Supporting Information

Biowaste-derived 3D honeycomb-like N and S dual-doped hierarchically porous carbons for high-efficient CO_2 capture

Weiwei Shi[a], Rongzhen Wang[a], Huili Liu[a], Binbin Chang[a]*, Baocheng Yang*, Zuling Zhang[b]

[a]Henan Provincial Key Laboratory of Nanocomposites and Applications, Institute of Nanostructured Functional Materials, Huanghe Science and Technology College, Zhengzhou, Henan 450006, China

[b]Henan Provincial Chemi-Industries Research Station Co., Ltd, Zhengzhou 450000, China

**Corresponding author. Tel. Fax: +86 571 87541018.*

E-mail address: binbinchang@infm.hhstu.edu.cn (B. Chang);

baochengyang@infm.hhstu.edu.cn (B. Yang)

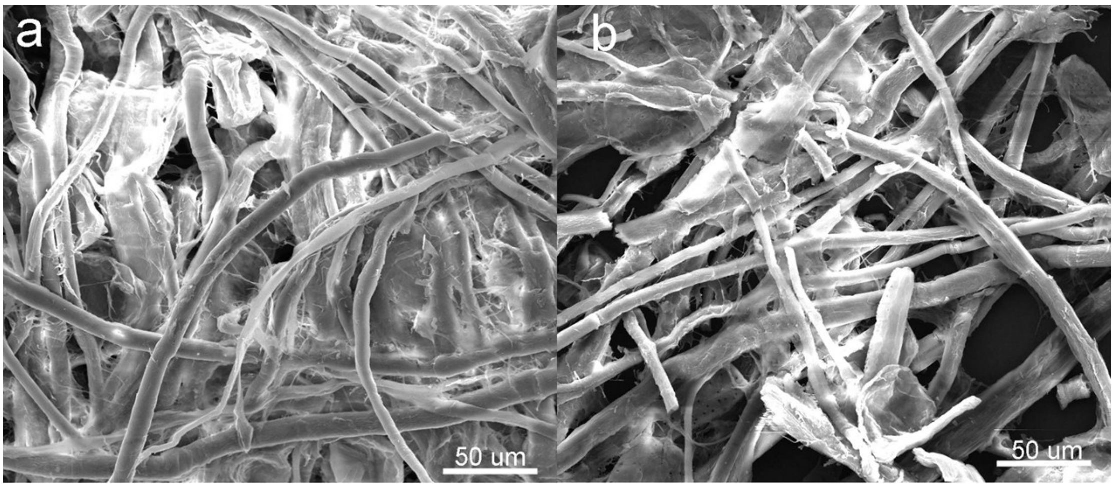

Fig. S1 The SEM images of waste paper towel (a) and hydrothermally synthesized precursors at 200 ^oC (b)

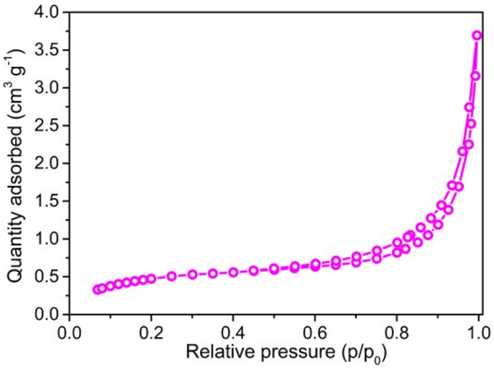

Fig. S2 The N_2 adsorption-desorption isotherm of hydrothermally synthesized precursor at 200 ^{o}C

