Supporting Information

On-demand Oil-Water Separation by Environmentally-responsive Cotton Fabrics

Meina Xiao, Yinghui Huang, Anli Xu, Tongtong Zhang, Chengdong Zhan and Liangzhi Hong*

Department of Polymer Materials Science and Engineering, South China University of Technology, Guangzhou 510641, China.

To whom correspondence should be addressed.

*E-mail: mslzhong@scut.edu.cn

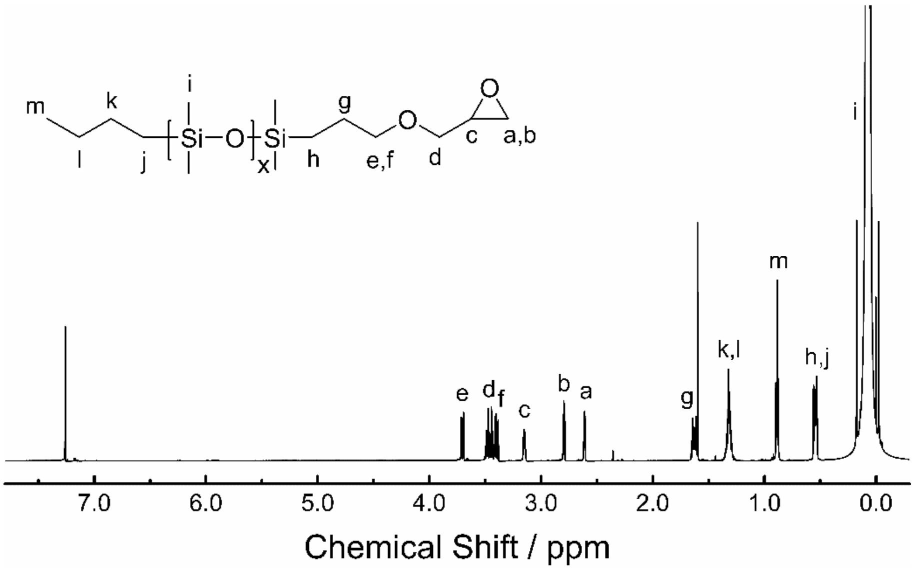

Figure S1. ^{1}H NMR spectra of epoxide-terminated PDMS in $CDCl_3$.

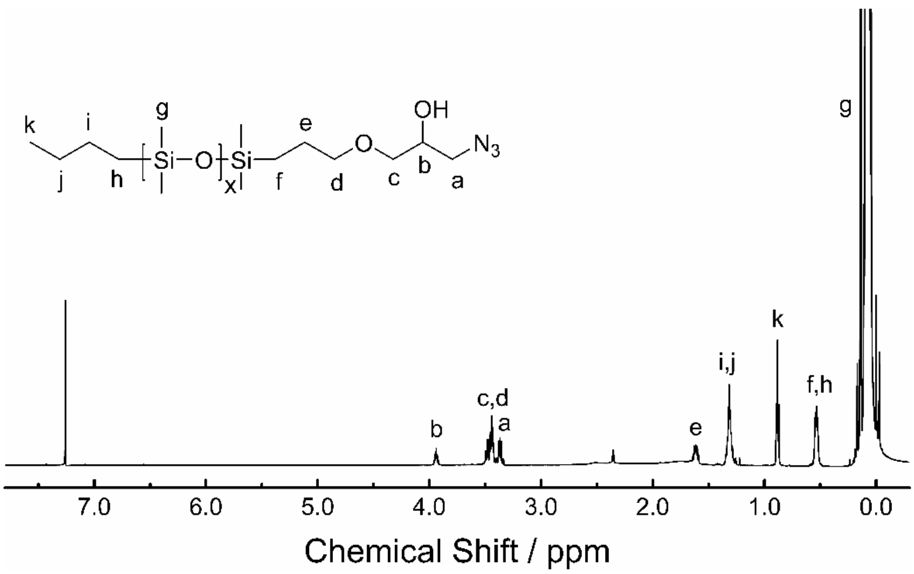

Figure S2. ^{1}H NMR spectra of azide-functionalized PDMS [PDMS-(OH, N_3)] (**1**) in $CDCl_3$.

