

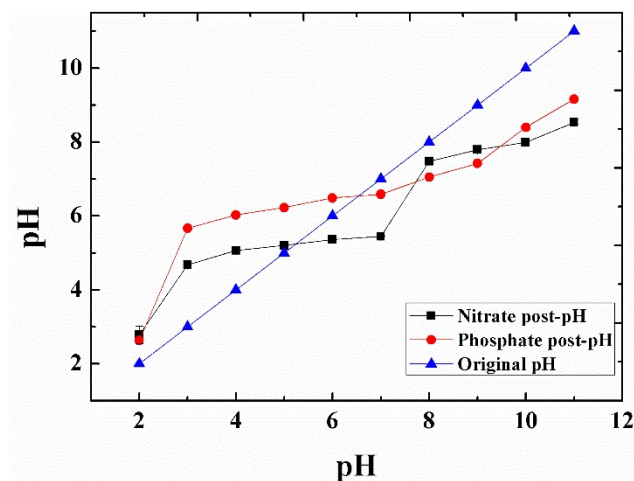
Supplementary information

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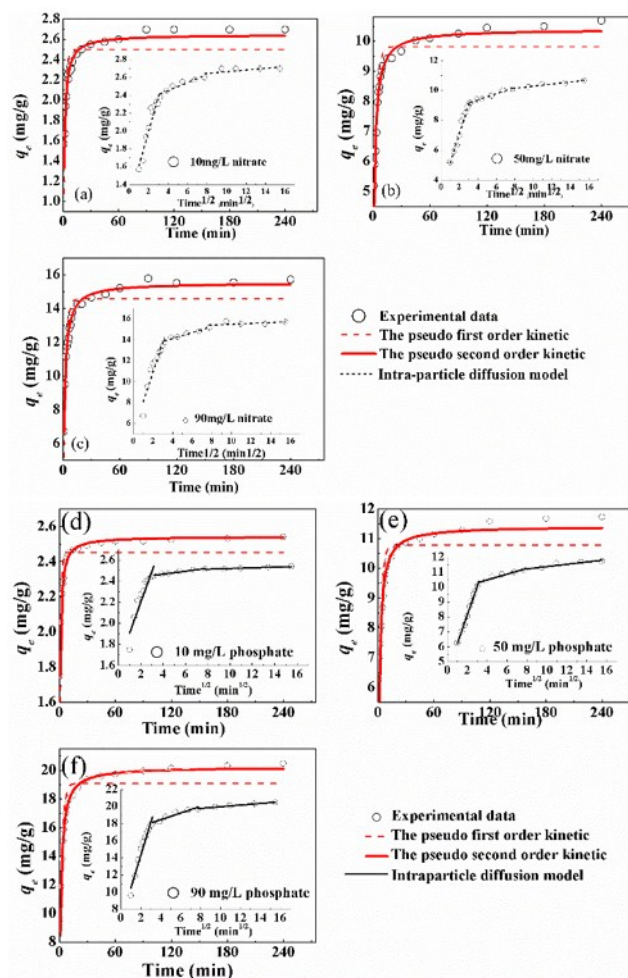
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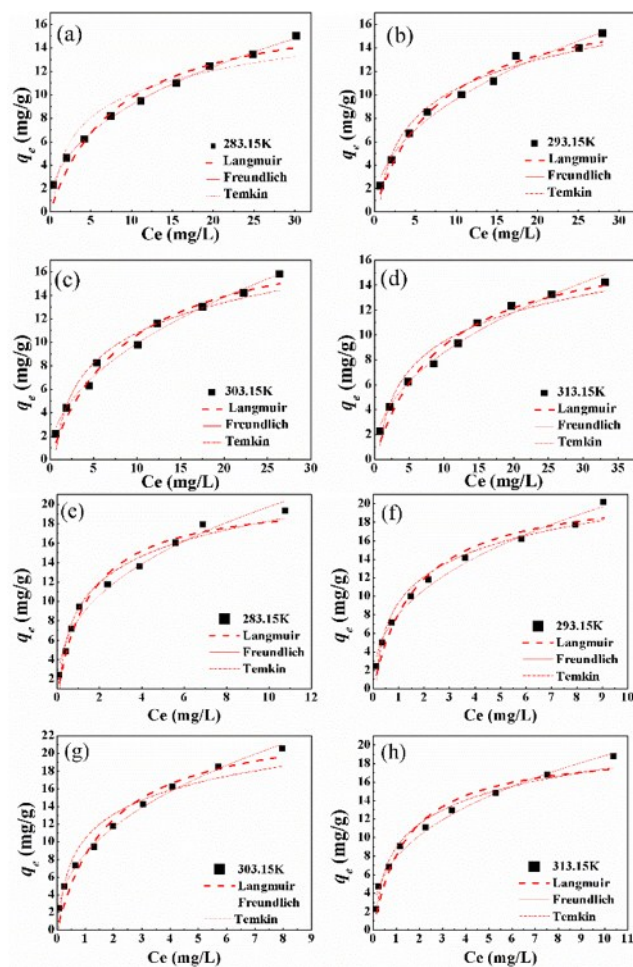
Supplementary Fig.1 pH changes before and after nitrate and phosphate adsorption on MCS