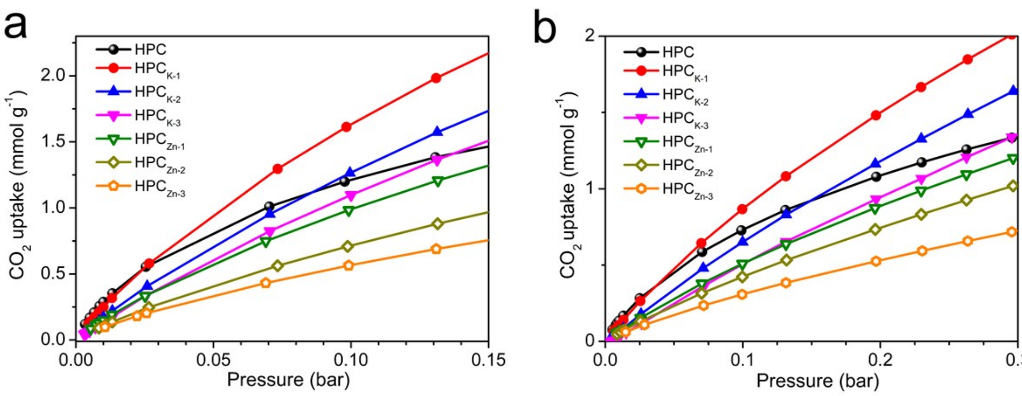

Fig. S3 CO_2 adsorption isotherms of all the resultant samples: (a) at 273 K below 0.15 bar; (b) at 298 K below 0.3 bar.

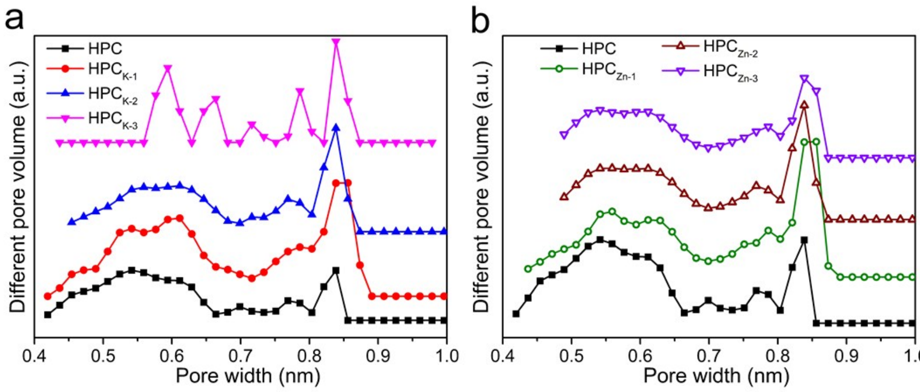

Fig. S4 Micropore (<1 nm) size distribution of all as-obtained materials measured by CO_2 adsorption at 273 K using the DFT method: (a) $HPC_{K\text{-}x}$; (b) $HPC_{Zn\text{-}x}$

