Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Magnetic activated carbon prepared from rice straw-derived hydrochar for triclosan removal

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Experimental Section (SI)

(1) Materials

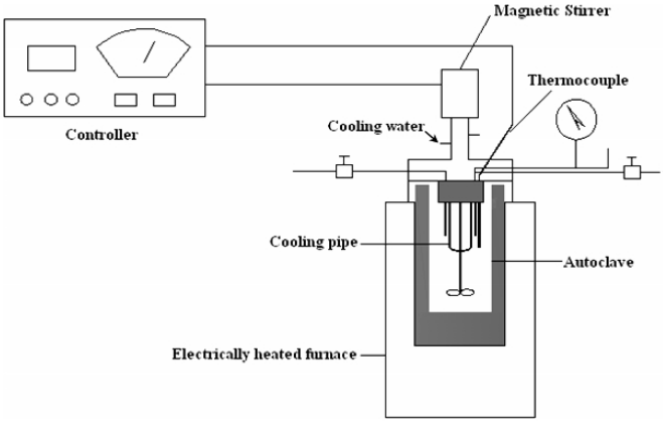

Fig. S1 Schematic diagram of the hydrothermal reaction system[1]

(2) Fabrication of Magnetic Activated Carbon

The fabrication of activated carbon from hydrochar can be composed of the following steps:

(1) Hydrochar was impregnated into the solution of the activating reagent (K_2CO_3) and then mixed for 24 h under continuous agitation (200 rpm).

(2) Then, the dried mixture was placed in a quartz boat and pyrolyzed at a certain temperature for 1.5 h under nitrogen atmosphere (1 L min^{-1} N_2 flow rate).

(3) After cooling down to room temperature under nitrogen, the carbonized sample was washed to neutral sequentially with HCl (0.1 M) and distilled water, and then dried at 373 K for 4 h.

Moreover, the procedure for the synthesis of magnetic activated carbon from activated carbon was as follows: activated carbon (3.4 g) was immersed into a 200 ml solution of ferric chloride ($FeCl_3$, 4.6 g, 28 mmol) and ferrous sulfate heptahydrate ($FeSO_4 \cdot 7H_2O$, 3.9 g, 14 mmol) in a three necked balloon at 343 K. Then sodium hydroxide (NaOH) solution (100 ml, 5 M) was added dropwise into the solution under vigorous stirring. After the mixture aged at 343 K for 3 h, the obtained material was then repeatedly washed with distilled water and dried at 373 K for 4 h.

Results and Disscussion (SI)

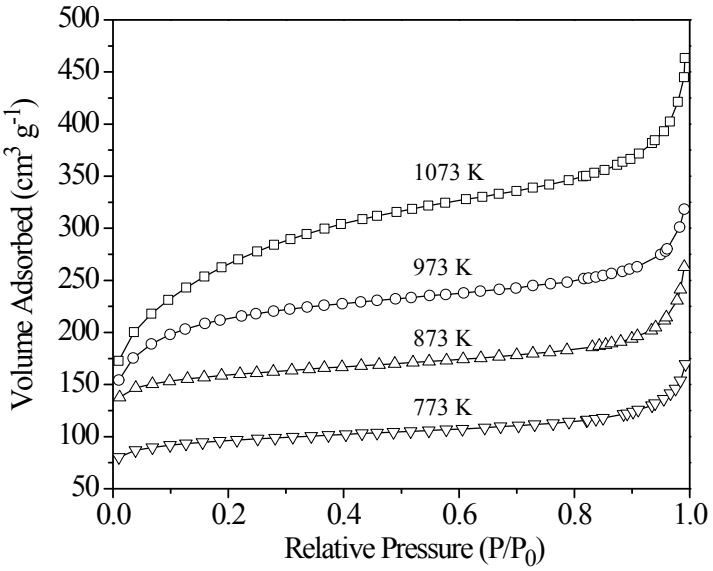

Fig. S2 N_2 adsorption isotherms of activated carbons prepared under different temperatures (impregnation ratios, 2:1)

