

Supporting information

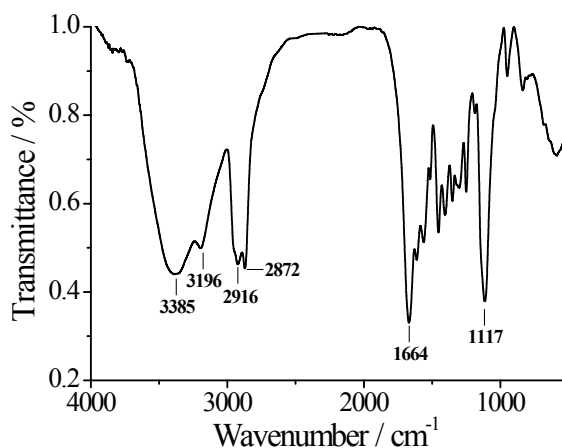


Figure S1. FTIR spectrum of amphiphilic macromolecule.

Fourier Transform infrared spectroscopy (FTIR) spectra were obtained with a Bruker Tensor-27 spectrometer at $25.0 \pm 0.5^\circ\text{C}$. A doublet adsorption peaks at around 3385 and 3196 cm^{-1} appeared in Fig.S1, corresponding to primary amine residues; but they were in a shift to low wave number, probably because of the coupling between primary amine and tertiary amine residues^[1]. A peak at around 2196 and 2872 cm^{-1} was observed and attributed to CH_3 - and $-\text{CH}_2$ - stretching vibration, respectively. The intensity of the adsorption peak at $\sim 1664\text{ cm}^{-1}$ was the characteristic peak of the $\text{C}=\text{O}$ stretching vibration. The adsorption peak of $-\text{C}-\text{O}-\text{C}-$ group was observed at $\sim 1117\text{ cm}^{-1}$.

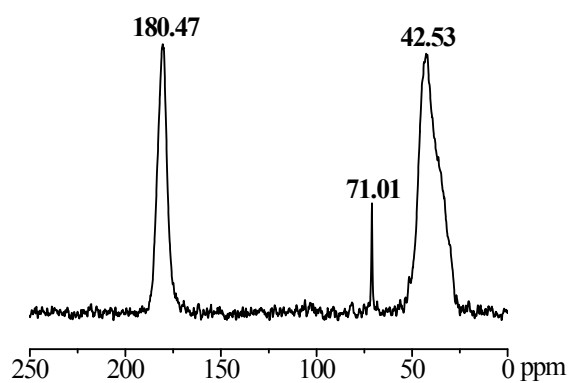


Figure S2. Solid-state ^{13}C NMR of amphiphilic macromolecule.

Solid-state ^{13}C NMR measurements were carried out at 25.0 ± 0.1 °C on a Bruker Avance III spectrometer (400 MHz). From Fig.S2, the carbon chemical shift at ~ 180 ppm was attributed to C=O group; a narrow shift at ~ 71 ppm was assigned to the C-C group close to ether bond; the shift at around 42 ppm was attributed to alkyl group.

LLS spectrometer (ALV/DLS/SLS-5022F) with a multi- τ digital time correlator (ALV-5000) and a cylindrical 22 mW He-Ne laser ($\lambda = 632.8$ nm) as the incident beam was used. In static LLS continuously measuring in the range of $30\sim 80^\circ$, we can obtain the weight-average molar mass (M_w), and the z-average root-mean-square radius of gyration ($\langle R_g^2 \rangle^{1/2}$ or written as $\langle R_g \rangle$) of scattering objects in a dilute solution or dispersion from the angular dependence of the excess scattering intensity, known as Rayleigh ratio $R_{vv}(q)$ and shown as eq 1:^[2,3]

$$\frac{KC}{R_{vv}(q)} \approx \frac{1}{M_w} \left(1 + \frac{1}{3} \langle R_g^2 \rangle q^2\right) + 2A_2C \quad (1)$$

where $K = 4\pi n^2 (dn/dc)^2 / (N_A \lambda_0^4)$ and $q = (4\pi n / \lambda_0) \sin(\theta/2)$ with N_A , dn/dc (approximately being 0.1 ml/g), n , and λ_0 being the Avogadro number, the specific refractive index increment, the solvent refractive index, and the wavelength of the light in a vacuum, respectively.

