Supplementary information

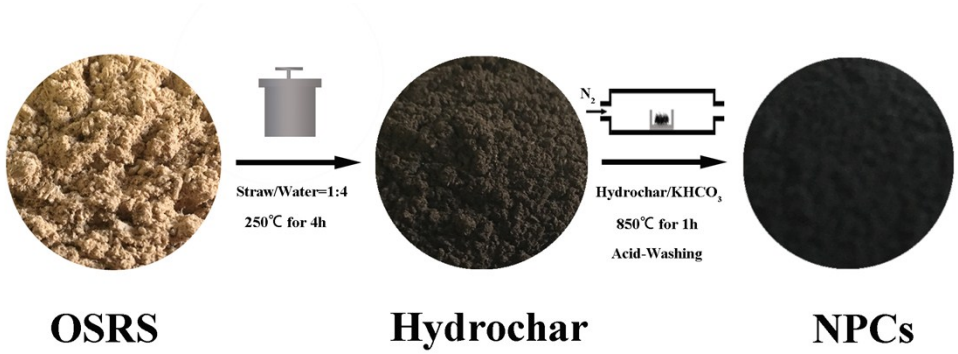
Sustainable synthesis of nanoporous carbons from agricultural waste and their application for solid-phase microextraction of chlorinated organic pollutants

Hu Cheng,[ab] Yang Song,[ab] Yongrong Bian,*[ab] Rongting Ji,[ab] Fang Wang,[ab] Chenggang Gu,[ab] Xinglun Yang[ab] and Xin Jiang*[ab]

[a] Key Laboratory of Soil Environment and Pollution Remediation, Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, PR China
[b] University of Chinese Academy of Sciences, Beijing 100049, PR China

*Corresponding author.
Tel.: +86 25 86881195; Fax: +86 25 86881000.
E-mail: yrbian@issas.ac.cn (Yongrong Bian), jiangxin@issas.ac.cn (Xin Jiang).
Address: NO. 71 East Beijing Road, Nanjing, 210008, PR China.

Fig. S1 Synthesis scheme of the NPCs.



The hydrothermal process could resolve OSRS into small fragments, forming oxygen-contained functional groups and increasing the porosity by hydrolysis of the lignin and hemicellulose. Then, remained crystalline cellulose was activated by $KHCO_3$ under the process of redox reactions between various decomposed potassium compounds with carbon precursor, blowing the melt carbon matrix with as-prepared H_2O and CO_2, intercalating into the carbon lattices of the carbon matrix with the formation of metallic K, and removing metallic K via acid washing.

Fig. S2 Typical SEM (a, b) and TEM (c, d) images of the NPC-8.

