Supporting Information

In-situ self-foaming preparation of hydrophobic polyurethane foam for oil/water separation

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Content

Table S1 Proportion of foaming raw materials

Raw materials	Mass ratio (%)
Polyether polyol	100
H_2O	5.25
Dichloromethane	10.26
Stannous octoate	0.28
Triethylene diamine	0.32
Silicone oil (L-580)	2
Polyether additives	1

Note: Taking the mass of polyether polyol as the reference.

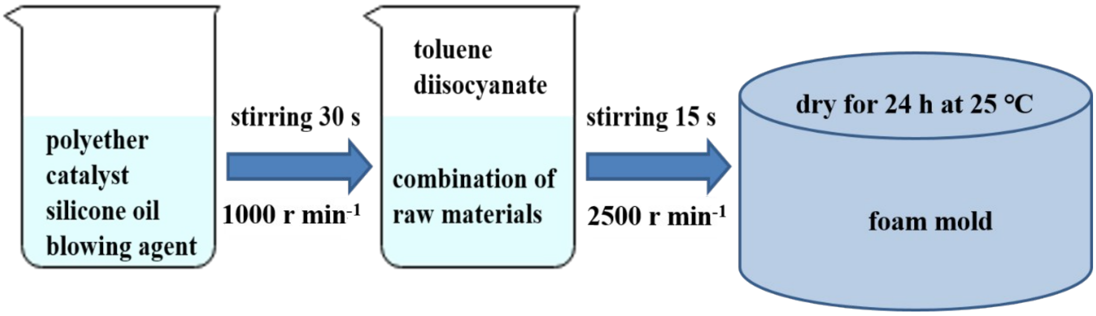
The dosage of toluene diisocyanate is calculated by the following formula.

$$W_{TDI} = G \times (\frac{W_{OH} \times OHV}{56.1 \times 1000} + \frac{W_{H_2O}}{9}) \times R \times \frac{1}{P}$$

Where, W_{TDI} represents the quality of toluene diisocyanate. G is the equivalent value of toluene diisocyanate, and the specific value is 87. W_{OH} represents the added amount of polyether polyol, OHV represents the hydroxyl value in polyether, W_{H20} represents the mass of water. R represents the use index of toluene diisocyanate, which is 1.2 in this study. P is the purity of toluene diisocyanate (98%).

Table S2 Comparison of adsorption capacity and cycle performance between various materials

Sample name	Q_{wt}(g g^{-1})	Cycles	Cycle stability	Reference
Silane-f-rGONR@PU	30-68	10	97%	[1]
PU-CNT-PDA	22-34.9	150	86%	[2]
PU-TiO_2-GO-TDA	20.2-62.4	20	90%	[3]
ZnO-PU	33-44	95	Stable	[4]
GN-PU	28-47	100	Stable	[5]
LPU-rGO-ODA	26-68	20	Stable	[6]
PPy-PA sponge	22-62	10	Slightly lower	[7]
Pure PU foam	< 6	-	-	[8]
Mg-Al PF/PU composite	5.1-11.6	10	Stable	[8]
PU-PTMG	53.0-75.0	200	Stable	This work



Scheme S1 Schematic diagram of in-situ foaming for preparing the polyurethane foam

(a) (b) (c)

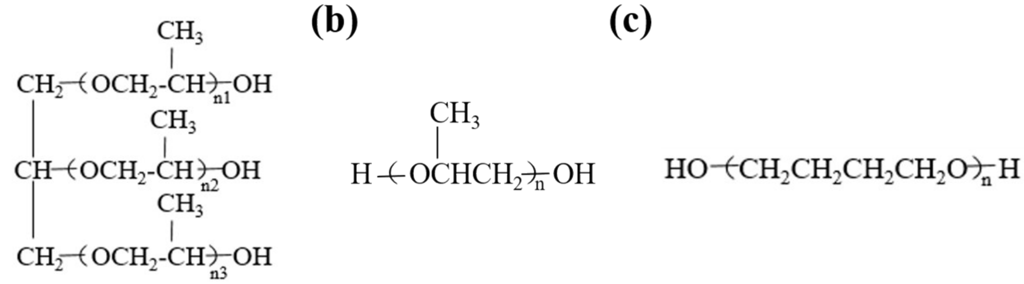


Fig. S1 Schematic diagram of the molecular structure of polyether N330(a), polyether N220(b), and polyether PTMG(c)

