Supporting Information on

Magnetic Porous Carbonaceous Material Produced from Tea Waste for Efficient Removal of As(V), Cr(VI), Humic Acid and Dyes

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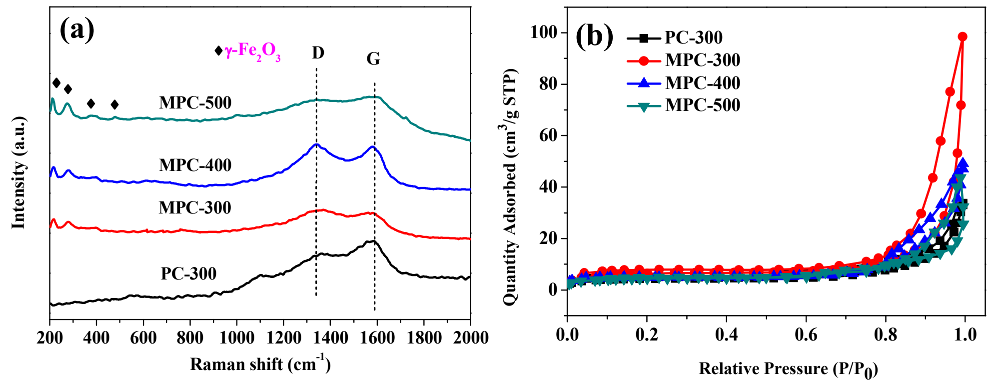

Figure S1. Raman spectra and N_2 adsorption–desorption isotherms of PC-300 and MPC-*T* (300, 400, and 500 ^{o}C).

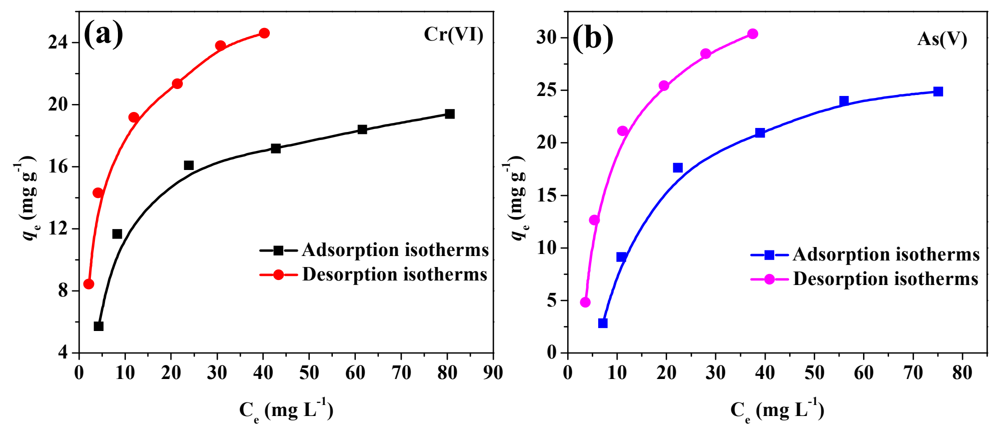

Figure S2. Adsorption-desorption isotherms of Cr(VI) (a) and As(V) (b) on MPC-300. m/V = 1.0 g L^{-1}, pH = 5.0 ± 0.1, I = 0.01 M $NaNO_3$.