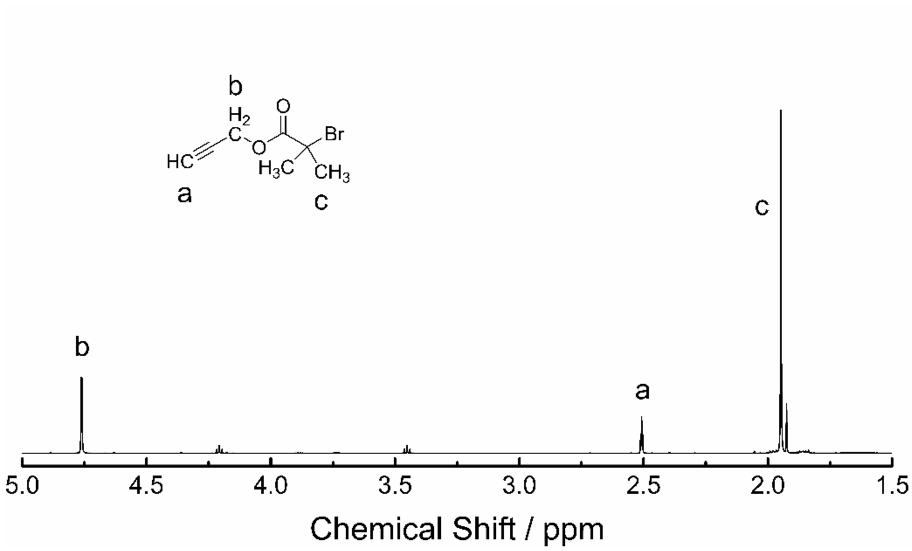

Figure S3. ^{1}H NMR spectra of propargyl 2-bromoisobutyrate (PBiB) in $CDCl_3$.

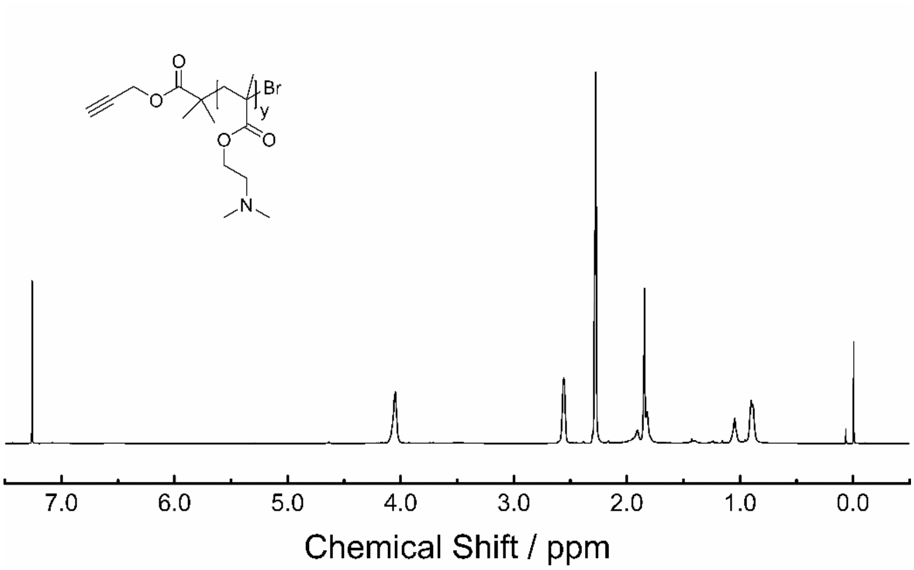

Figure S4. ^{1}H NMR spectra of *α*-alkynyl-*ω*-bromo-poly(*N,N*-dimethylaminoethyl methacrylate) (alkynyl-PDMAEMA$_{42}$-Br) in $CDCl_3$.

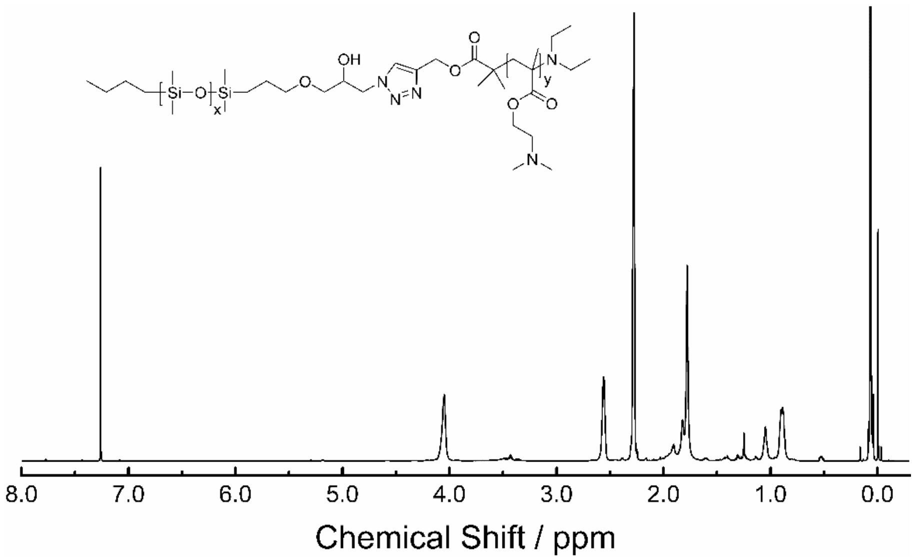

Figure S5. ¹H NMR spectra of poly(dimethylsiloxane)-(OH)-*b*-poly(*N,N*-dimethylaminoethyl methacrylate) ($PDMS_{64}$-(OH)-*b*-$PDMAMEA_{42}$) in $CDCl_3$.