Supplementary Fig.2 Adsorption kinetics of nitrate (a, b, c) and phosphate (d, e, f) in different concentrations



Supplementary Fig.3 Adsorption isotherms of nitrate (a, b, c, d) and phosphate (e, f, g, h) at different temperatures



Supplementary Tables

Supplementary Table 1 pH changes before and after nitrate and phosphate adsorption on MCS

pH	Nitrate adsorption capacity	error	Nitrate removal rate	error	Nitrate post-pH	error	Phosphate adsorption capacity	error	Phosphate removal rate	error	Phosphate post-pH	error
2	10.14	0.0173	82.68785	0.3262	2.79	0.2333	8.19	0.0470	66.40	0.3812	2.64	0.0212
3	10.09	0.0867	78.82038	0.6770	4.68	0.0354	11.17	0.0086	90.54	0.0693	5.67	0.0212
4	9.86	0.0693	77.00115	0.5416	5.06	0.0566	11.23	0.0342	90.98	0.2773	6.03	0.0495
5	9.86	0.2080	77.00115	1.6249	5.20	0.0141	11.76	0.0086	95.29	0.0693	6.23	0.0212
6	9.76	0.1733	76.24	1.3541	5.37	0.0354	11.83	0.0043	95.86	0.0347	6.49	0.0071
7	9.84	0.0173	76.91	0.1354	5.45	0.0071	11.75	0.0043	95.27	0.0347	6.59	0.0071
8	9.62	0.0520	75.18	0.4062	7.48	0.0849	11.64	0.0171	94.36	0.1386	7.05	0.0707
9	9.70	0.1213	75.76	0.9479	7.79	0.0141	11.24	0.0043	91.10	0.0347	7.42	0.0566
10	9.73	0.0347	76.04	0.2708	7.99	0.0424	11.21	0.0086	90.83	0.0693	8.40	0.0212
11	8.43	0.0347	67.59	1.4118	8.53	0.0566	10.81	0.0043	87.57	0.0347	9.16	0.0000

Supplementary Table 2 Regeneration capacity of MCS by NaOH and HCl

Regeneration times	NaOH		HCl	
	q_e mg/g	R(%)	q_e mg/g	R(%)
(Nitrate)				
Original	9.98		9.88	
1	6.43	64.43	9.88	100
2	5.20	52.10	9.87	99.90
3	4.87	48.80	9.69	98.08
(Phosphate)				
Original	13.88		13.88	
1	13.59	97.91	12.48	89.91
2	12.85	92.58	12.39	89.27
3	12.58	90.63	12.20	87.90

After adsorption, MCS adsorbed nitrate and phosphate were desorbed in 50 mL of 0.1 M NaOH and HCl for a period of 0.5 h, respectively. After washed with distilled water, the regenerated MCS were used to adsorb nitrate and phosphate again in the subsequent experiments. The adsorption and regeneration cycles were repeated 3 times. The regeneration efficiency (R%) of the adsorbents was calculated as follows:

$$(\%R) = \frac{q_r}{q_0} \times 100$$

Where q_0 and q_r (mg/g) represent the adsorption capacities of adsorbents before and after

regeneration, respectively.”

The analysis results were shown below.

In order to investigate the reusability of MCS in acidic or alkaline conditions, the results were shown in supplementary Table 2 . The results indicated that the same concentration of NaOH and HCl showed different regeneration capacity on MCS loaded nitrate and phosphate. For nitrate, the regeneration rate slightly decrease from 100% to 98.08% by using HCl. For phosphate, the NaOH showed higher regeneration rate. These results are similar to the results of pH effect. During the process of desorption, both NO_3^- and PO_4^{3-} can be replaced by Cl^- or OH^- . For the next adsorption, Cl^- and OH^- would be exchanged into solvent again and lead to the lower or higher pH, respectively. The results in Fig.5 showed that the lower pH was benefit to the nitrate adsorption and the higher pH had adverse effect. Therefore, we can use MCS as potential adsorbent for nitrate and phosphate removal, and maybe MCS could be a selective adsorbent after activation by NaOH or HCl.