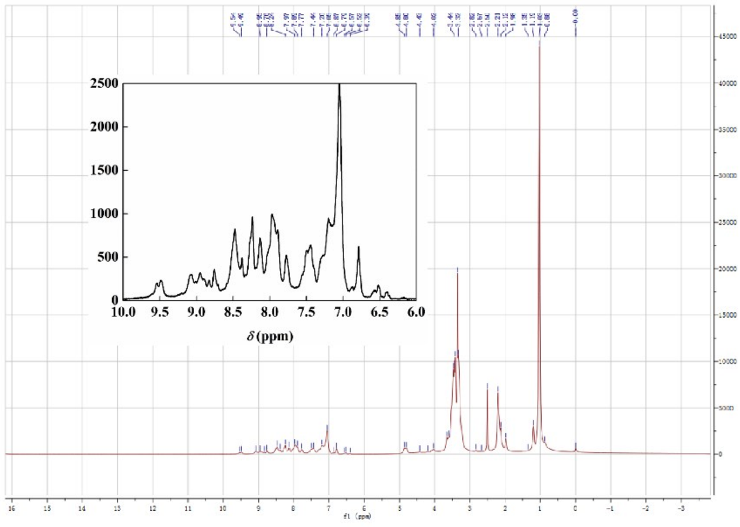


Fig. S2 1H NMR spectrum of PU-N330

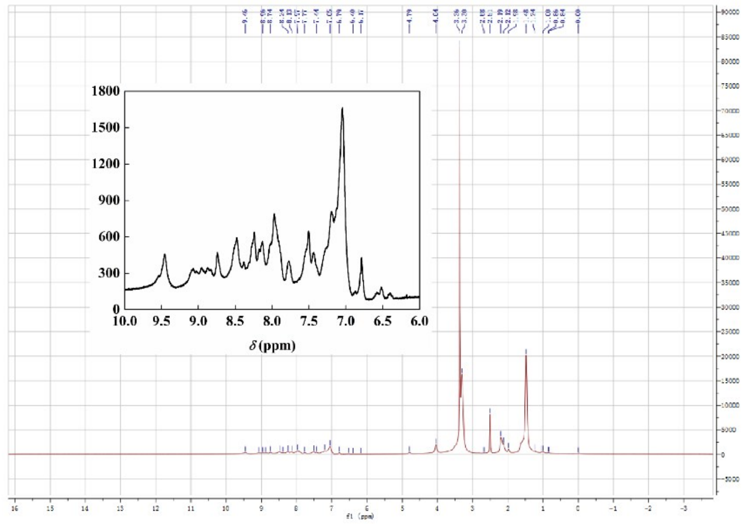


Fig. S3 1H NMR spectrum of PU-N220

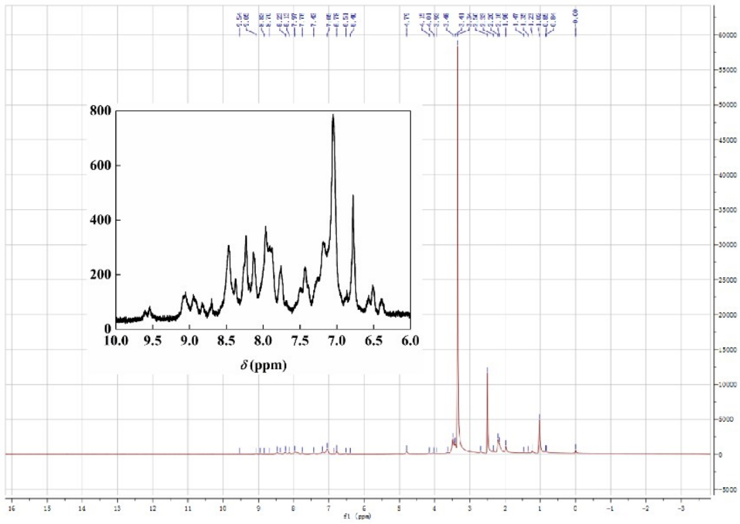


Fig. S4 1H NMR spectrum of PU-PTMG

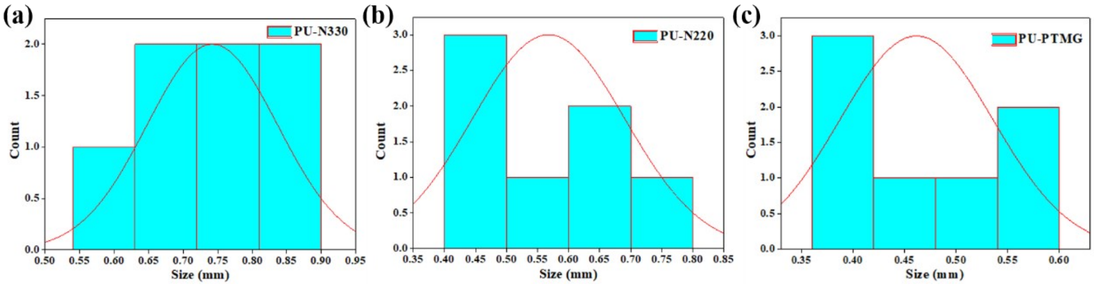


Fig. S5 Pore distribution of (a) PU-N330, (b) PU-N220 and (c) PU-PTMG

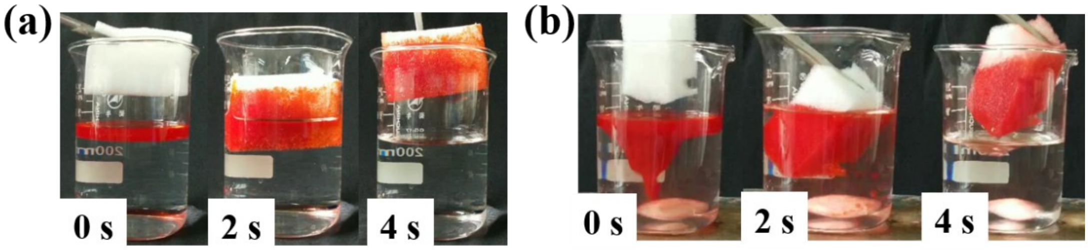