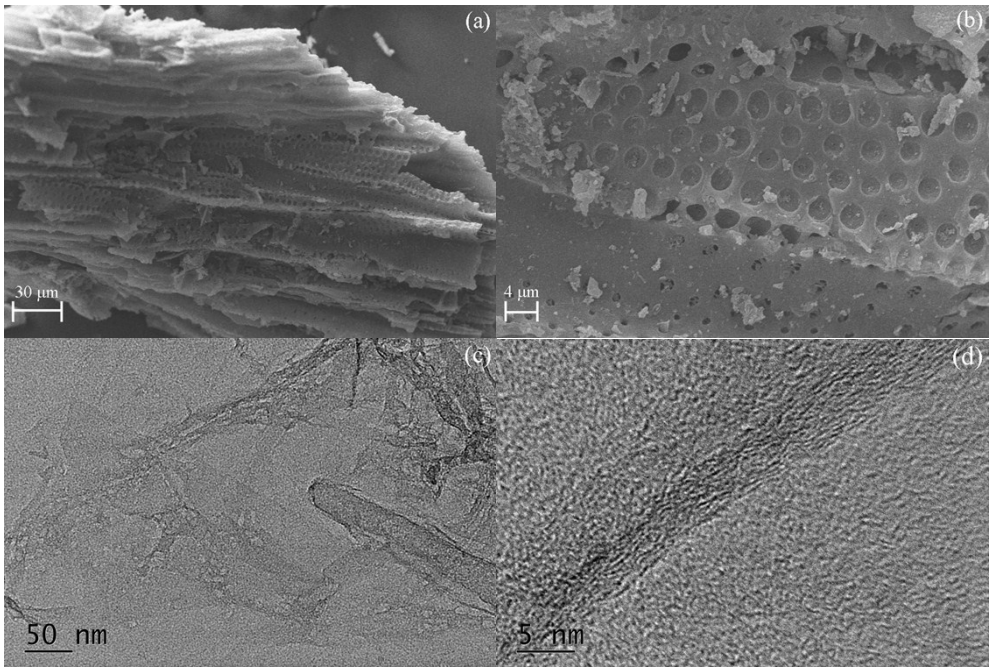


Fig. S3 Typical TG and DSC results for the mixture of the hydrochar and $KHCO_3$ before and after activated.

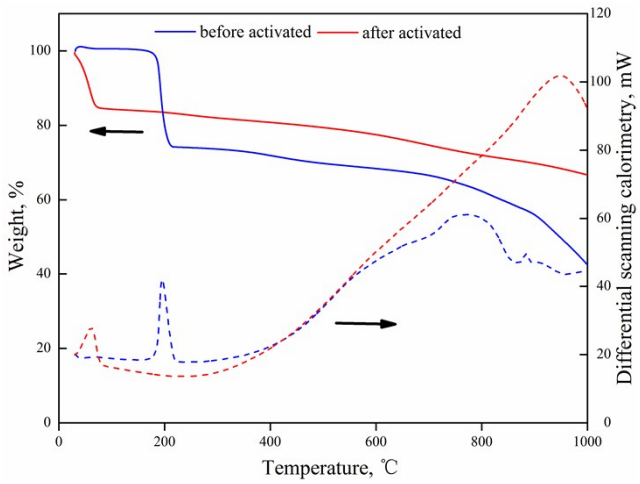


Fig. S4 XRD patterns of the NPCs.

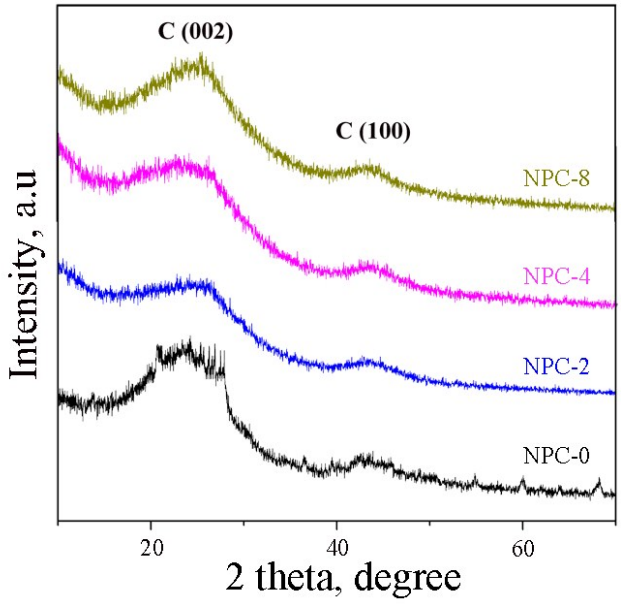


Fig. S5 Raman spectrum of the NPCs.

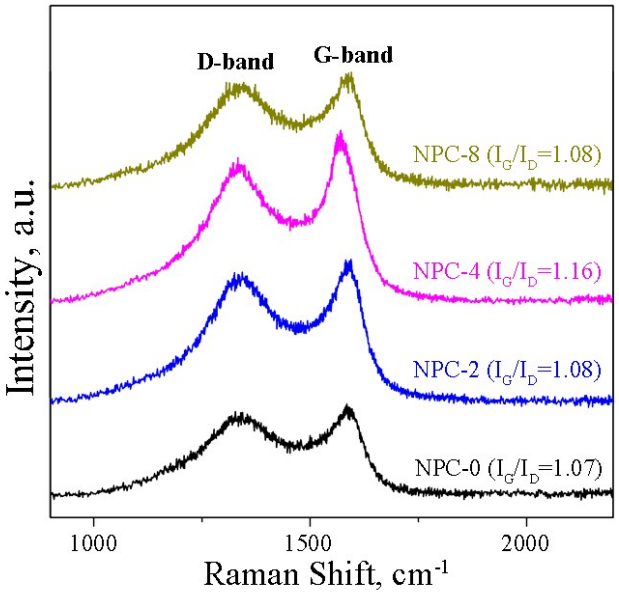


Fig. S6 FT-IR spectrum of the NPCs.

