for selected NSC in aqueous solution (the adsorption isotherms were fitted with the Langmuir model).

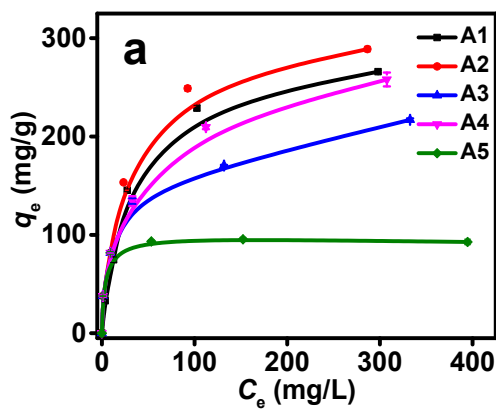


Figure S6. (a) Adsorption isotherms of Pb^{2+} for selected NSC in aqueous solution (the adsorption isotherms were fitted with the Langmuir model).

Table S1. Elemental compositions and textural properties of NSC samples. The activation conditions were set to be 700 °C, KSCN and biomass with weight ratio of 1:1, various weight ratio between K₂CO₃ and biomass.

m(K ₂ CO ₃) /m(biomass)	Yield (%)	C (%)	O (%)	N (%)	S (%)	S _{BET} ^a (m ² /g)	S _{mic} ^b (m ² /g)	V _T ^c (cm ³ /g)	V _{super} ^d (cm ³ /g)	V _{ultra} ^e (cm ³ /g)
0	38.7	65.7	10.03	5.03	10.01	1403	1040 (74)	1.17	0.29	0.18
0.5	28.2	64.15	10.42	3.76	11.8	2113	1723 (82)	1.1	0.52	0.2
1	26.3	71.44	9.66	2.98	9.75	2397	1970 (82)	1.24	0.63	0.13
2	17.4	81.56	5.91	2.11	4.04	2900	1820 (63)	1.63	0.68	0.12

^a BET surface area, ^b micropore surface area, the values in parenthesis was the S_{mic} / S_{BET} and the unit was %, ^c total pore volume, and ^d supermicropore volume (0.7 nm < pore-size < 2 nm) and ^e ultramicropore volume (< 0.7 nm).

Table S2. Elemental compositions and textural properties of NSC samples. The activation conditions were set to be 700 °C, K₂CO₃ and biomass with weight ratio of 1:1, various weight ratio between KSCN and biomass.

m(KSCN) /m(biomass)	Yield (%)	C (%)	O (%)	N (%)	S (%)	S _{BET} ^a (m ² /g)	S _{mic} ^b (m ² /g)	V _T ^c (cm ³ /g)	V _{super} ^d (cm ³ /g)	V _{ultra} ^e (cm ³ /g)
0	33.4	83.23	12.57	0.01	0	1159	975 (84)	0.58	0.13	0.29
0.5	25.5	76.57	7.83	1.42	6.74	2230	1926 (87)	1.11	0.63	0.12
1	26.3	71.44	9.66	2.98	9.75	2397	1970 (82)	1.24	0.63	0.13
2	31.5	68.13	10.47	4.15	10.3	1926	1539 (80)	1.04	0.49	0.11

^a BET surface area, ^b micropore surface area, the values in parenthesis was the S_{mic} / S_{BET} and the unit was %, ^c total pore volume, ^d supermicropore volume (> 0.7 and < 2 nm), ^e ultramicropore volume (< 0.7 nm).

Table S3. Porosity, preparation condition, and elemental compositions of selected NSC materials. The activation conditions were set to be 700 °C.

Sample	m(K ₂ CO ₃) /m(KSCN) /m(Biomass)	N (%)	S (%)	S _{BET} (m ² /g)
A1	0/1/1	5.03	10.01	1403
A2	1/2/1	4.15	10.8	1926
A3	1/0.5/1	1.42	6.74	2230
A4	1/1/1	2.98	9.75	2397
A5	2/1/1	2.11	4.04	2900

Table S4. The isothermal parameters and kinetic parameters of selected NSC materials for CAP adsorption.

Sample	Langmuir		pseudo-second-order model	
	q_m mg/g	R ²	k_2 g/mg/min	R ²
A1	417	0.99	0.0003	0.99
A2	588	0.99	-	-
A3	625	0.99	-	-
A4	714	0.99	0.0002	0.99
A5	833	0.99	-	-

Table S5. The isothermal parameters of selected NSC materials for Pb²⁺ adsorption.

Sample	Langmuir	
	q_m mg/g	R^2
A1	294	0.97
A2	303	0.99
A3	222	0.99
A4	285	0.99
A5	100	0.99