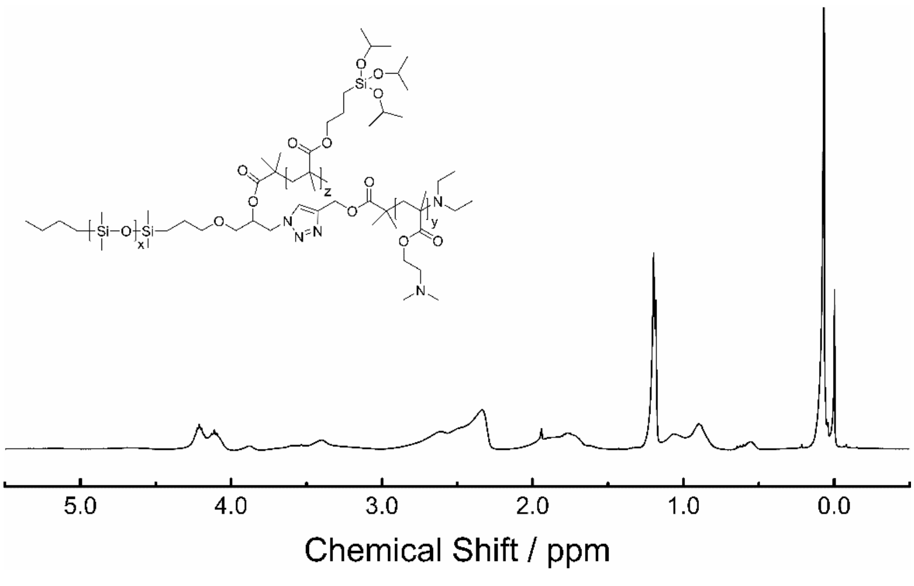

Figure S6. ¹H NMR spectra of *μ*-$PDMS_{64}$-*b*-$PDMAEMA_{42}$-*b*-$PIPSMA_{22}$ (P1) in $CDCl_3$.

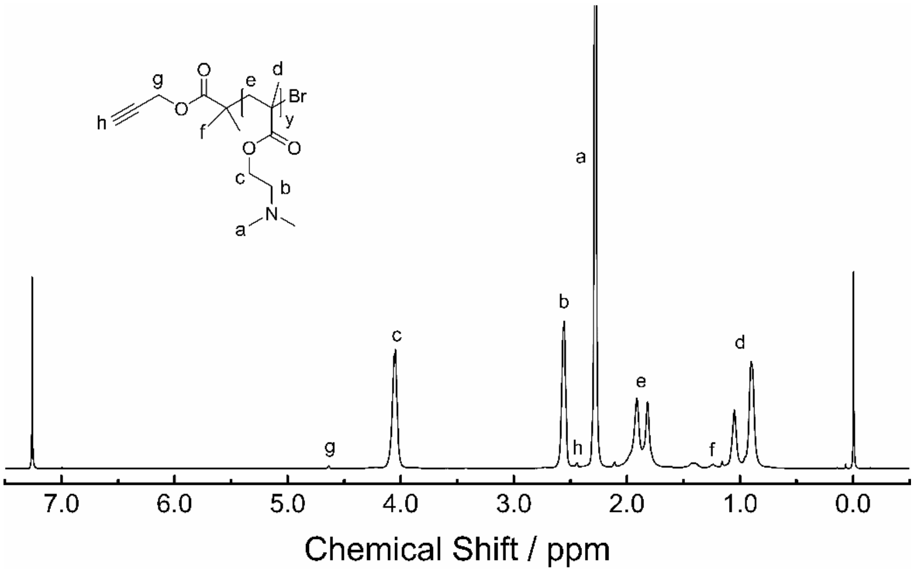

Figure S7. [1]H NMR spectra of *α*-alkynyl-*ω*-bromo-poly(*N,N*-dimethylaminoethyl methacrylate) (alkynyl-$PDMAEMA_{121}$-Br) in $CDCl_3$.

