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Supplementary material

SUPPLEMENTARY MATERIAL TO

Performance of carbon-coated magnetic nanocomposite in methylene blue and arsenate treatment from aqueous solution

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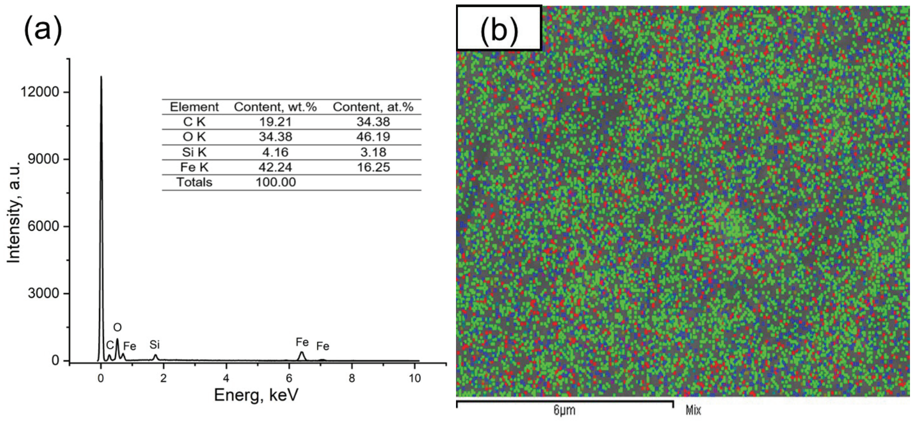

Element	Content, wt.%	Content, at.%
C K	19.21	34.38
O K	34.38	46.19
Si K	4.16	3.18
Fe K	42.24	16.25
Totals	100.00	

Fig. S-1. EDS analysis (a) and elementals map (b) of CMC.

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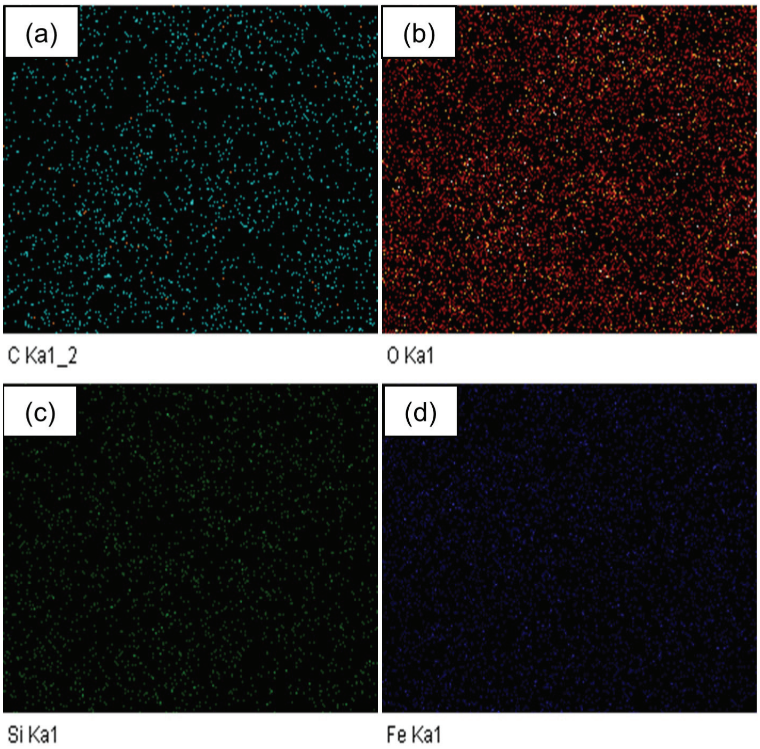

Fig. S-2. Elemental maps of C (a), O (b), Si (c) and Fe (d) of CMC.

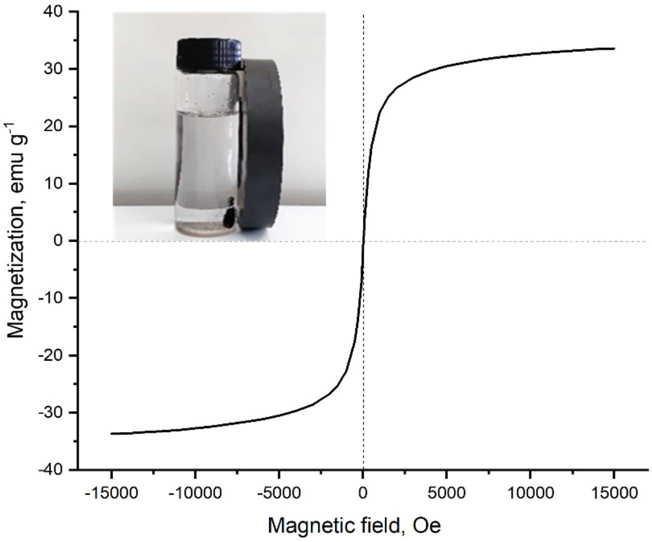

Fig. S-3. Magnetization curves and illustration of the magnetic separability of CMC.

