

Supplementary Material

Selective Adsorption and Separation of Organic Dyes by Poly (acrylic acid) Hydrogels Formed with Spherical Polymer Brushes and Chitosan

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1. Synthesis of Spherical Polyelectrolyte Brushes

Neutral spherical polyelectrolyte brushes, polystyrene-poly-N-isopropylacrylamide (PNIPAM@PS) were synthesized by photo-emulsion polymerization method through a three-step strategy.¹ Here, grafting-form technique was adopted. Firstly, polystyrene (PS) cores (85.0 nm in diameter) were obtained using a conventional emulsion polymerization method with SDS as the surfactant and KPS as the initiator. Secondly, the photo-initiator 2-[p-(2-hydroxy-2-methylpropiophenone)]-ethylene glycol-methacrylate (HMEM) was covered on the surface of PS cores to generate a very thin layer. Finally, a certain amount of N-isopropylacrylamide monomer (75.0 wt% with regard to the amount of styrene) was mixed with diluted PS cores solution (1.0 wt%) under stirring. Photo-emulsion polymerization was operated by using of UV irradiation at room temperature for 2 h. All these processes were in nitrogen environment. The obtained products were dialyzed in pure water until the conductivity of eluent was constant. The specific diameters of PS core and PNIPAM@PS brushes were measured by dynamic light scattering (DLS) as 85.0±3.0 nm and 155.0±3.0 nm respectively (Fig. S1a), confirming the PNIPAM chains have been successfully grafted onto the surface of PS core. Fig. S1b showed the SEM image of PNIPAM@PS brush. The well-defined and monodispersed morphology is in accordance with the result of DLS.

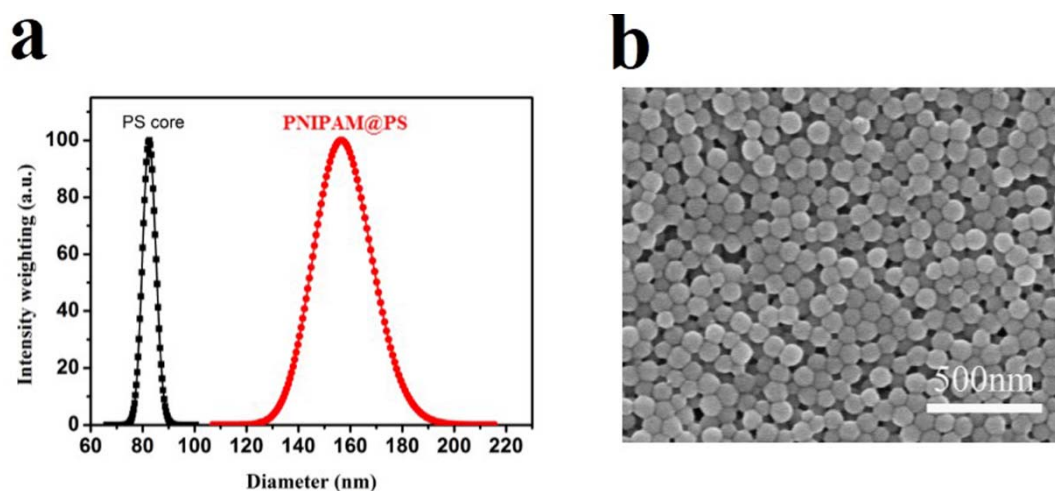
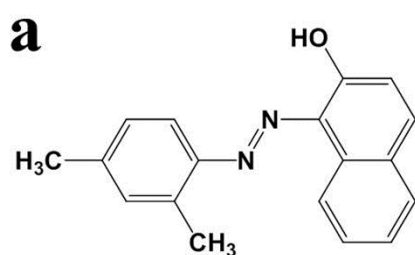


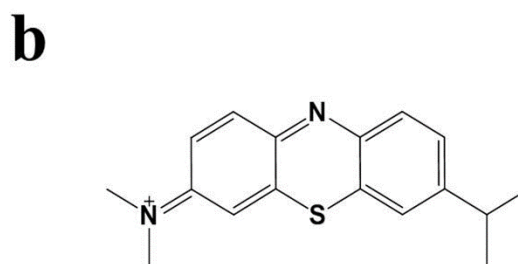
Fig. S1 (a) Diameter of PS core and PNIPAM@PS in the water. The NIPAM addition of SPBs was 75.0 wt % (relative to the core). (b) SEM image of PNIPAM@PS brush prepared by filtering with PC membrane.