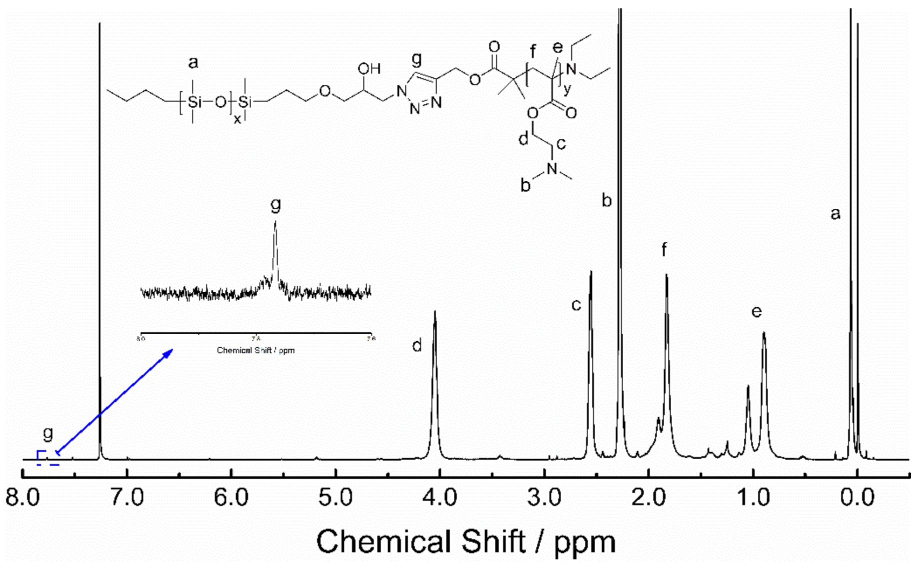

Figure S8. [1]H NMR spectra of poly(dimethylsiloxane)-(OH)-*b*-poly(*N,N*-dimethylaminoethyl methacrylate) ($PDMS_{64}$-(OH)-*b*-$PDMAMEA_{121}$) (**3**) in $CDCl_3$.

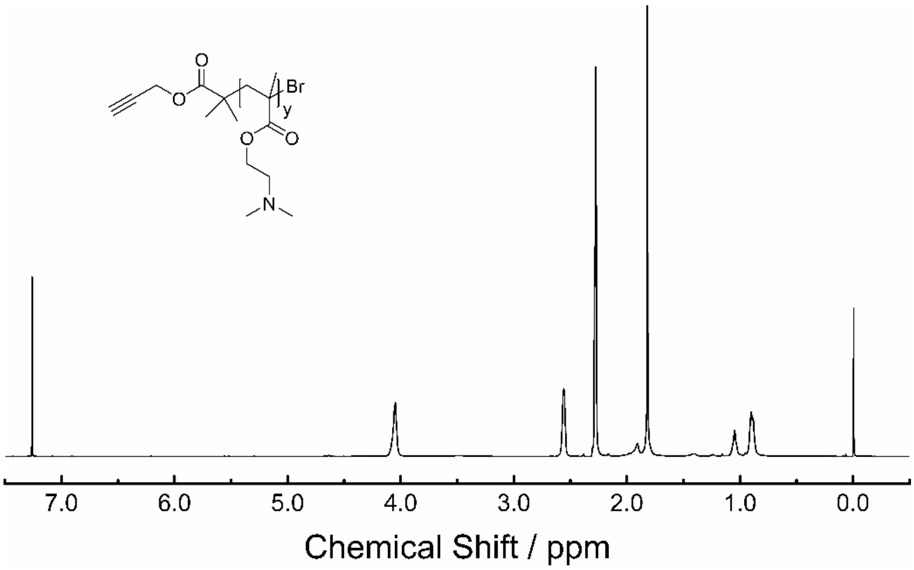

Figure S9. [1]H NMR spectra of *α*-alkynyl-*ω*-bromo-poly(*N,N*-dimethylaminoethyl methacrylate) (alkynyl-PDMAEMA$_{148}$-Br) in $CDCl_3$.