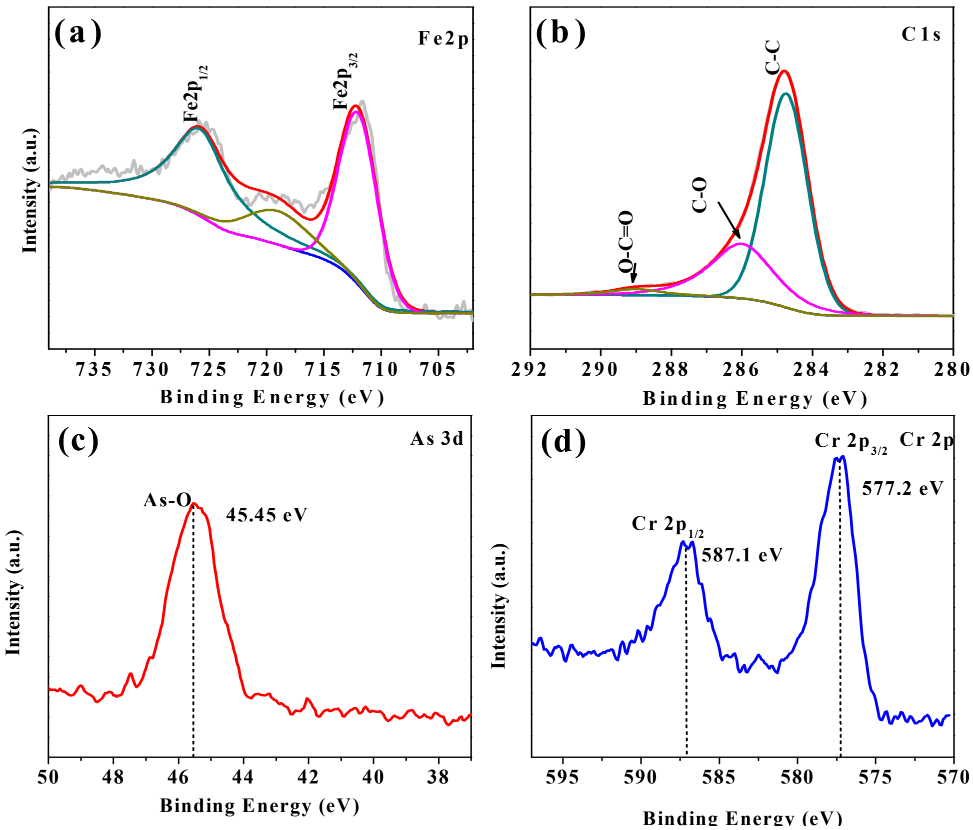

Figure S3. The fine spectra of Fe 2p (a) and C1s (b) for MPC-300. XPS spectrum of (c) As 3d and (d) Cr 2p of MPC-300 after As(V) and Cr(VI) adsorption.

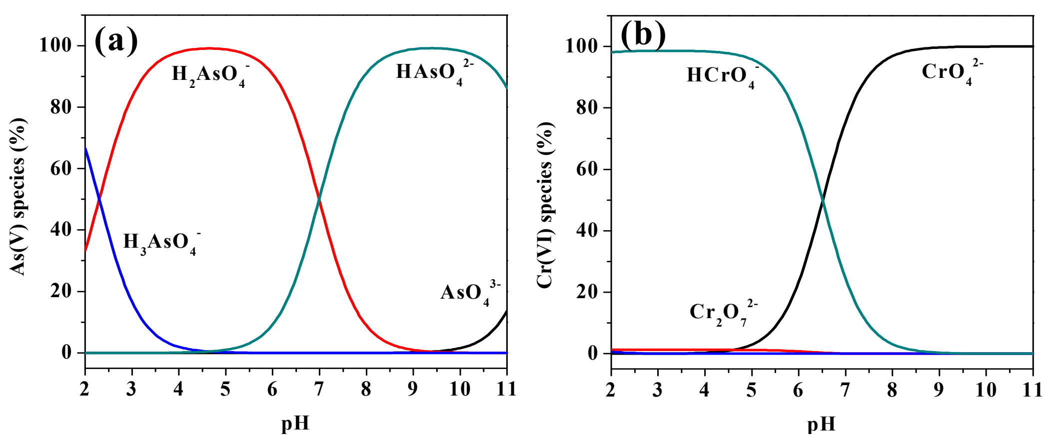

Figure S4. The relative distribution of As(V) (a) and Cr(VI) (b) species in aqueous solutions.

