Supporting Information

One-pot Fabrication of Nanoporous Polymer Decorated Materials: From Oil-collecting Devices to High-efficiency Emulsion Separation

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Movie S1 This movie shows adsorptive process of superhydrophobic sponge in cold water/ chloroform mixtures. Moreover the superhydrophobic sponge can be used for oil-water separation under extreme turbulent condition.

Movie S2 The designed oil-collecting device using superhydrophobic sponges can immediately and continuously collect oils away in situ from water surface while reject water.

Movie S3 Oils floating on 3.5% NaCl water surface can be successfully collected via the designed oil-collecting device continuously.

Movie S4 The designed oil-collecting device can immediately and continuously collect oils away in situ from acidic water surface.

Movie S5 The designed oil-collecting device can also be used to collect oils away in situ from alkaline water surface immediately and continuously.

Preparation of surfactant-stabilized water-in-oil emulsions

Four types of surfactant-stabilized water-in-oil emulsions including water-in-toluene, water-in-hexane, water-in-hexadecane and water-in-chloroform have been prepared. Water and oil (toluene, hexane and hexadecane) were mixed in 1:100 (v/v) with the adding of 2.0 mg/mL of Span80, respectively. For water-in-chloroform emulsion, water and chloroform was mixed in 1:100 (v/v) with the adding of 5.0 mg/mL of Span80. The whole solution was stirred for 15 h.

Oils and organic solvents sorption test

The adsorption capacity was investigated by the following procedure. A weight measured superhydrophobic melamine sponge was dropped into the oil for 15 min in order to ensure the sponge was completely filled with the organic liquid. Then the absorbed sponge was taken out with sharp needle tweezers for weight measurement. The absorption capacity is defined as the weight of absorbed substance per unit weight of the dried superhydrophobic sponge. In order to avoid evaporation of the absorbed organic liquid with low boiling points, the weight measurement should be done quickly. The draining time is about 15 seconds for oils with high boiling points. Each oil or organic solvent was tested three times. In the cyclic absorption measurement for toluene, the absorption capacity was obtained through the same method. The absorbed sponge was recovered by squeezed out most absorbed toluene and dried in an oven.

Table **S1** the density and viscosity (20 °C) of used oils and organic solvents in present work

Oils	DMF	Toluene	$CHCl_3$	Pump oil	Acetone	CH_2Cl_2	CH_3OH	Hexadecane	N-hexane
Density (g/cm^3)	0.96	0.87	1.49	0.88	0.79	1.33	0.79	0.77	0.67
Viscosity (mPa/s)	0.92	0.59	0.57	150	0.32	0.44	0.60	3.28	0.33

Table S2 Relative amount of C, O, N and Si from XPS for original materials and modified materials

Samples	C(wt%)	O(wt%)	N(wt%)	Si(wt%)
Original sponge	43.99	33.68	22.34	/
Modified sponge	66.59	15.86	3.34	14.21
Original filter paper	57.70	42.30	/	/
Modified filter paper	71.94	14.87	/	13.20

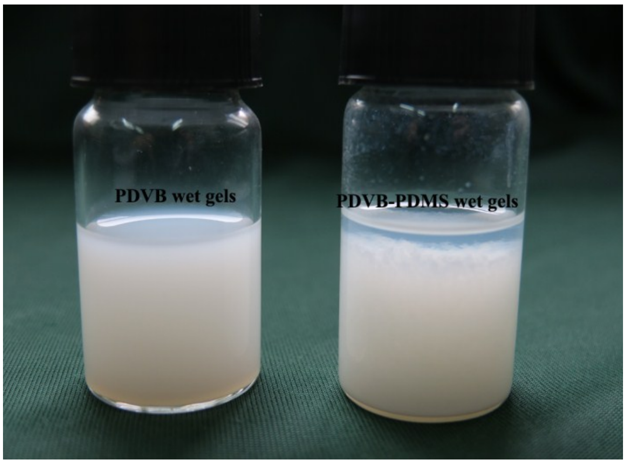

Figure S1 Digital photo of PDVB wet gels and PDVB-PDMS wet gels.