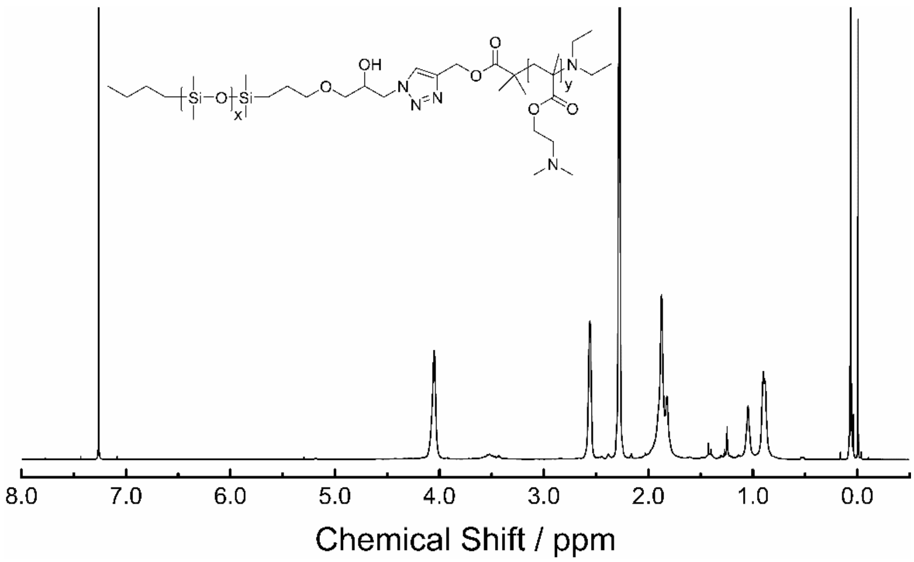

Figure S10. [1]H NMR spectra of poly(dimethylsiloxane)-(OH)-*b*-poly(*N,N*-dimethylamino-ethyl methacrylate) (PDMS$_{64}$-(OH)-*b*-PDMAMEA$_{148}$) in $CDCl_3$.

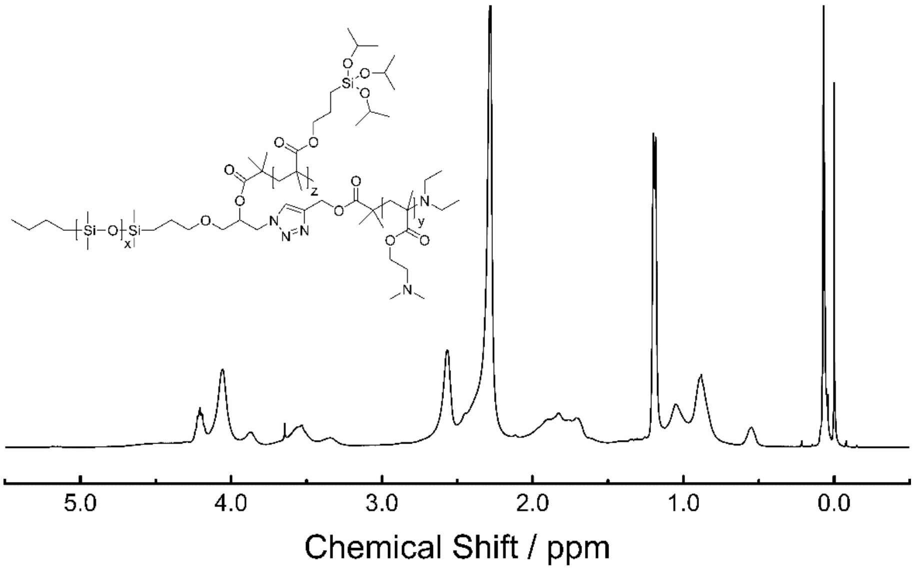

Figure S11. ^{1}H NMR spectra of μ-PDMS$_{64}$-*b*-PDMAEMA$_{148}$-*b*-PIPSMA$_{25}$ (P3) in CDCl$_3$.

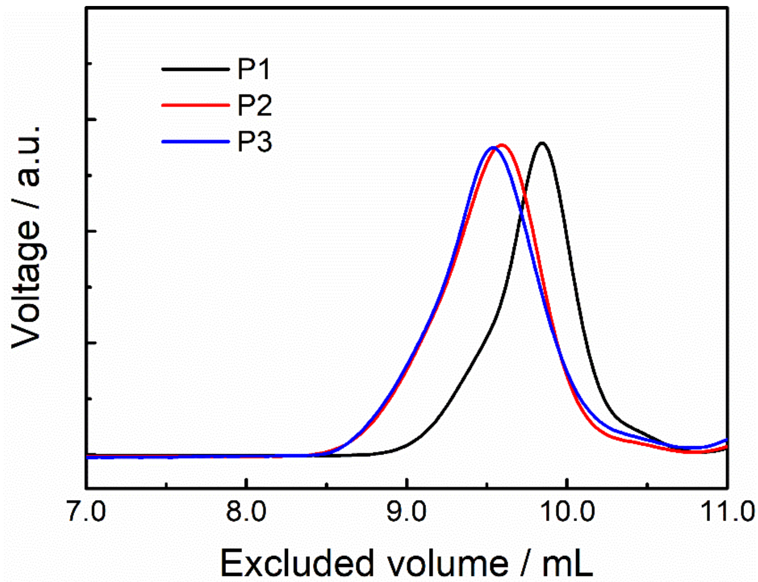

Figure S12. GPC curves of μ-PDMS-*b*-PDMAEMA-*b*-PIPSMA ABC miktoarm star terpolymers.