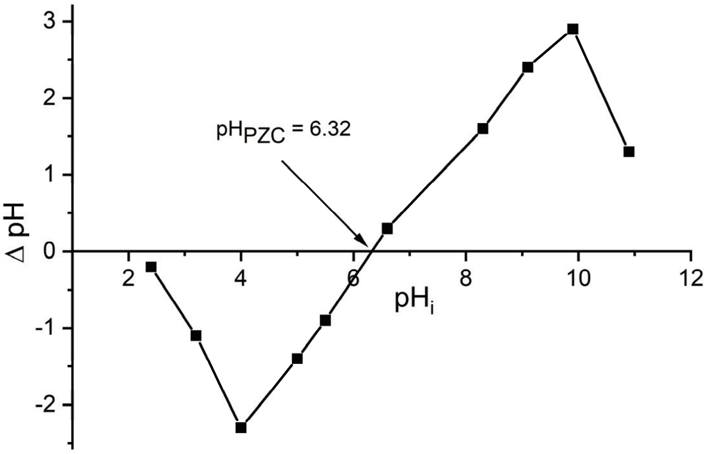

Fig. S-4. Plot of point of zero charge of CMC.

TABLE S-I. Different kinetic models, thermodynamic equations and adsorption isotherms

Model	Parameter	Equation	
Adsorption kinetic models			
Pseudo first-order	q_e / mg g^{-1} = equilibrium adsorption capacity	$q_t = q_e - q_e e^{-k_1 t}$	(1)
	q_t / mg g^{-1} = adsorption capacity at time t		
	k_1 / min^{-1} = rate constant		
Pseudo second-order	k_2 / g mg^{-1} min^{-1} = rate constant	$q_t = \frac{k^2 q_e^2 t}{1 + k^2 q_e t}$	(2)
Thermodynamic equations			
Van't Hoff equation	ΔS^o/ J mol^{-1} = entropy change	$\ln K_D = \frac{\Delta H^o}{RT} + \frac{\Delta S^o}{R}$	(3)
	ΔH^o/ J mol^{-1} = enthalpy change		
	R / J mol^{-1} K^{-1} = 8.314 (universal gas constant)		
	T / K = absolute temperature		
	K_D / L g^{-1} = q_e/C_e thermodynamic equilibrium constant		
	ΔG^o/ J mol^{-1} = Gibbs free energy change	$\Delta G^o = -RT \ln K_D$	(4)
Adsorption isotherms			
Langmuir	q_m / mg g^{-1} = maximum monolayer adsorption capacity of the adsorbent	$\frac{C_e}{q_e} = \frac{1}{K_a q_m} + \frac{C_e}{q_m}$	(5)
	K_a = energy constant		
	R_L = separation factor which gives an idea about Langmuir isotherm	$R_L = \frac{1}{1 + K_a C_0}$	(6)
Freundlich	K_F / mg g^{-1} L$^{1/n}$ mg$^{-1/n}$ = Freundlich constant n = intensity of adsorption, $n > 1$ indicates a favourable and heterogeneous adsorption	$\ln q_e = \ln K_F + \frac{1}{n} \ln C_e$	(7)

TABLE S-II. The comparison of the magnetization of CMC with various biochar

Precursors of magnetic biochar	Method	Magnetization, emu g^{-1}	Reference
Rice straw, Fe(NO$_3$)$_3$, KOH	Hydrothermal	33.7	This work
Coconut shells, FeCl$_3$	Pyrolysis, microwave	6.0	1
Corn stalk, FeSO$_4$, Na$_2$S$_2$O$_3$, NaOH	Hydrothermal	11.2	2
Corn stalk, FeSO$_4$, Na$_2$S$_2$O$_3$, NaOH	Pyrolysis	20.4	2
Palm fiber, FeSO$_4$, FeCl$_3$, NH$_3$	Pyrolysis	19.4	3
Firwood, α-FeOOH	Pyrolysis	20.8	4
Oleyl amine, FeCl$_2$, FeCl$_3$, NaOH	Hydrothermal	21.7	5
Rice husk, Fe(NO$_3$)$_3$, KMnO$_4$	Pyrolysis	27.5	6

TABLE S-III. The porous parameters of RS, BS, CMC samples

Sample	**S_{BET} / m^2 g^{-1}**	**V_T / cm^3 g^{-1}**	**D_P / nm**
RS	1.3	0.01	30.6
BS	6.6	0.04	33.0
CMC	171.4	0.15	6.0

TABLE S-IV. The comparison of the maximum adsorption capacity of MB and As(V) on CMC with various adsorbents.

Adsorbent	Capacity, mg g^{-1}		
	MB	As(V)	Ref.
CMC	110.63	2.31	This study
Fe$_2$O$_3$-ZrO$_2$/BC	38.1	1.01	7
M-MWCNTs	48.06	-	8
Fe$_3$O$_4$ /MWCNT	74	-	9
Fe$_3$O$_4$@C NPs	117	-	10
HPB (hematite/biochar)	-	0.43	11
Ch-Rs (chitosan/red scoria)	-	0.72	12
OBC (Canola straw-based biochar)	-	0.95	13
TB 800 (biochar from waste)	-	1.25	14
PAC-500 (magnetic biosorbents)	-	2.00	15
MC-O/NC-L-MG (magnetite/ microcellulose)	-	18.5	16
ChM (Chitosan-Magnetite Hydrogel)	-	66.9	17

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