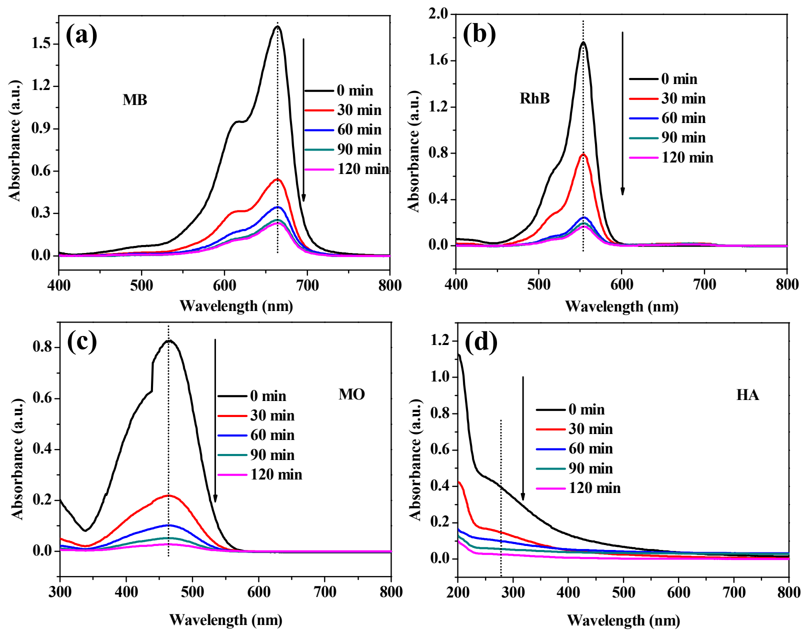

Figure S5. The UV-vis spectra of MB (a), RhB (b), MO (c), and HA (d) adsorption on MPC-300 as a function of reaction time. The stock suspensions (300 mg L^{-1}) were prepared by dissolution of various organic pollutants into Milli-Q water. UV-vis adsorption was performed to examine the residual solutions. Interestingly, the highest adsorption of MB, RhB, MO and HA was found at wavelength of 664, 554, 464, and 254 nm, suggesting the basic structure of organic pollutants was not destroyed during the adsorption process under the investigation solution pH. The humic acid stock solution was prepared by introducing 0.1 g of humic acid powder into 5 mL of deionized water and stirring the solution overnight. This solution was then adjusted by NaOH solutions to dissolve the solid. The pH of the solution was finally maintained at 5.0 by adding HCl.

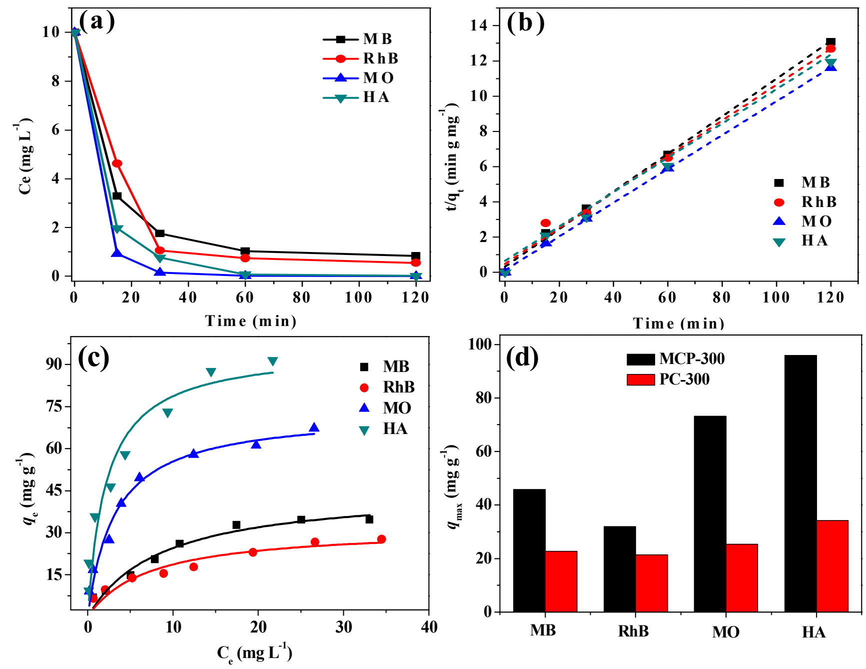

Figure S6. (a) Time-dependent, (b) pseudo-second-order linear plots, and (c) adsorption isotherms of MB, RhB, MO, and HA on MPC-300. m/V = 1.0 g L^{-1}, I = 0.01 M $NaNO_3$. (d) Comparison of the adsorption capacities of PC and MPC-300 toward MB, RhB, MO and HA, respectively.

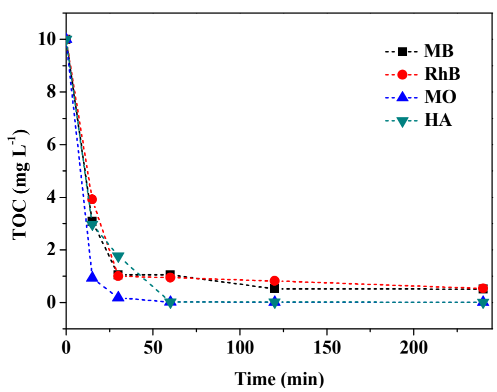

Figure S7. The concentration of TOC as a function of reaction time during the adsorption of MB, RhB, MO, and HA on MPC-300.

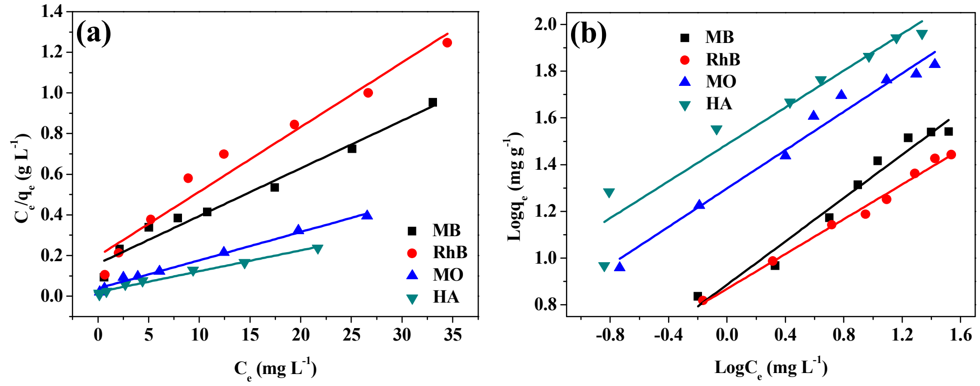

Figure S8. (a) Langmuir and (b) Freundlich isotherms for MB, RhB, MO, and HA on MPC-300. m/V = 1.0 g L^{-1}, I = 0.01 M $NaNO_3$.