Table S1. Characteristics of synthesized polymers.

Sample	M_n [a] (Kg mol^{-1})	(M_w/M_n)[b]	f_{PDMS}[c]	$f_{PDMAEMA}$[c]	f_{PIPSMA}[c]
$PDMS_{64}$-OH	5.0	1.13	-	--	--
α-alkynyl-$PDMAEMA_{42}$-$N(Et)_2$	6.8	1.14	-	--	--
μ-$PDMS_{64}$-*b*-$PDMAEMA_{42}$-*b*-$PIPSMA_{22}$ (P1)	19.2	1.30	26.4	34.9	38.7
α-alkynyl-$PDMAEMA_{121}$-$N(Et)_2$	19.2	1.13	-	--	--
μ-$PDMS_{64}$-*b*-$PDMAEMA_{121}$-*b*-$PIPSMA_{24}$ (P2)	32.3	1.29	15.6	59.5	24.9
α-alkynyl-$PDMAEMA_{148}$-$N(Et)_2$	23.4	1.14	-	--	--
μ-$PDMS_{64}$-*b*-$PDMAEMA_{148}$-*b*-$PIPSMA_{25}$ (P3)	36.8	1.26	13.7	63.6	22.7

[a] Determined by ^1H NMR in $CDCl_3$. [b] Determined by GPC with calibrated PS standards at 35 ^oC. [c] The weight fractions (wt%) were determined by ^1H NMR.

P2 and P3.

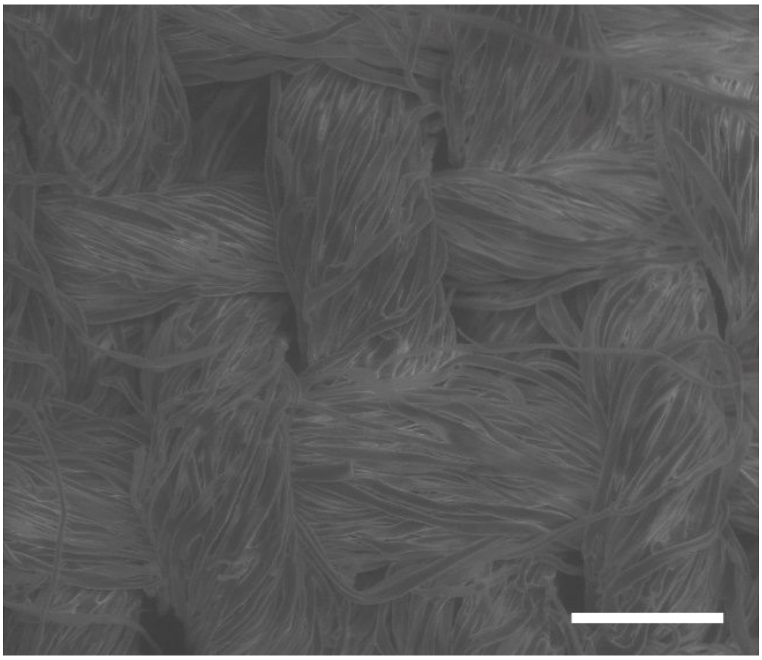

Figure S13. SEM image of the fabric used. The scale bar is 200 μm.

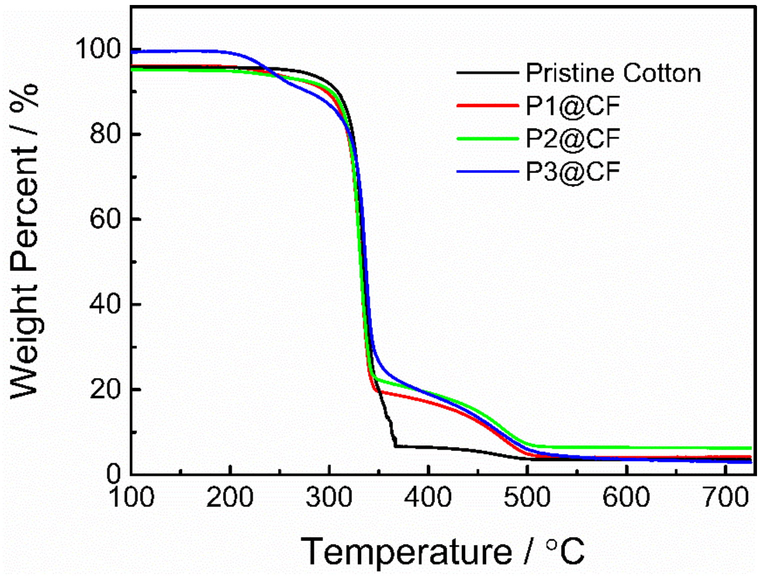

Figure S14. TGA traces of pristine cotton fabrics and functionalized cotton fabrics with P1, P2 and P3.