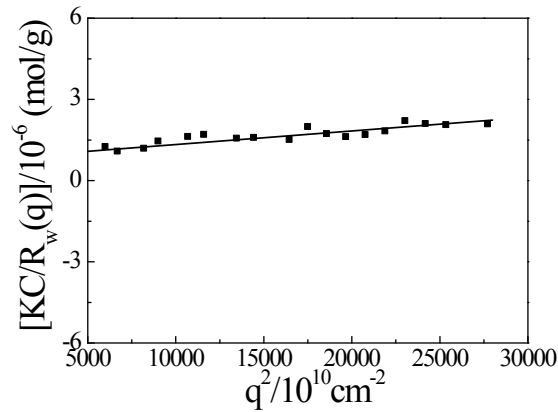


Figure S3. Scattering vector (q) dependence of Rayleigh ratio $R_{vv}(q)$ of amphiphilic macromolecule chains in water, where the macromolecule concentration is 5.0×10^{-6} g/mL and the relative error is no more than 5% for each data point.

In SLS study of our amphiphilic macromolecule, the solution was so dilute that the extrapolation of $C \rightarrow 0$ is not necessary, and the second term $2A_2C$ in eq 1 can be dropped.^[2,3] The results show that M_w and $\langle R_g \rangle$ of the amphiphilic macromolecule are 1.01×10^6 g/mol and 113 nm, respectively.

X-ray photoelectron spectroscopy (XPS) was performed on Thermo Scientific ESCALab 250Xi using 200 W monochromated Al K α radiation. The 500 μ m X-ray spot was used for XPS analysis. The base pressure in the analysis chamber was about 3×10^{-10} mbar. Typically, the hydrocarbon C 1s line at 284.8 eV from adventitious carbon is used for energy referencing.

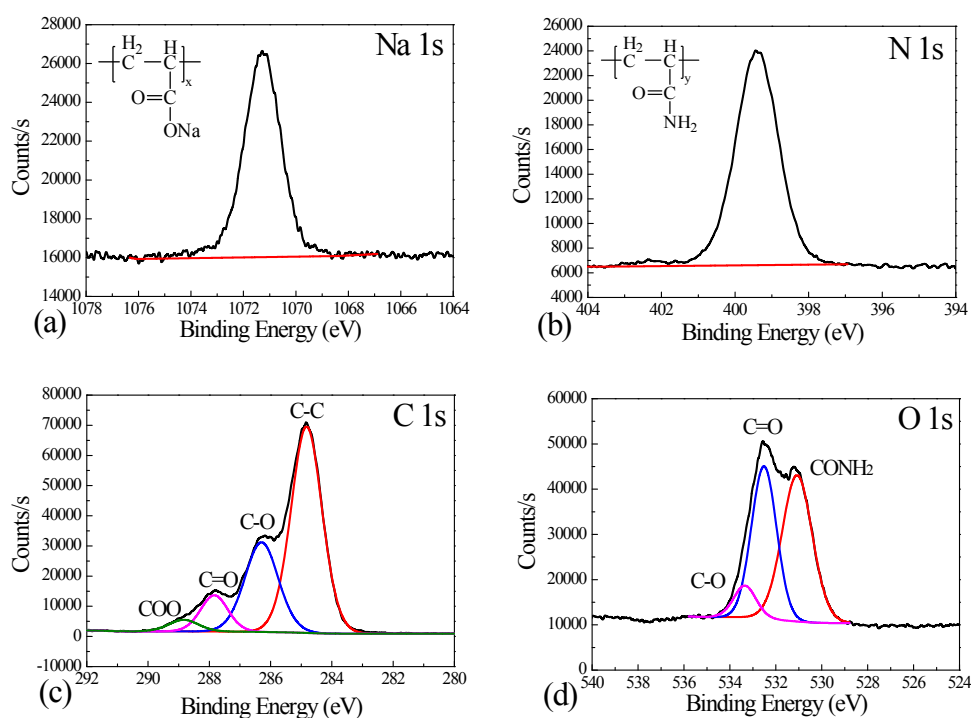


Figure S4. XPS Na 1s, N 1s, C 1s, and O 1s spectra of amphiphilic macromolecule. From X-ray photoelectron spectroscopy (XPS) results (Figure 2), the peaks of Na 1s and N 1s at around 1071.3 eV and 399.4 eV can be observed, respectively. 4 peaks are fitted up to the data set from Figure 2c, in which C 1s peaks at around 284.8 eV, 286.3 eV, 287.8 eV, and 288.8 eV are observed, assigned to C–C, C–O, C=O, and COO, respectively. O 1s peaks at around 531.7 eV, 532.5 eV, and 533.4 eV can be observed, which are assigned to C=ONH₂, C=O, and C–O. XPS results afford the ability to quantify the fraction of each block^[4,5], such as the fraction of ionizable group being approximately 23.1 %.