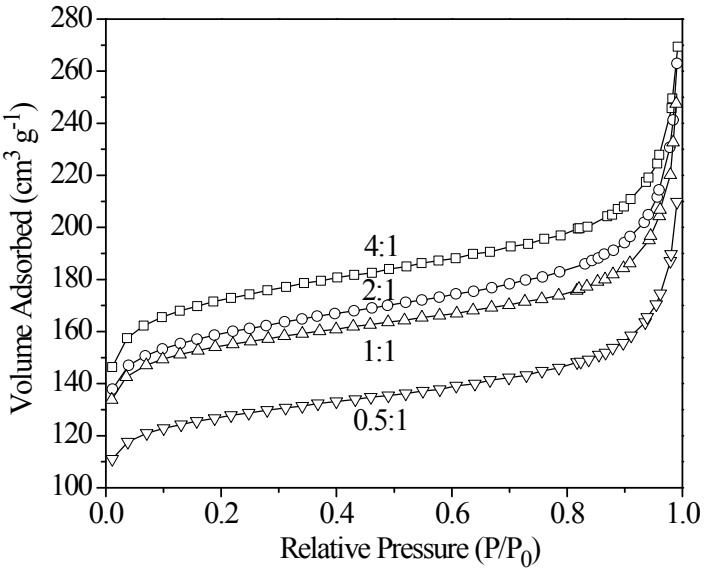

Fig. S3 N_2 adsorption isotherms of activated carbons prepared under different impregnation ratios (activation temperature: 873 K)

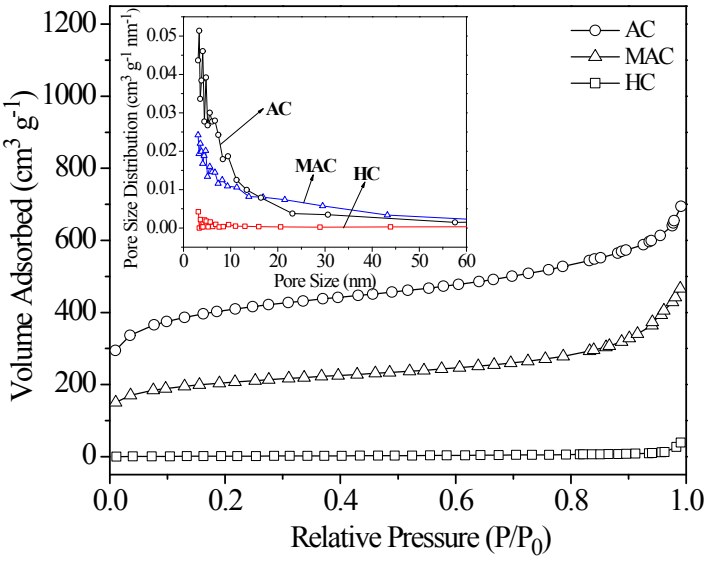

Fig. S4 N_2 adsorption isotherms of hydrochar (HC), activated carbon (AC) and magnetic activated carbon (MAC) (The inset shows mesopore size distribution of hydrochar, activated carbon and magnetic activated carbon)

Table S1 Curve fitting results of XPS C 1s and O 1s spectra of magnetic activated carbon (BE is binding energy (eV), FWHM is the full width at half maximum)

Elements	Peaks	BE	FWHM	Area (%)
C 1s	C-C	284.6	2.71	74.9
	C-O	286.5	1.37	4.45
	C=O	287.8	2.31	5.85
	O-C=O	289.0	4.41	14.8
O 1s	O-C=O	530.0	2.04	24.4
	C-O-C	531.4	1.06	2.00
	C-O	532.9	3.09	26.8
	Fe_3O_4	530.7	1.55	11.6
	FeOOH	531.8	2.17	25.2
	γ-Fe_2O_3	532.0	2.25	10.0

