Annular and threadlike wormlike micelles formed by a bio-based surfactant containing an extremely large hydrophobic group

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1. Method

1.1 Surface Tension

The surface tension of C_{12}-MPA-Na was detected at 25 °C through a Sigma701 Automatic Surface Tensiometer (KSV, Finland) equipped with a Wilhelmy plate T107, and width of the plate is 19.44 mm, thickness is 0.1 mm, height is 65 mm and circumference is 39.08. The concentration of C_{12}-MPA-Na was gradually increased by dropping mother liquid using a dispenser (TITRONIC universal, Schott, Germany) into the measurement cell. The surface tension was automatically recorded by software and each concentration of C_{12}-MPA-Na aqueous solution was repeatedly tested three times, and the measurement error for each point is set to 0.05 mN·m^{-1}. All data were obtained from the One Attention software.

1.2 Fluorescent intensity

The fluorescence intensity of Nile red (NR) which is fluorescence probe in the solution of surfactant was measured on a LS-55 spectrofluorometer (PerkinElmer, PE) at 25±0.1 °C controlled by thermostated cell holder using 1 cm path length quartz cuvettes. The concentration of NR was controlled to 1.0 μmol·L^{-1} by adding a suitable amount of 1.0 mmol·L^{-1} methanol stock solution of NR. A series of C_{12}-MPA-Na solutions were prepared and then all the solutions were oscillated for 24 h after ultra-sonication for 2 h. The parameter was set as follow: Excitation wavelength (540 nm); Excitation slit (3 nm); Emission slit (3 nm) and Scan speed (250 nm·min^{-1}).

1.3 Size Measurement

A series of C_{12}-MPA-Na solutions at desired concentration were prepared and then all the solutions remain for 24 h at 25±0.1 °C. The size measurement was performed on Malven nanometer particle-size analyzer (Malvern Instruments Ltd., Worcestershire, UK) equipped with 1 cm path length quartz cuvettes.

2. Results and discussion

2.1 {^1}H NMR N-dodecyl-maleimidepimaric (C_{17}-MPA)
2.2 FT-IR spectrum

![FT-IR spectrum of MPA, C_{12}-MPA and C_{12}-MPA-Na](image)

2.3 Critical micelle concentration (cmc)

![Variation of surface tension (a) and fluorescent intensity of NR (b) for C_{12}-MPA-Na aqueous solutions with concentration at 25 °C](image)

2.4 size distributions
Fig. S4. The size distributions of C₁₂-MPA-Na at different concentration

2.5 Cole–Cole curve

Fig. S5. The Cole-Cole plots of the solution of C₁₂-MPA-Na

2.6 ¹H-¹H 2D NOESY spectra

Fig. S6. ¹H-¹H 2D NOESY spectra of the aqueous solution of C₁₂-MPA-Na (5 mM)