Fig. S6 Absorption for static surface oil slick (a) and dynamic surface oil slick (b) over PU-PTMG

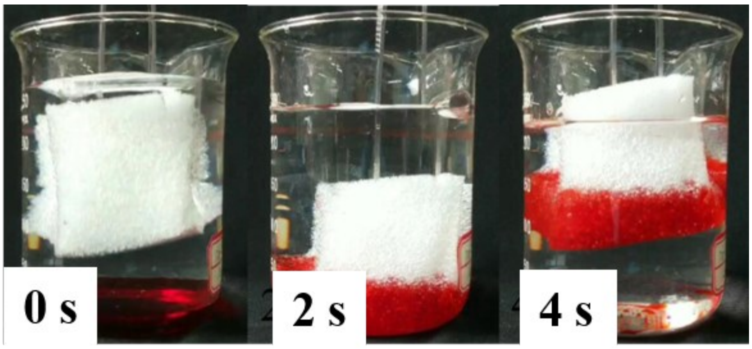


Fig. S7 Absorption for static underwater sinking oil over PU-PTMG

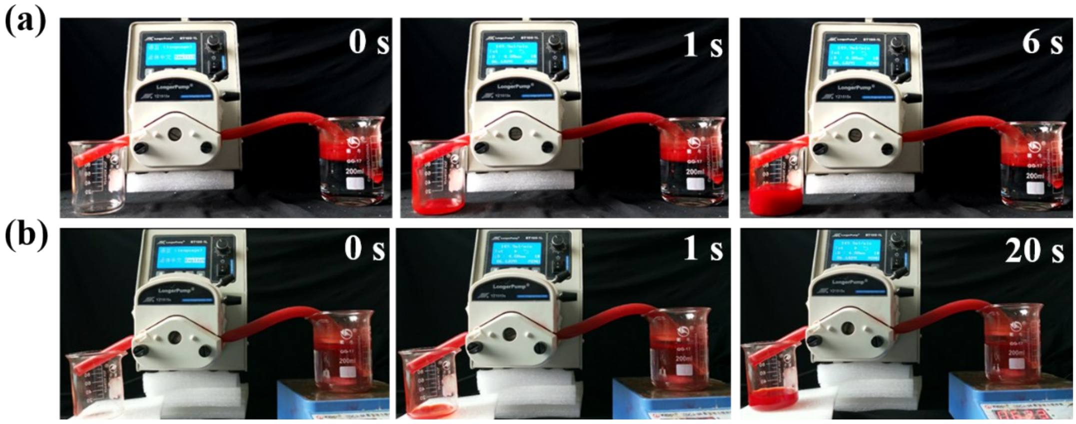


Fig. S8 Continuous separation for static surface oil slick (a) and dynamic surface oil slick (b) over PU-PTMG