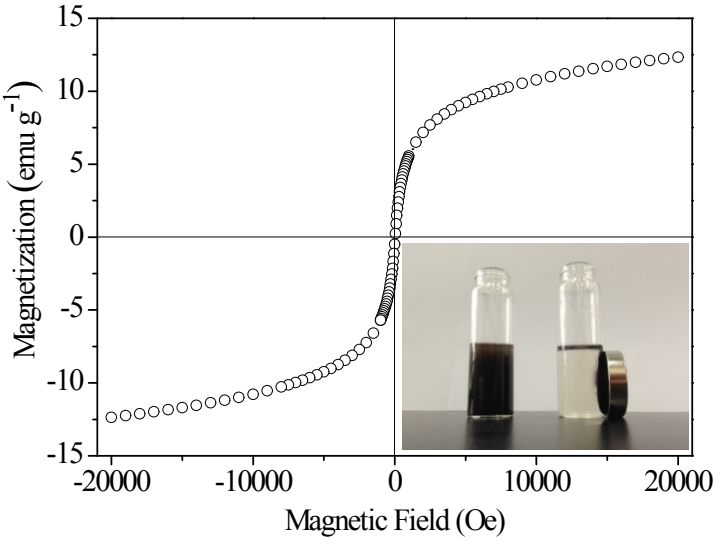

Fig. S5 Magnetization curve of magnetic activated carbon at 300 K (The inset shows that magnetic activated carbon can be separated easily under an external magnetic field)

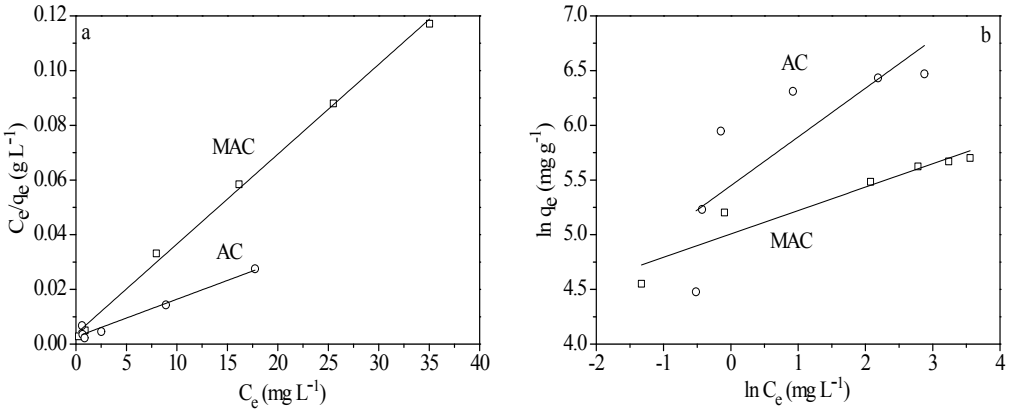

Fig. S6 (a) Langmuir adsorption isotherm of TCS onto activated carbon (AC) and magnetic activated carbon (MAC) at 298 K. (b) Freundlich adsorption isotherm of TCS onto activated carbon (AC) and magnetic activated carbon (MAC) at 298 K.

Table S2 Comparisons of TCS maximum adsorption capacity (q_m, mg g^{-1}) of adsorbents

adsorbents	q_m	reference
organo-zeolite	46.95	[1]
activated carbon	70.42	[3]
multi-walled carbon nanotube	166.83	[29]
tyre crumb rubber	66.67	[30]
activated carbon	714	this study
magnetic activated carbon	303	this study