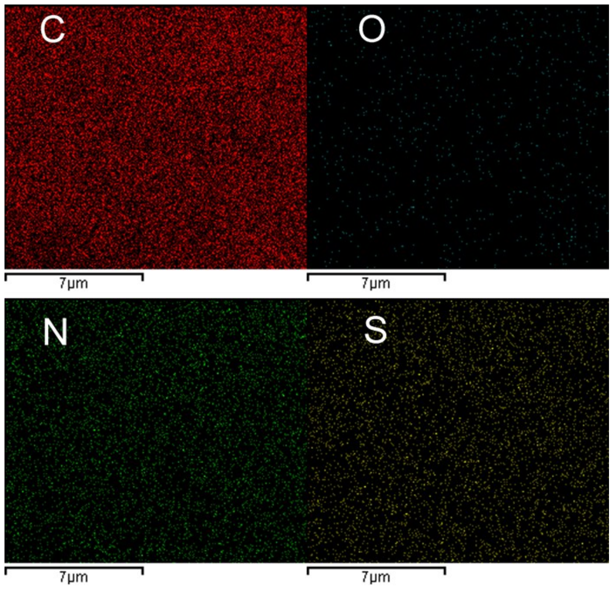

Fig. S5 The element mapping of N,S-HPC_{K-1} sample

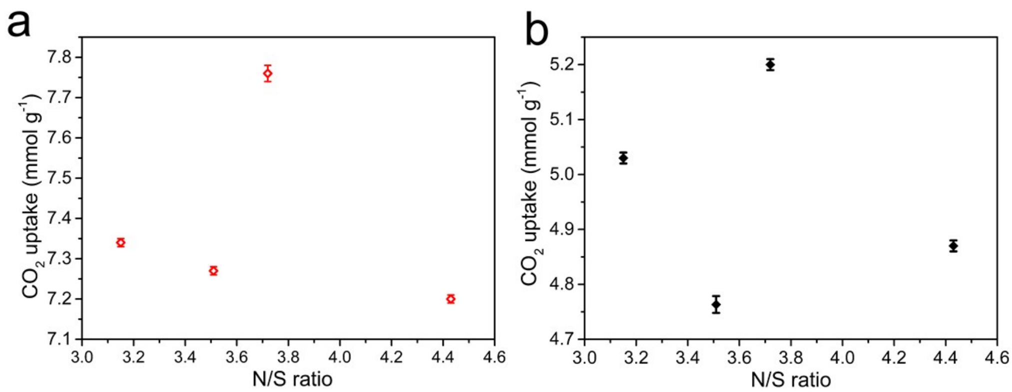

Fig. S6 The effect of different N/S ratios on CO_2 capture: (a) at 273 K under 1 bar; (b) at 298 K under 1 bar

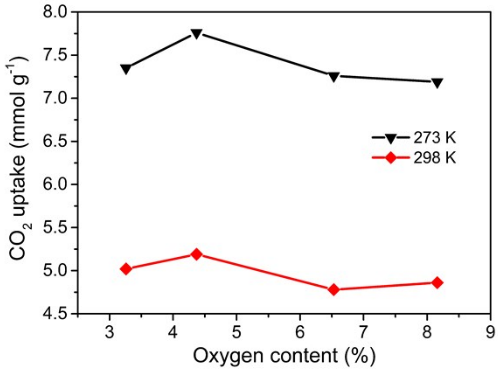

Fig. S7 The effect of oxygen content on CO_2 capture

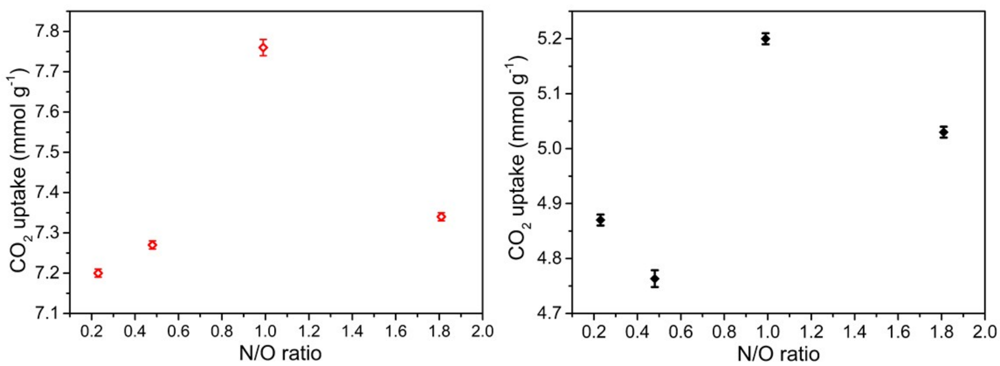

Fig. S8 The effect of different N/O ratios on CO_2 capture: (a) at 273 K under 1 bar; (b) at 298 K under 1 bar