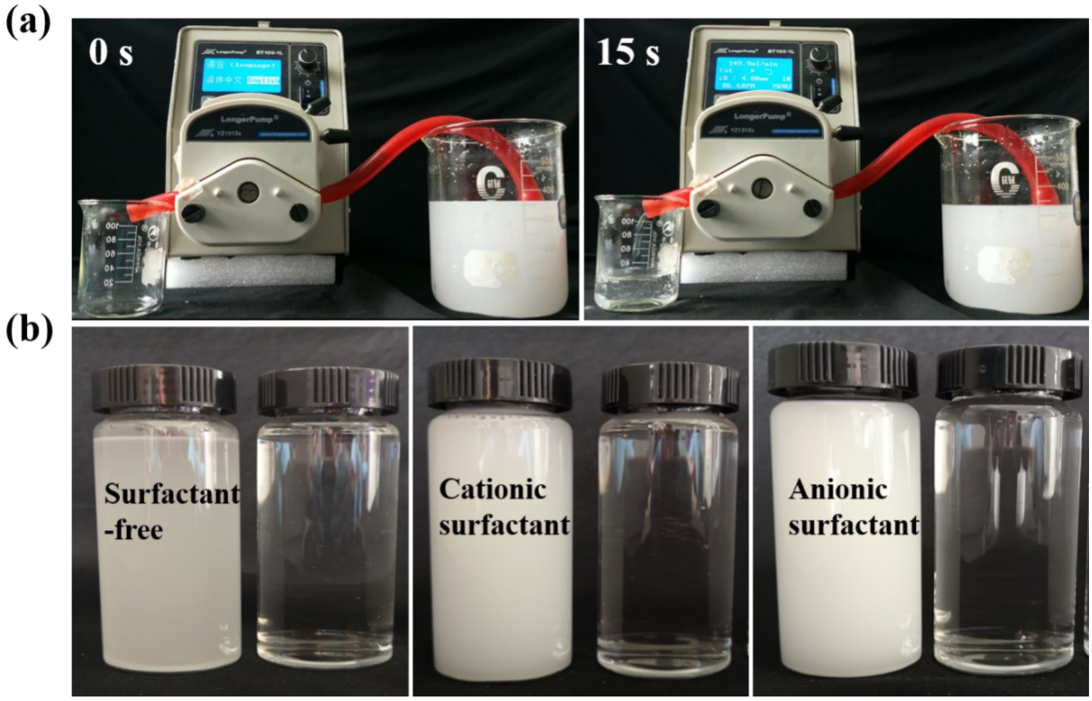


Fig. S9 Continuous separation for emulsion (a), the comparison diagram before and after separation over PU-PTMG (b)

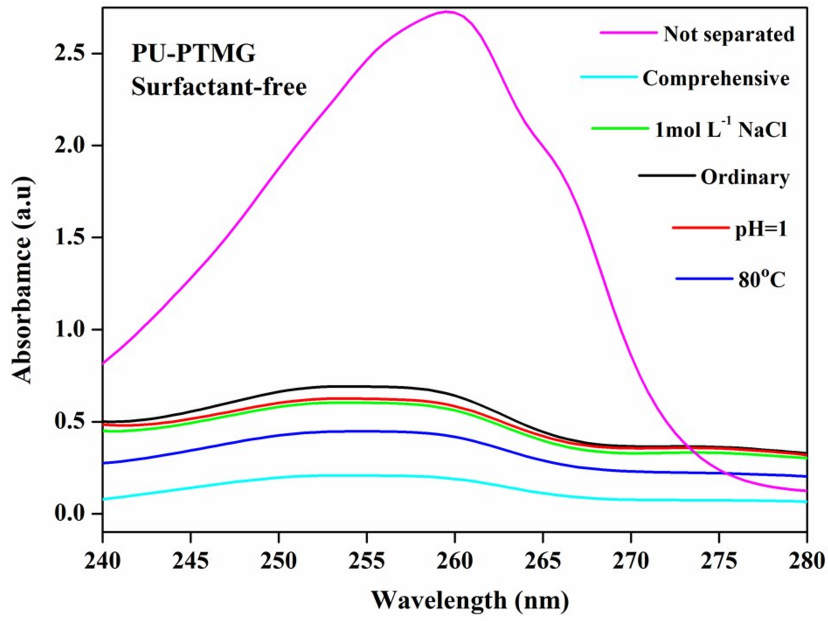


Fig. S10 UV test chart of surfactant-free emulsion after separation by PU-PTMG under different conditions