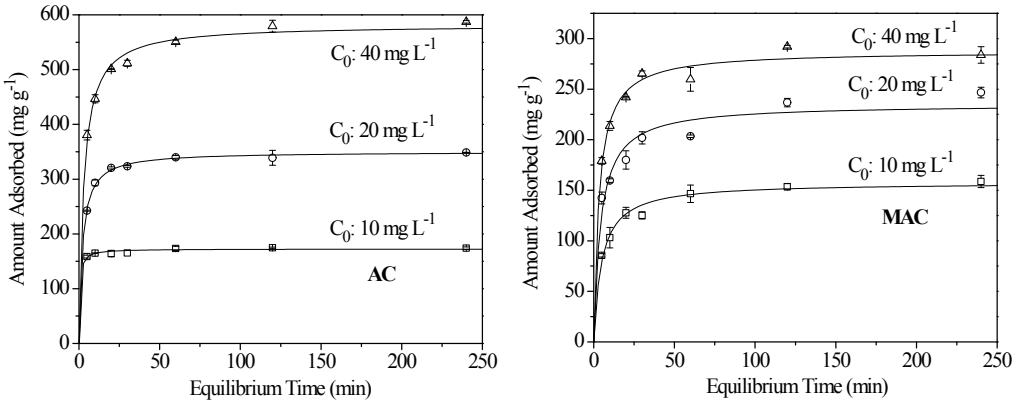

Fig. S7 Pseudo-second-order kinetics for the adsorption of TCS onto activated carbon (AC, left) and magnetic activated carbon (MAC, right) at 298 K

Table S3 Kinetic parameters calculated from intraparticle diffusion model for the adsorption of TCS onto activated carbon (AC) and magnetic activated carbon (MAC) at 298 K (C_0: mg L^{-1}, k_{i1}: mg g^{-1} $min^{-0.5}$, k_{i2}: mg g^{-1} $min^{-0.5}$)

Sample	C_0	k_{i1}	c_1	R^2	k_{i2}	c_2	R^2
AC	10	1.60	157	0.55	0.05	174	0.09
	20	24.2	202	0.78	1.22	329	0.52
	40	40.4	305	0.88	4.55	521	0.68
MAC	10	13.1	60.3	0.82	1.54	135	0.94
	20	18.0	102	0.99	5.36	168	0.69
	40	25.9	125	0.98	2.78	247	0.42

Table S4 The pH, TOC for various water matrix

Water matrix	pH	TOC (mg L^{-1})
Sea water	7.50	3.31
Lake water	7.89	9.43
Ground water	7.45	3.50
River water	7.59	5.08
Pure water	7.04	1.42

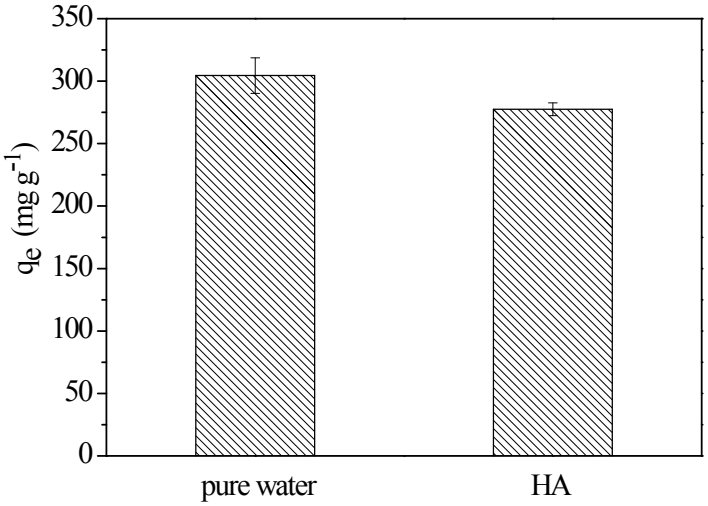

Fig. S8 Effect of humic acid (HA) on the TCS adsorption performance of magnetic activated carbon (MAC) (MAC: 50 mg L^{-1}, TCS: 40 mg L^{-1}, HA: 40 mg L^{-1}, temperature: 298 K)

References

1 D. Zhou, L. Zhang, S. Zhang, H. Fu and J. Chen, *Energ. Fuel.*, 2010, **24**, 4054-4061.