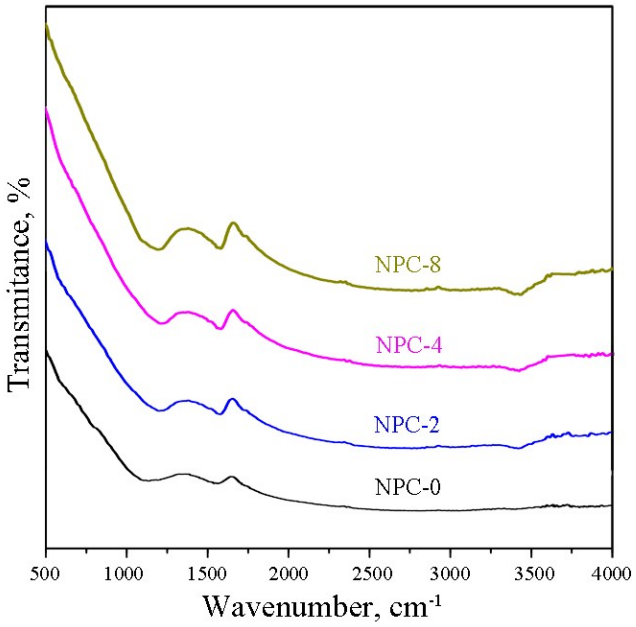


Fig. S7 Typical XPS spectra (a), C 1s XPS spectra (b) and N 1s XPS spectra (c) from the NPC-4.

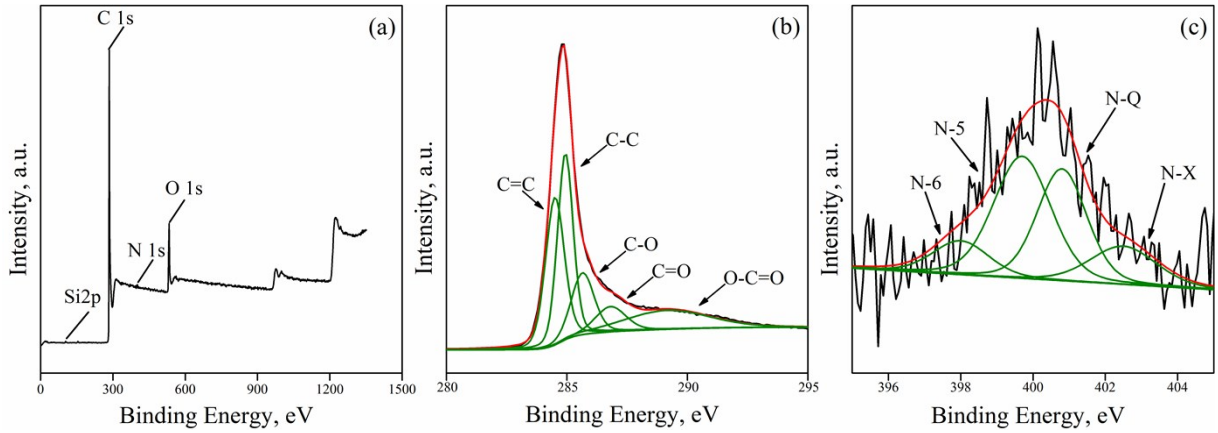


Fig. S8 Effects of operation conditions on the extraction efficiencies of the NPC-coated fiber (NPC-8) towards CBs and PCBs, desorption temperature (1a, 1b), extraction temperature (2a, 2b) and extraction time (3a, 3b).