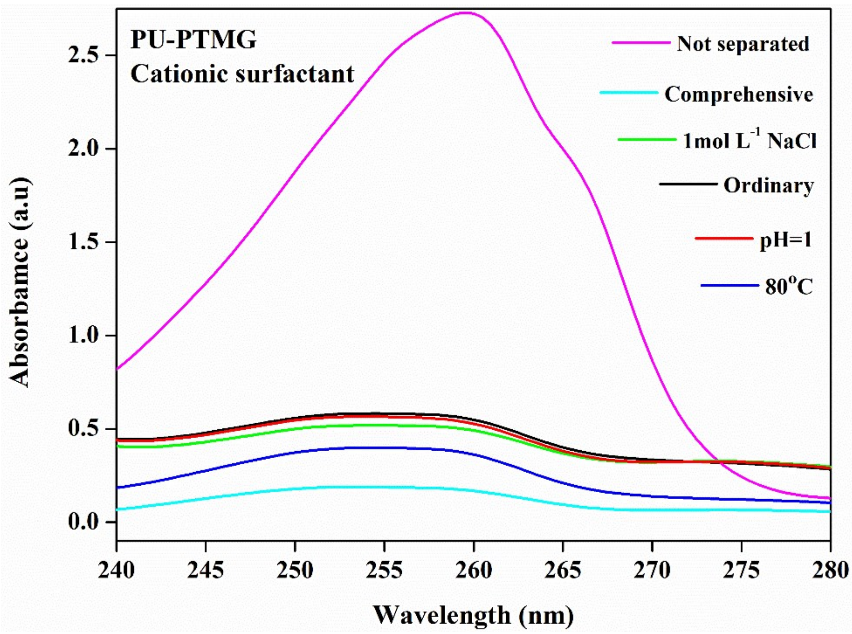


Fig. S11 UV test chart of cationic surfactant stabilized emulsion after separation by PU-PTMG under different conditions

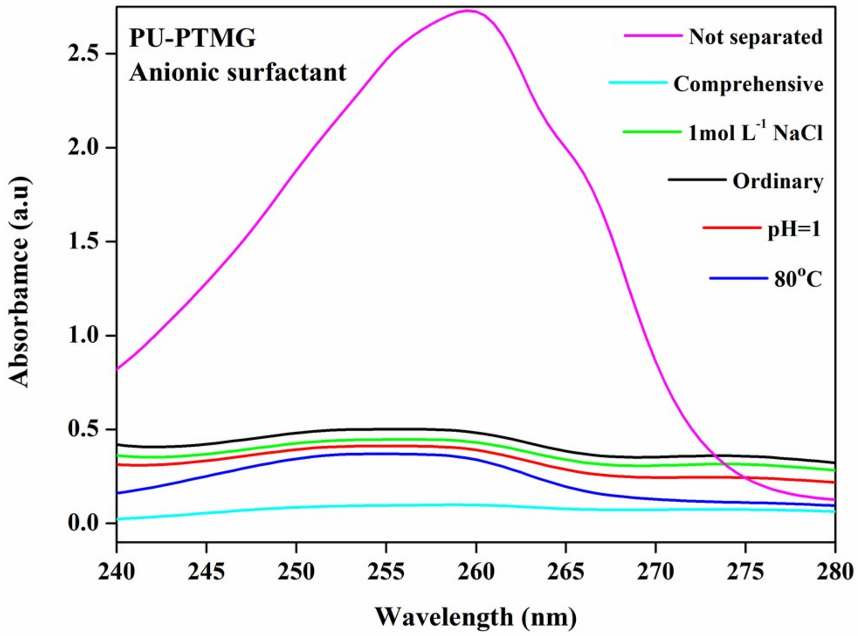


Fig. S12 UV test chart of anionic surfactant stabilized emulsion after separation by PU-PTMG under different conditions