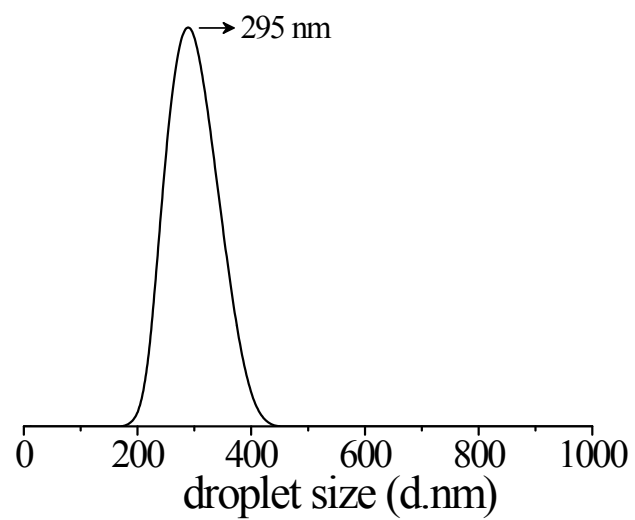
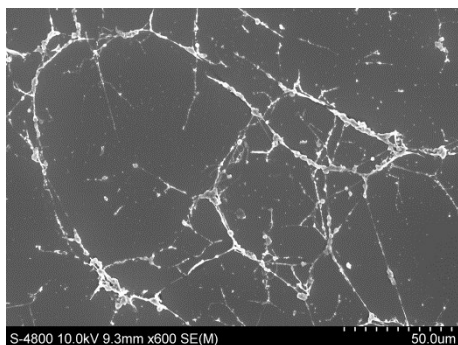
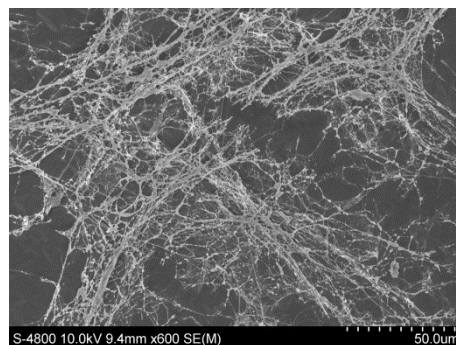


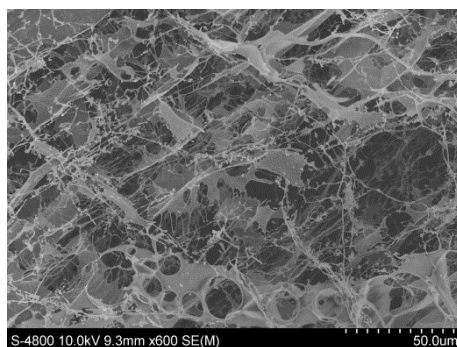
Figure S5. Distribution of volume average droplet diameter of the emulsion containing a fixed amount of macromolecule (1000 mg/L) in the aqueous phase.



(a) pH 2



(b) pH 6



(c) pH 10

Figure S6. SEM images of amphiphilic macromolecule systems at pH 2 (a), pH 6 (b), and pH 10 (c).

The macromolecule aqueous solutions at different pH values were prepared with the vacuum sublimation freezing drying technique^[6], and the aggregation behaviors of the macromolecules were investigated by using a Hitachi S-4800 scanning electron microscope.

Table S1. Zeta potential of emulsions at different pH values and salinities.

emulsions at different pH					
	pH 2	pH 4	pH 6	pH 8	pH 10
zeta potential (mV)	2.6±0.72	-4.1±0.23	-12.9±0.4	-15±4.8	-11.7±2.2

emulsions at different salinities (mg/L)						
	0	25	37.5	50	75	100
zeta potential (mV)	-28.4±2.8	-21.7±1.0	-19.5±3.2	-16.1±0.8	-14.1±3.1	4.9±0.18

Table S2. Interfacial tension of different systems.

emulsions at different pH					
	pH 2	pH 4	pH 6	pH 8	pH 10
interfacial tension (mN/m)	8.54 ± 0.11	7.67 ± 0.25	5.24 ± 0.12	4.34 ± 0.28	3.91 ± 0.16
emulsions at pH 5 and different salinities (mg/L)					
	0	25	37.5	50	
interfacial tension (mN/m)	6.84 ± 0.11	8.73 ± 0.36	12.33 ± 0.42	12.91 ± 0.13	

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