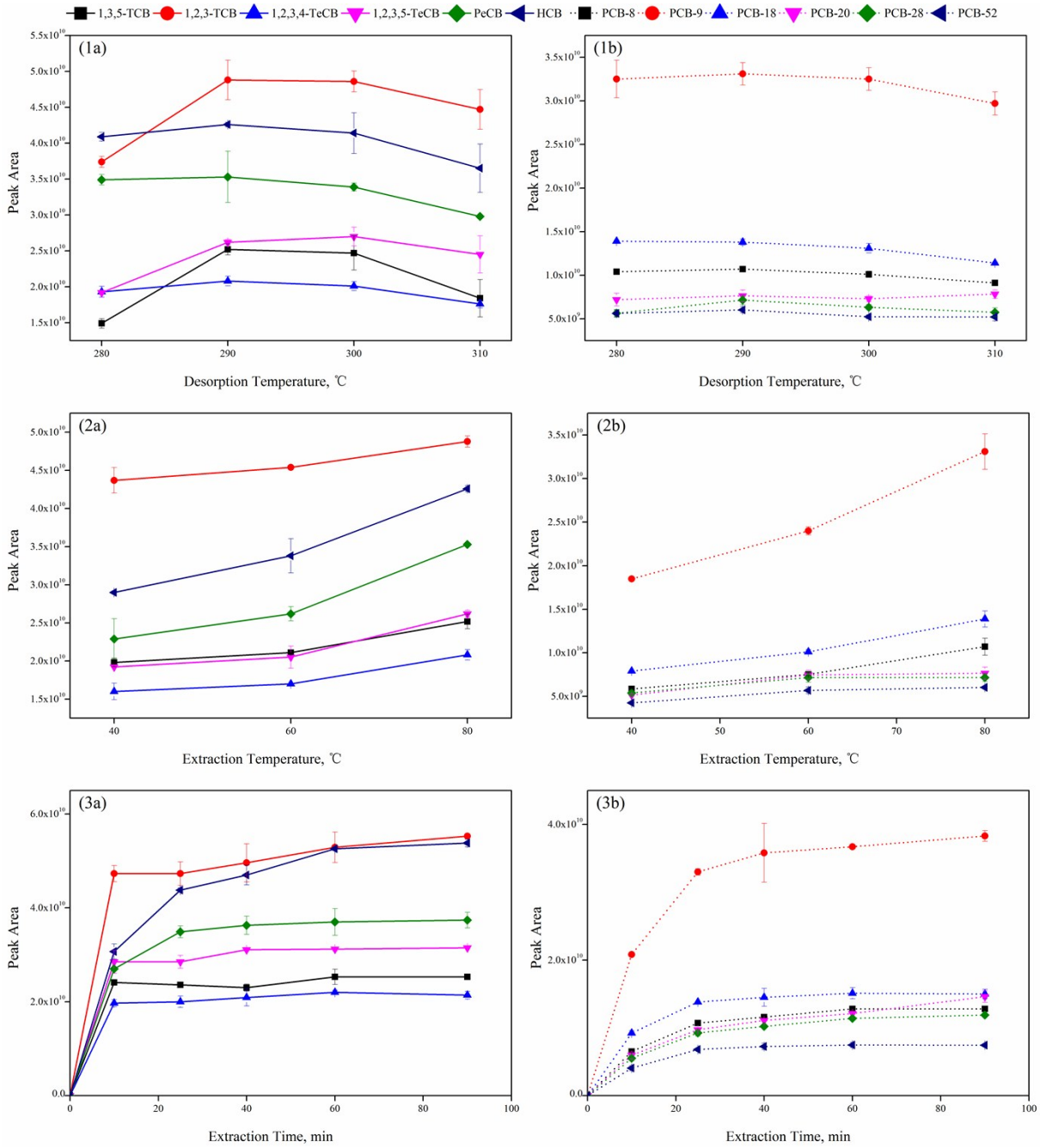


Table S1 Description of main contributions and respective calculation formula for the expanded uncertainty (U) following bottom-up approach.