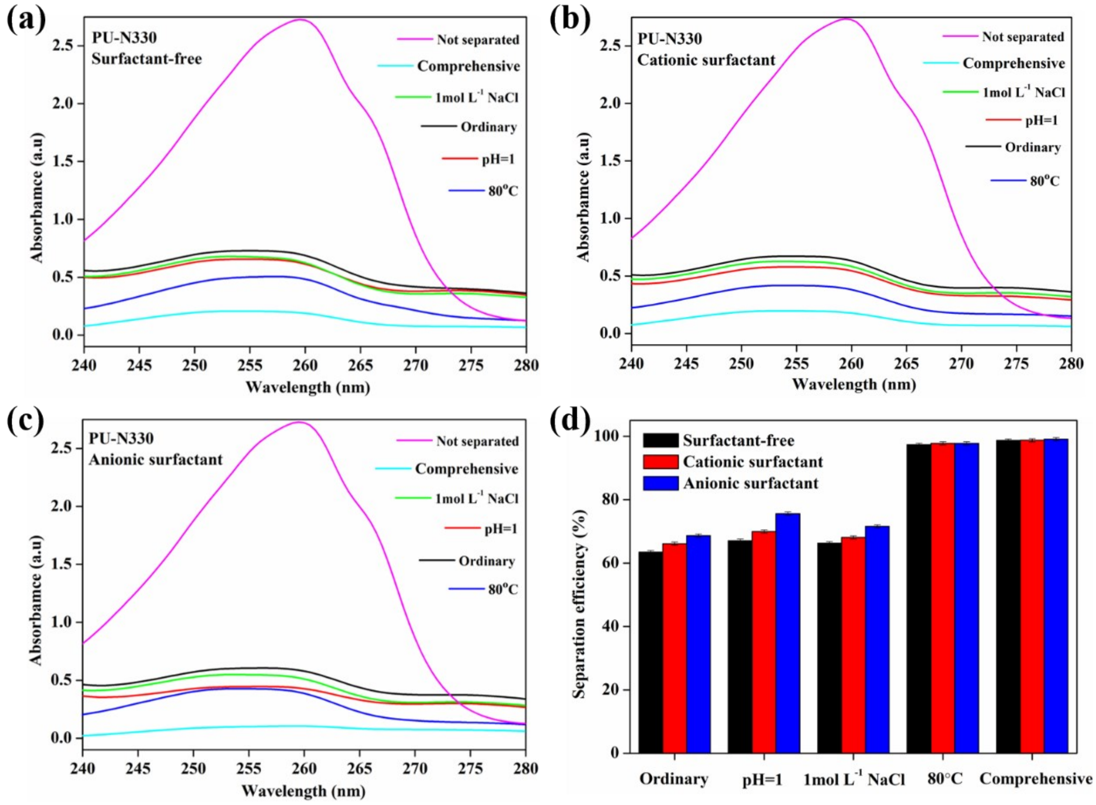


Fig. S13 UV test charts of surfactant-free emulsion (a), cationic surfactant stabilized emulsion (b), anion surfactant stabilized emulsion (c) and the separation efficiencies of emulsions (d) by PU-N330 under different conditions