Table S1 Mixture ratio of hydrogels

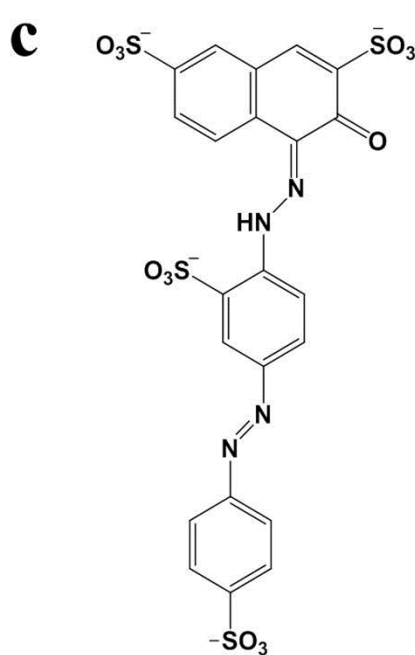
Samples (2mL)	SPBs (1.0 wt%) μL	AA μL	H ₂ O μL	CS(1.0 wt%) μL
C _{0.10} A _{0.35} S _{0.10}	200	700	900	200
C _{0.10} A _{0.50} S _{0.10}	200	1000	600	200
C _{0.10} A _{0.65} S _{0.10}	200	1300	300	200
C _{0.00} A _{0.65} S _{0.10}	200	1300	500	--
C _{0.10} A _{0.65} S _{0.00}	--	1300	500	200
C _{0.10} A _{0.75} S _{0.10}	200	1500	100	200



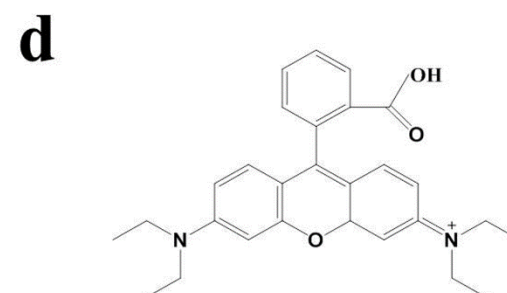
Sudan II



Methylene blue



Ponceau s



Rhodamine B

Fig. S2 Chemical structure of dyes (a) sudan II (neutral), (b) methylene blue (cationic), (c) ponceau s (anionic), (d) rhodamine B (cationic).

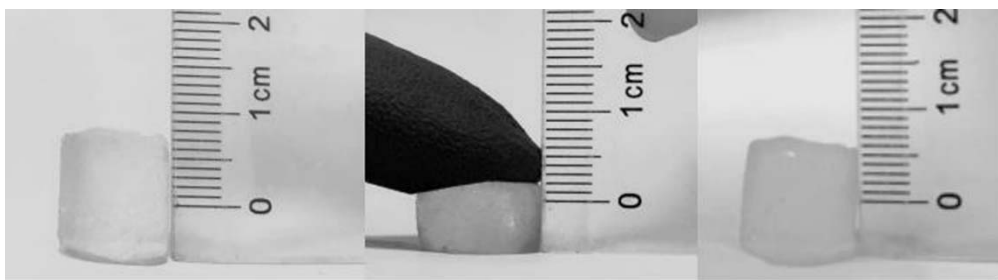


Fig. S3 Photographs of $C_{0.10}A_{0.65}S_{0.10}$ gel in compressive test.