Uncertainty	Calculation	Parameters
Standard preparation	$\mu_{sp}=[\sum(\Delta mi/mi)^2]^{1/2}$	Δmi: Error associated to the measurement of a given parameter mi: Value measured in each of those actions
Calibration curve	$\mu_{cal}=(SD_{x/y}/p)\{(1/n)+(1/p)+[(y-y_a)^2/b^2/(p-1)/S_{xi}^2]\}^{1/2}$	$SD_{x/y}$: Residual standard deviation in the determination of the sample n: Number of the measurements carried out for a given sample p: Number of the points included in the calibration curve y_a: Average value of the analytical signal b: Slope of the calibration curve S_{xi}: Variance of the standards concentration
Precision	$\mu_{pre}=SD/n^{1/2}$	SD: Standard deviation between duplicate samples n: Number of the replications
Accuracy	$\mu_{ac}=RSD/n^{1/2}$	RSD: Relative standard deviation of the average percent recovery n: Number of the replications
Expanded uncertainty	$U_{(k=2)}= 2C(\mu_{sp}^2+\mu_{cal}^2+\mu_{pre}^2+\mu_{ac}^2)^{1/2}$	C: Average concentration of the analyte

Table S2 Comparison of developed method with other analysis methods for determination of selected CBs and PCBs in water samples.

Analytes	Limits of detections, ng L^{-1}							
	This study	LLE-DSPE-GC-ECD [1]	SPNE-GC-ECD [2]	SBSE-GC-MS [3]	SPME-GC-MS [4]	HS-SPME-GC-ECD [5]	SPME-GC-ECD [6]	HS-SPME-GC-MS [7]
1,3,5-TCB	0.34	—	—	—	—	2.25	—	—
1,2,3-TCB	0.19	—	—	—	—	0.94	—	—
1,2,3,4-TeCB	0.09	—	—	—	—	0.32	—	—
1,2,3,5-TeCB	0.28	—	—	—	—	—	—	—
PeCB	0.64	—	—	—	—	0.50	—	—
HCB	0.30	—	—	—	0.69	0.64	—	—
PCB-8	0.29	—	—	0.36	—	—	—	—
PCB-9	0.22	—	—	—	—	—	—	—
PCB-18	0.21	—	—	—	—	—	—	0.03
PCB-20	0.08	—	—	0.39	—	—	—	—
PCB-28	0.13	0.25	1.40	0.50	—	—	0.1	—
PCB-52	0.12	0.30	3.10	0.27	—	—	0.1	0.03

Table S3 Comparison of partly detected COPs from water samples with others in the literatures.

Analytes	Detected concentration (ng L^{-1})					
	This study	Rainwater [8]	lake water1 [4]	pond water [9]	lake water2 [10]	well water [11]
1,3,5-TCB	0.45	—	—	—	nd	0.6
HCB	5.88	11.7	17.5	14.8	nd	0.3

nd: not detected; rainwater: collected from in Guangzhou, China, on May 21st, 2014; lake water1: collected from the surface water of Pearl River, Guangzhou, China; pond water: collected from the surface water of pond located in Sun Yat-sen University, China; lake water2: collected from the surface water of Xuan Wu Lake, Nanjing, Jiangsu, China; well water: none.

Table S4 Advantages and drawbacks of diverse protocols for the determination of COPs from water.

Techniques	Advantages	Drawbacks
LLE-DSPE-GC-ECD [1]	High sensitivity	Complex procedure
	Short extraction time consuming: 10 min	Uses organic solvents: methanol, n-hexane, dichloromethane
	Multiple analytes at the same run: 7	Consumes large quantities of solvents: 100 mL
	Low cost of analysis instrument	Large sample volume: 1000 mL
SPNE-GC-ECD [2]	Short extraction time consuming: 9.5 min	Complex procedure
	Consumes small quantities of solvents: 0.1 mL	Moderate sensitivity
	Multiple analytes at the same run: 7	Uses organic solvents: n-hexane
	Low cost of analysis instrument	
	Small sample volume: 1 mL	
SBSE-GC-MS [3]	Easy and simple procedure	Long extraction time consuming: >24 h
	High sensitivity	High cost of analysis instrument
	Non-toxic solvents	large sample volume: 200 mL
	Multiple analytes at the same run: 77	
	Environmental friendly, benign	
HS-SPME-GC-ECD	Easy and simple procedure	Long extraction time consuming: 24.5 min
	High sensitivity	
	Non-toxic solvents	
	Multiple analytes at the same run: 12	
	Environmental friendly, benign	
	Low cost of analysis instrument	
	Small sample volume: 10 mL	

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