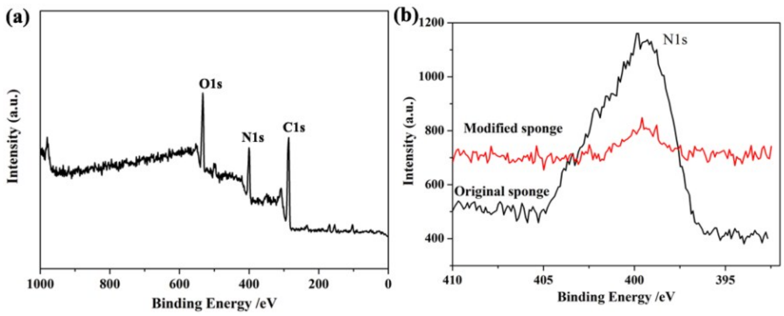

Figure S2 (a) XPS survey spectra of the pristine melamine sponge. (b) N1s high resolution spectrum of the original and the modified melamine sponge.

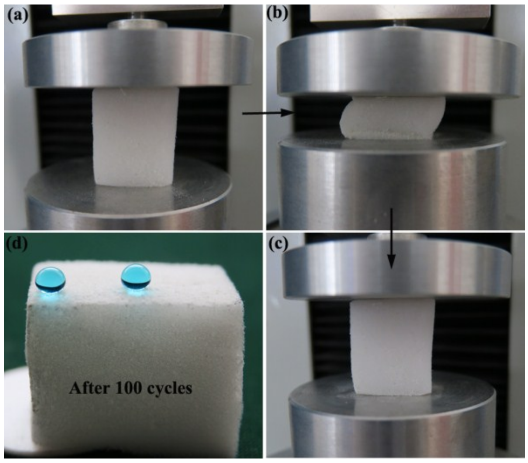

Figure S3 (a-c) Sequential digital images showing compressibility of the superhydrophobic melamine sponge. (d) The melamine sponge still shows superhydrophobicity and no fracture or collapse of the sponge was observed even after 100 cycles

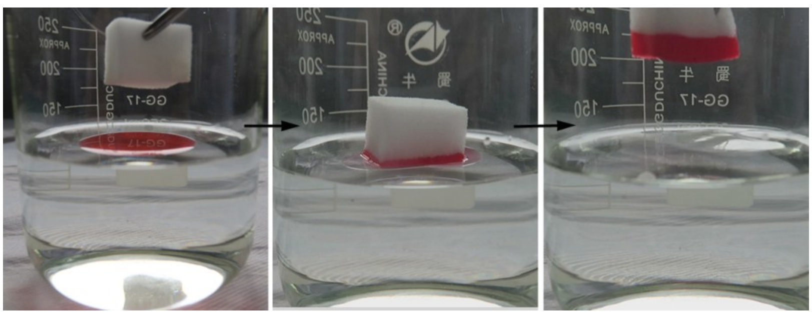

Figure S4 Selective collection of floating oils with superhydrophobic sponge.

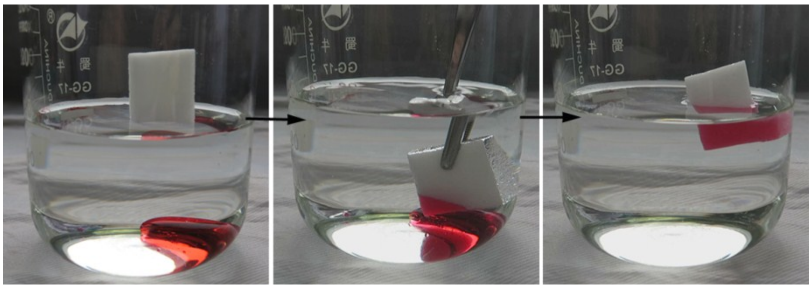

Figure S5 Selective collection of underwater oils with superhydrophobic sponge.