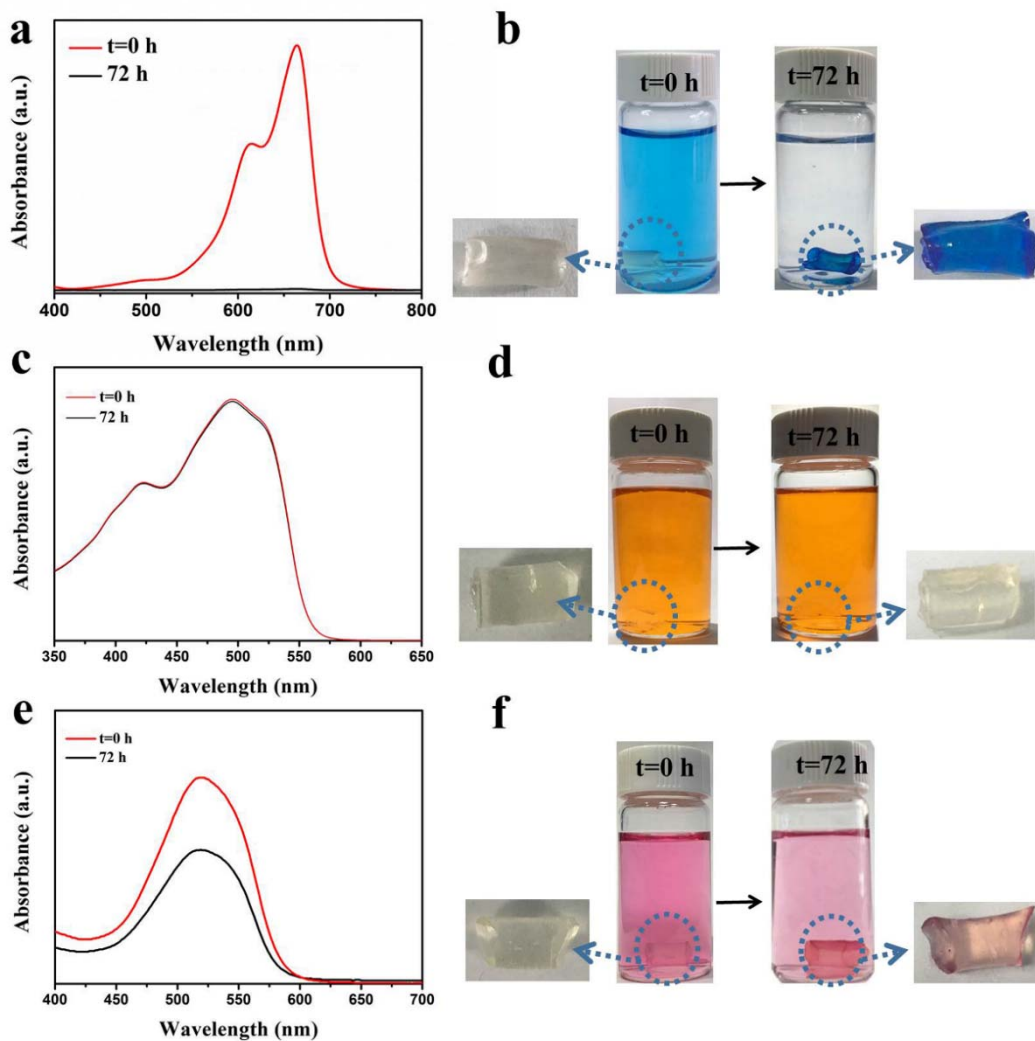


Fig. S4 (a) Adsorption of cationic MB on $C_{0.10}A_{0.50}S_{0.10}$ hydrogel with concentration of 100 mg L^{-1} from 0 h to 72 h. (b) MB solutions of the supernatant liquids collected at different time intervals during adsorption experiments. (c) Adsorption of neutral SD on $C_{0.10}A_{0.50}S_{0.10}$ hydrogel with concentration of 100.0 mg L^{-1} from 0 h to 72 h. (d) SD solutions of the supernatant liquids collected at different time intervals during adsorption experiments. (e) Adsorption of anionic Ps on $C_{0.10}A_{0.50}S_{0.10}$ hydrogel with concentration of 100 mg L^{-1} from 0 h to 72 h. (f) Ps solutions of the supernatant liquids collected at different time intervals during adsorption experiments.

References

- [1] X. Guo, A. A. Weiss, M. Ballauff, *Macromolecules* **1999**, *32*, 6043.