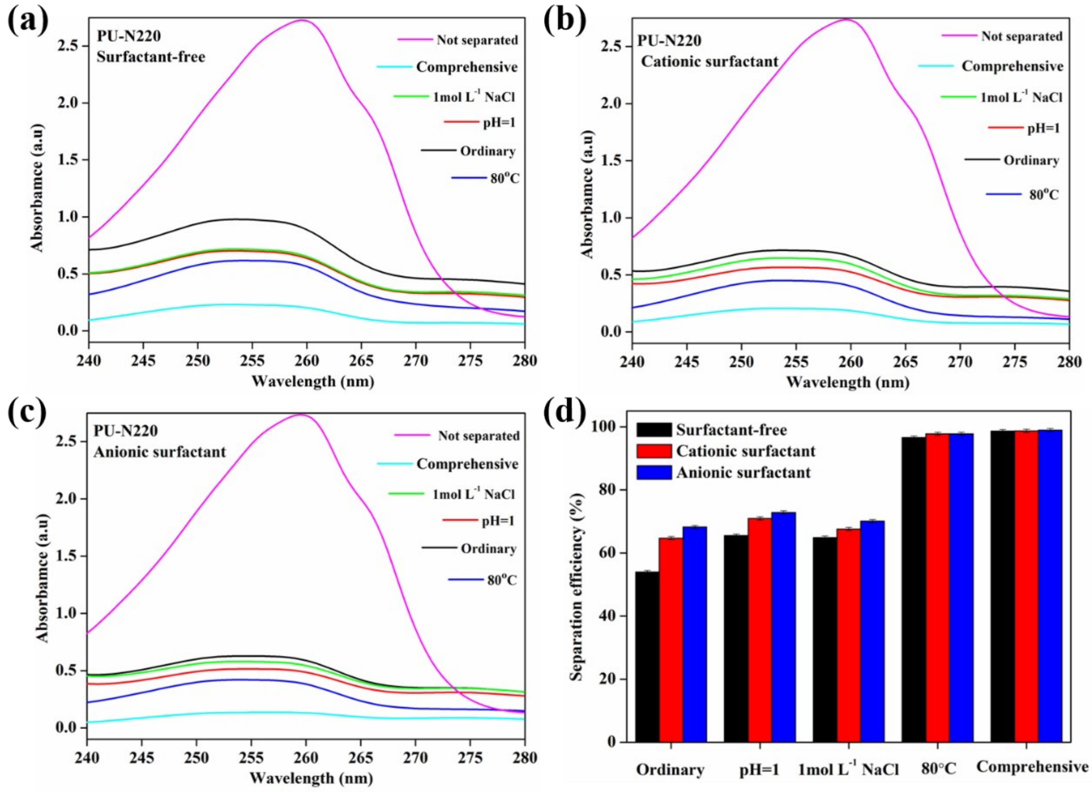


Fig. S14 UV test charts of surfactant-free emulsion (a), cationic surfactant stabilized emulsion (b), anion surfactant stabilized emulsion (c) and the separation efficiencies of emulsions (d) by PU-N220 under different conditions

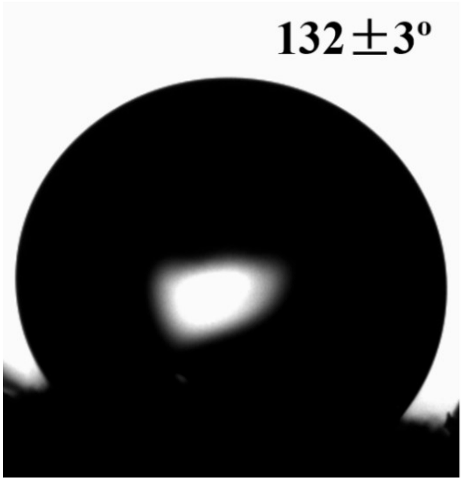


Fig. S15 Water contact angle of block polyurethane foam

References

1 F. Qiang, L. L. Hu, L. X. Gong, L. Zhao, S. N. Li, L. C. Tang, *Chem. Eng.J.*, 2017, **334**, 2154-2166.

2 H. Y. Wang, E. Q. Wang, Z. J. Liu, D. Gao, R.X. Yuan, L. Y. Sun and Y. J. Zhu, *J. Mater. Chem. A.*, 2015, **3**, 266-273

3 Q. Wei, O. Oribayo, X. S. Feng, G. L. Rempel and Q. M. Pan, *Ind. Eng. Chem. Res.*, 2018, **57**, 8918-8926

4 B. Li, X. Liu, X. Zhang, J. Zou, W. Chai and Y. Lou, *J Chem Technol Biot*, 2015, **90**, 2106-2112

5 X. T. Zhang, D. Y. Liu, Y. L. Ma, J. Nie and G. X. Sui, *Appl. Surf. Sci.*, 2017, **422**, 116-124

6 O. Oribayo, X. S. Feng, G. L. Rempel and Q. M. Pan, *Chem. Eng.J.*, *2017,* **323**, 191-202

7 M.Khosravi and S. Azizian, *ACS Appl. Mater. Interfaces*, 2015, **7**, 25326-25333

8 T. Zhang, L. Y. Kong, M. Y. Zhang, F. X. Qiu, J. Rong and J. M. Pan, *RSC Adv*., 2016, **6**, 86510-86519