Table S2. Mass fraction of grafted block copolymer in the functionalized cotton fabrics.

	w_0 / g	w_1 / g	x / %
P1@CF	0.1908	0.2124	11.3
P2@CF	0.1855	0.2035	9.7
P3@CF	0.1864	0.1994	7.0

w_0: weights of the pristine cotton fabrics before dip-coating; w_1: weights of the functionalized cotton fabrics. Mass fraction of grafted block copolymer x is determined by the following equation: $x = (w_1 - w_0)/w_0 \times 100\%$

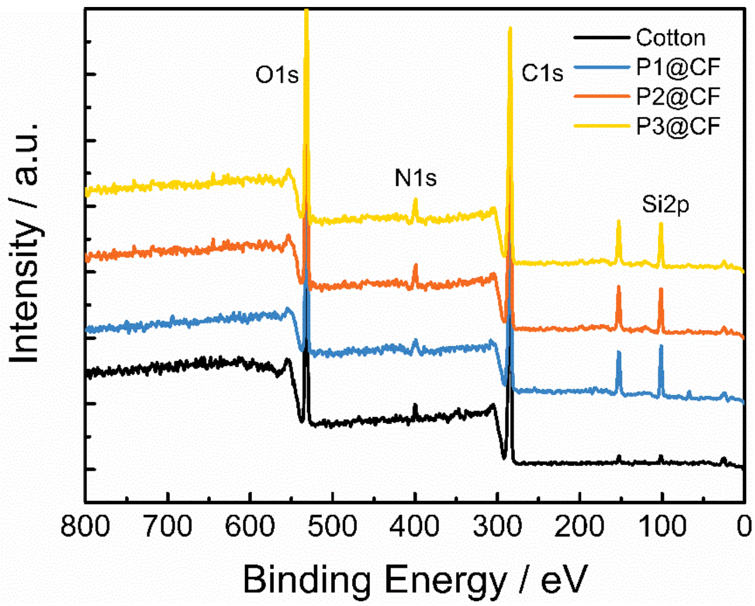

Figure S15. XPS spectra of pristine cotton fabrics and functionalized cotton fabrics with P1, P2, and P3.

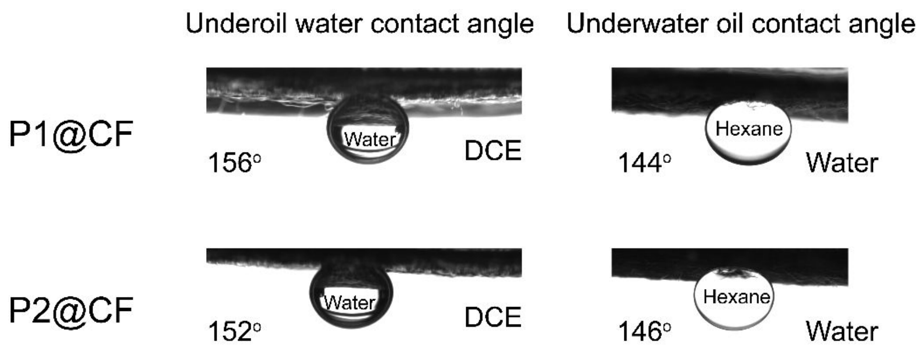

Figure S16. Underoil water contact angle of P1@CF and P2@CF, the oil is dichloroethane (DCE). And underwater oil contact angle of P1@CF and P2@CF. The oil is hexane.