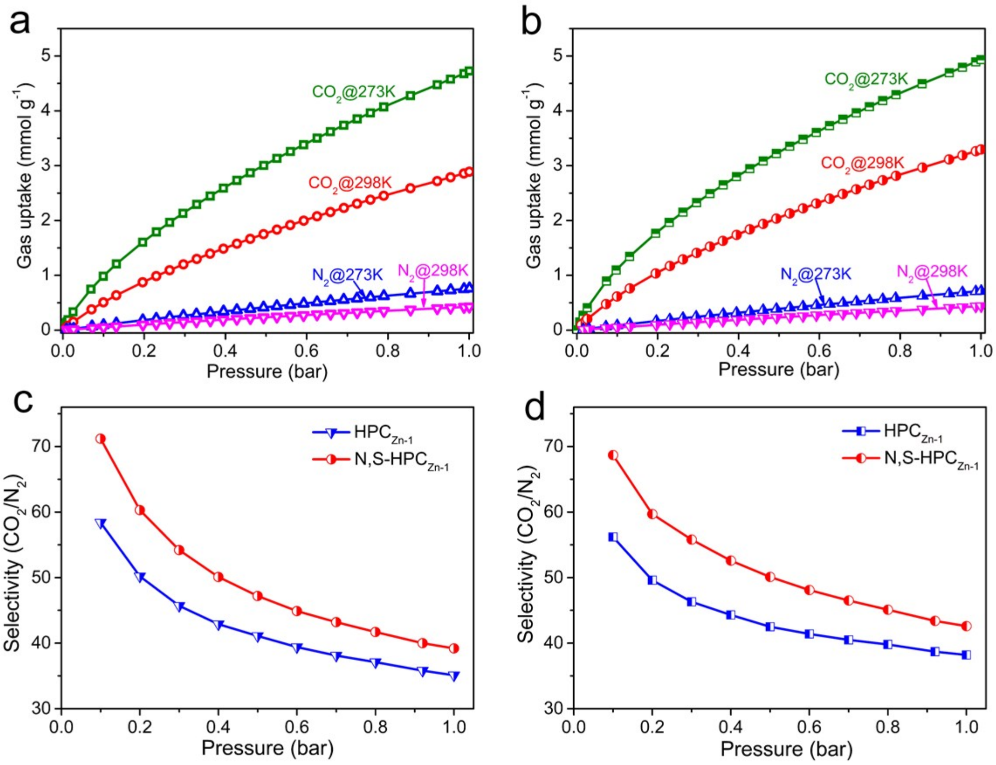

Fig. S9 Adsorption selectivities. (a) CO_2 and N_2 adsorption isotherms of HPC_{K-1} at 273 and 298 K. (b) CO_2 and N_2 adsorption isotherms of N,S-HPC_{K-1} at 273 and 298 K. (c) IAST-calculated selectivities of CO_2/N_2 on HPC_{K-1} and N,S-HPC_{K-1}at 273 K. (d) IAST-calculated selectivities of CO_2/N_2 on HPC_{K-1} and N,S-HPC_{K-1} at 298 K.

Table S1 Comparison of the CO_2 uptake with different carbon-based adsorbents

Sample	S_{BET} ($m^2 g^{-1}$)	Nitrogen content (wt %)	CO_2 uptake at 0.15 bar ($mmol g^{-1}$)	CO_2 uptake at 1 bar ($mmol g^{-1}$)	Temperature (K)	Reference
Commercial activated carbons	2000–3000	—	—	2.1–2.5	298	—
N-doped porous carbon nanofiber	1923	12.27	1.25 at 298 K	6.44/4.42	273/298	1
Popcorn-derived porous carbon	~850	2.47	~1.3 at 298 K	4.6	298	2
Dialdehyde and diamine derived microporous carbons	1881	0.36	—	4.92/2.86	273/298	3
Conjugated microporous polymers aerogels	1701	—	—	3.47	273	4
N-doped mesoporous carbons	748	11.67	1.16 at 298 K	2.73	298	5
N-doped porous carbon microflowers	2309	2.45	—	3.75	298	6
N-doped porous carbon hollow sphere	775	8.39	—	4.42/2.96	273/298	7
Hierarchically porous carbons	829	1.23	—	4.6	273	8
N-doped hierarchical porous carbon nanosheets	1120	17.4	~0.8 at 298 K	4.37	273	9
Wheat-derived activated microporous carbon	1438	—	~1.0 at 298 K	5.7/3.48	273/298	10
Salt-templated porous carbon with arginine	857	2.94	—	3.36	273	11
N-rich microporous carbon sphere	648	7.9	~2.0 at 298 K	5.4/4.3	273/298	12
N-doped porous carbon nanofibers/NiO	330.7	7.86	~0.89 at 298 K	2.46/1.79	273/298	13
Hierarchically porous carbons	~2700	—	—	3.7	298	14
N-enriched hierarchically porous carbon nanosheet	1354	6.47	~0.8 at 298 K	2.50	298	15
Biomass-derived microporous carbons	2511	—	—	3.71	298	16
Plant-derived porous graphene nanosheets	355.4	—	—	2.43	298	17
N and S co-doped hierarchically porous carbons	1770.7	4.32	1.51 at 298 K	7.76/5.19	273/298	This work

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