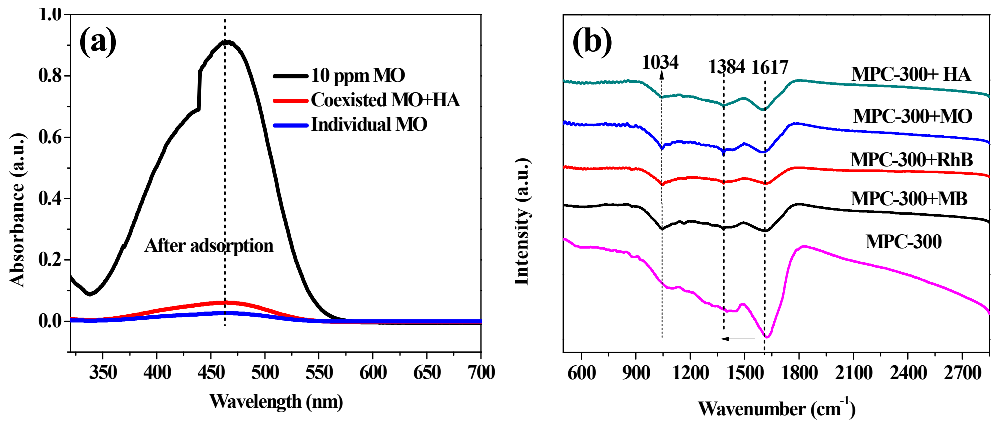

Figure S9. (a) The effect of HA on the adsorption of MO by MPC-300. m/V = 1.0 g L^{-1}, I = 0.01 M $NaNO_3$. (b) FTIR spectra of MPC-300 before and after various dyes and HA adsorption.

Tables

Table S1. Comparison of the maximum adsorption capacity of Cr(VI) and As(V) on PC-300, MPC-*T* and other adsorbents.

Materials	Experimental conditions	Q_{max} (mg g^{-1})		Ref
		Cr(VI)	As(V)	
CeO_2	T = 298 K	5.9	14.4	32
surfactant-modified zeolite Y	pH 3.0, T = 298 K	1.95	0.93	33
Flowerlike α-Fe_2O_3	pH 3.0, T = 298 K	5.4	7.6	34
Commercial bulk α-Fe_2O_3	pH 3.0, T = 298 K	0.37	0.3	34
PC-300	pH 5.0, T = 298 K	8.53	9.25	This work
MPC-300	pH 5.0, T = 298 K	21.23	38.03	This work
MPC-400	pH 5.0, T = 298 K	17.14	31.67	This work
MPC-500	pH 5.0, T = 298 K	12.33	27.81	This work

Table S2. Kinetic parameters calculated from pseudo-first-order model.

Species	C_0 (mg L^{-1})	$q_{e,exp}$ (mg g^{-1})	$q_{e,cal}$ (mg g^{-1})	k_2 (g mg^{-1} h^{-1})	R^2
Cr(VI)	2	1.88	1.94	2.93	0.899
	5	4.96	5.06	1.58	0.936
	10	8.18	8.41	0.91	0.912
As(V)	2	1.91	2.03	4.27	0.979
	5	4.86	5.12	3.68	0.992
	10	9.07	10.18	1.43	0.980

Table S3. Kinetic parameters of MB, RhB, MO and HA adsorption on MPC-300.

Species	$q_{e,exp}$ (mg g^{-1})	$q_{e,cal}$ (mg g^{-1})	k_2 (g mg^{-1} h^{-1})	R^2
MB	9.45	9.83	0.0348	0.997
RhB	9.17	9.37	0.0212	0.998
MO	9.88	10.26	0.0436	0.999
HA	9.99	10.42	0.0760	0.991

Table S4. Langmuir and Freundlich adsorption isotherm parameters for MB, RhB, MO and HA sorption on MPC-300.

Species	Langmuir			Freundlich		
	q_{max}(mg g^{-1})	b (L mg^{-1})	R^2	k	n	R^2
MB	45.74	0.115	0.964	8.40	2.31	0.944
RhB	31.94	0.140	0.898	7.02	2.55	0.885
MO	73.12	0.313	0.971	23.05	2.94	0.952
HA	95.92	0.457	0.929	33.94	2.96	0.917