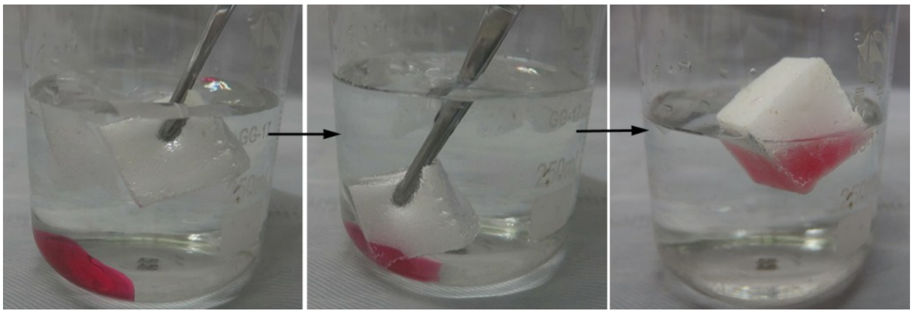

Figure S6 The prepared superhydrophobic sponge can selective collect oils from ice water mixtures.

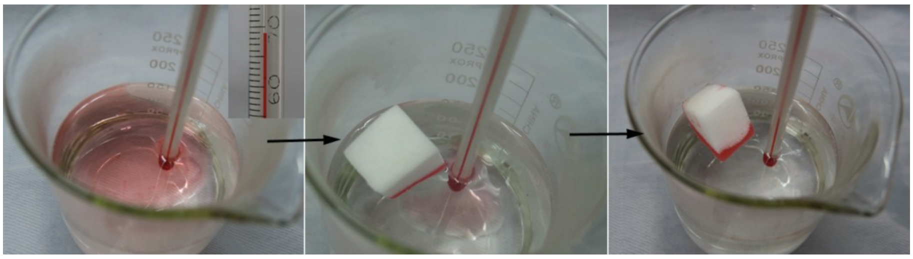

Figure S7 Hexadecane can be successfully removed from hot water surface with prepared superhydrophobic sponge.

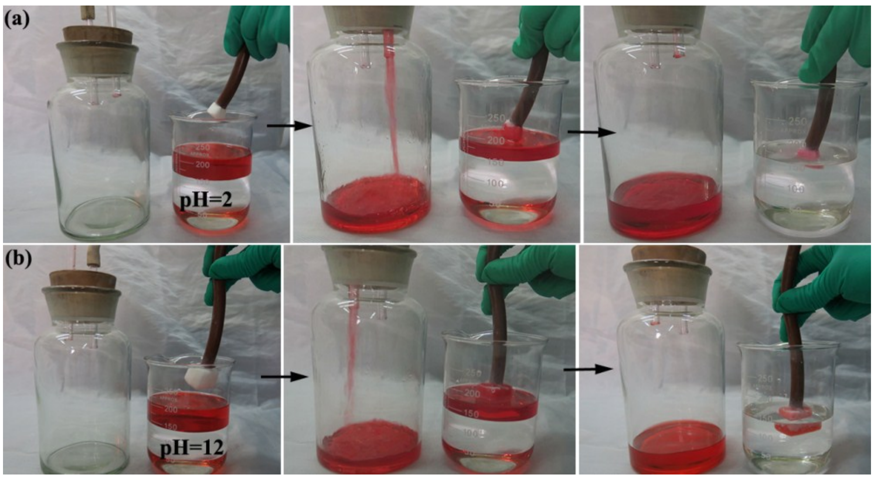

Figure S8 The designed oil-collecting device using superhydrophobic sponges can immediately and continuously collect oils away in situ from both acidic and alkaline water surface while reject water.