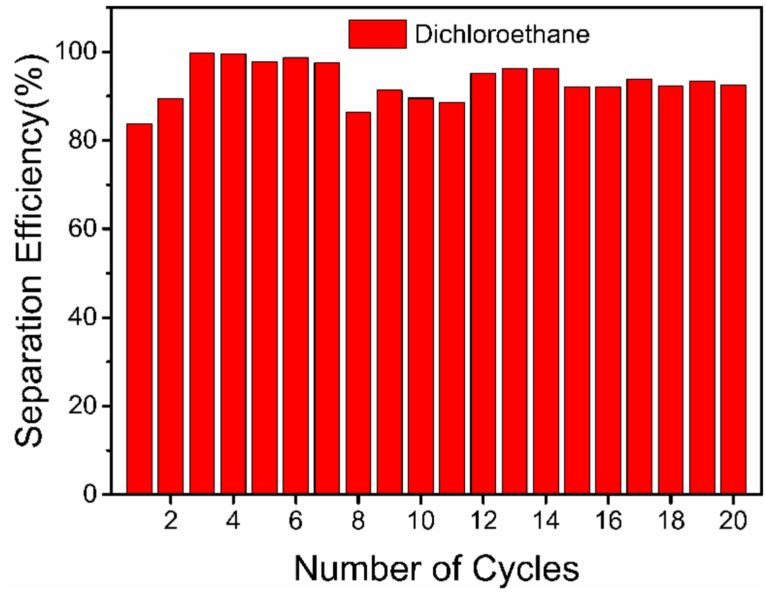

Figure S17. Oil/water separation efficiency versus recycle numbers. The oil is dichloroethane and the membrane used is P1@CF. The separation efficiency was determined by comparing the weight of dichloroethane before and after separation.

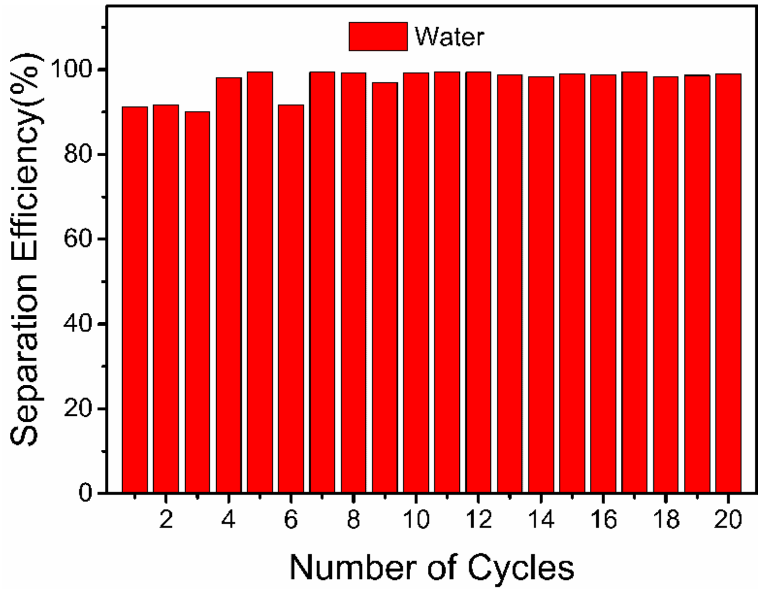

Figure S18. Oil/water separation efficiency versus recycle numbers. The oil is hexane and the membrane used is P1@CF. The separation efficiency was determined by comparing the weight of water before and after separation.

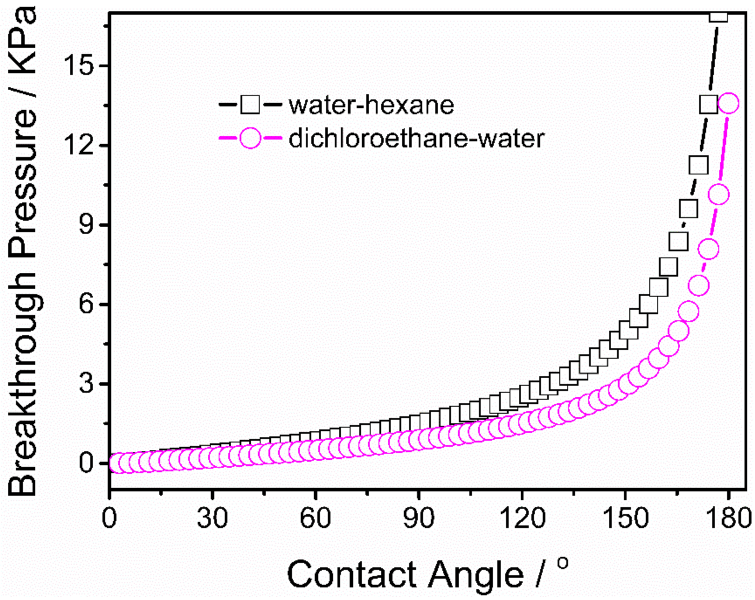

Figure S19. Relationship between breakthrough pressure (P_{bt}) and contact angle θ′ given by the equation: $P_{bt} = \frac{2R\gamma_{12}}{D^2}\frac{1-\cos(\theta')}{1+2(R/D)\sin(\theta')}$, here R is the cylinder radius, D is the half of the inter-cylinder spacing, γ_{12} is the interfacial tension between the wetting phase and non-wetting phase, and θ′ is the contact angle of the non-wetting liquid droplet on the fabric surface in the wetting phase. For the fabrics used, R and D are 100 and 30 microns, respectively. $\gamma_{water\text{-}hexane}$ is 51.1 mN/m, $\gamma_{dichloroethane\text{-}water}$ = 30.5 mN/m.