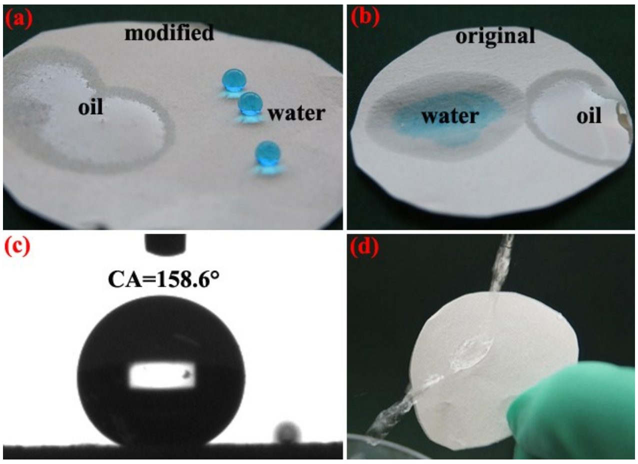

Figure S9 (a, c)The prepared superhydrophobic filter paper shows a high contact angle of 158.6° and can only be selectively wetted by oil. (d)A jet of water could perfectly bounce off the surface. In contrast, both water and oil can wet the raw filter paper (b).

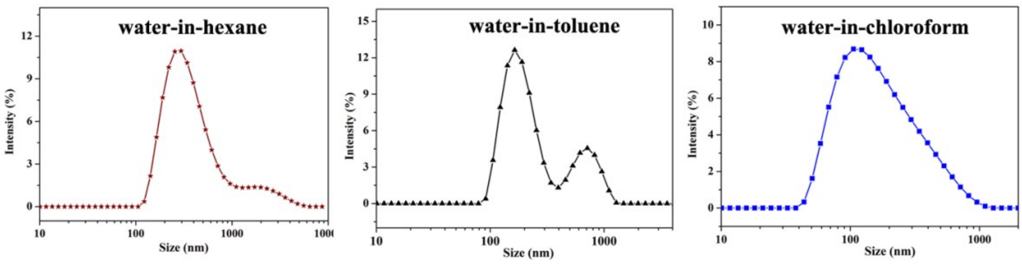

Figure S10 Droplet size of (a) water-in-hexane emulsion, (b) water-in-toluene emulsion and (c) water-in-chloroform emulsion via DLS measurements.

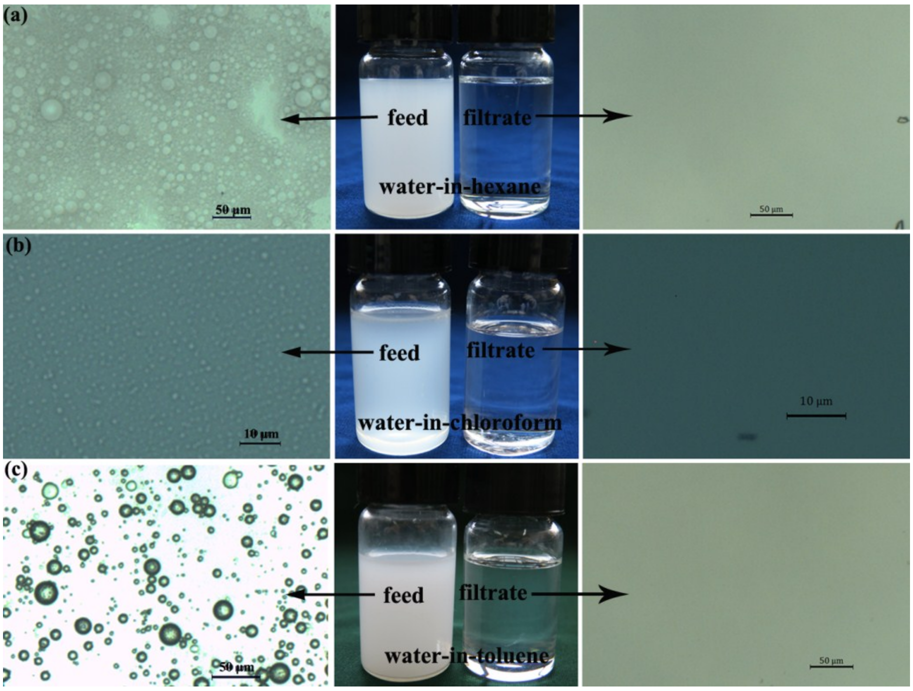

Figure S11. Microscope images and digital photos of the separation results for other three types of water-in-oil emulsions, including (a) water-in-hexane emulsion, (b) water-in-chloroform emulsion and (c) water-in-toluene emulsion