Electronic Supplementary Information (ESI) for

Effects of sodium chloride on rheological behaviour of the Gemini-like Surfactants

Xinxin Li,[ab] Pengxiang Wang,[ab] Xiaoyu Hou,[ab] Fang Wang,[ab] Han Zhao,[ab] Bobo Zhou,[ab] Hongwen Zhang,[ab] Hongbin Yang[ab] and Wanli Kang*[abc]

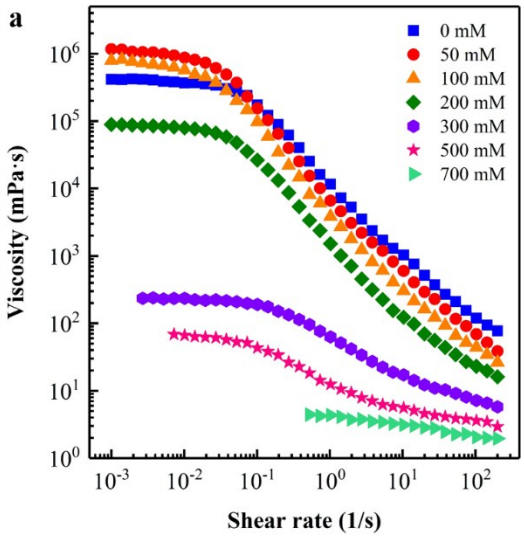
[a.] Key Laboratory of Unconventional Oil & Gas Development (China University of Petroleum (East China)), Ministry of Education, Qingdao 266580, P. R. China

[b.] School of Petroleum Engineering, China University of Petroleum (East China), Qingdao 266580, P. R. China.

[c.] Kazakh-British Technical University, Almaty 050000, Kazakhstan

*Corresponding Author: Wanli Kang, email: kangwanli@upc.edu.cn

Additional Results



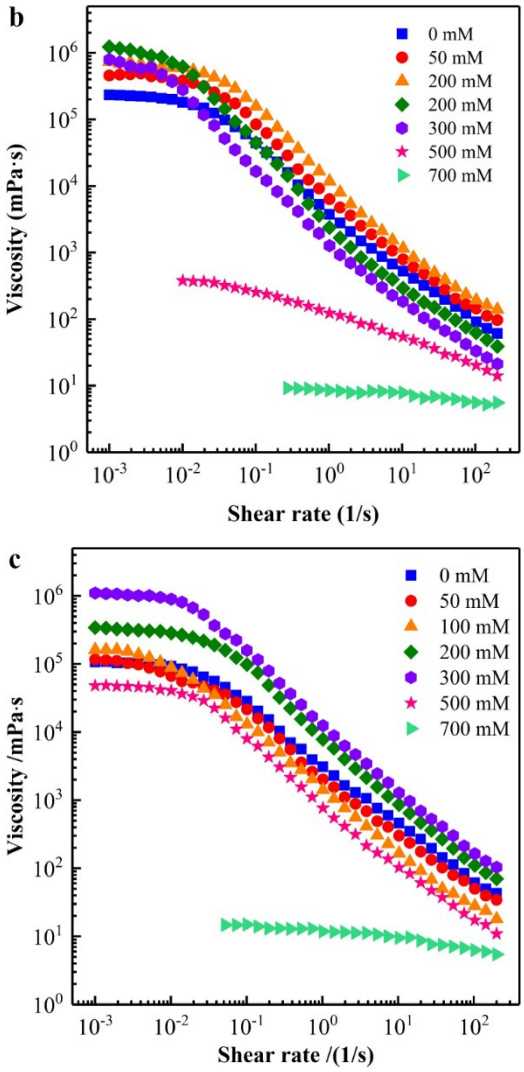
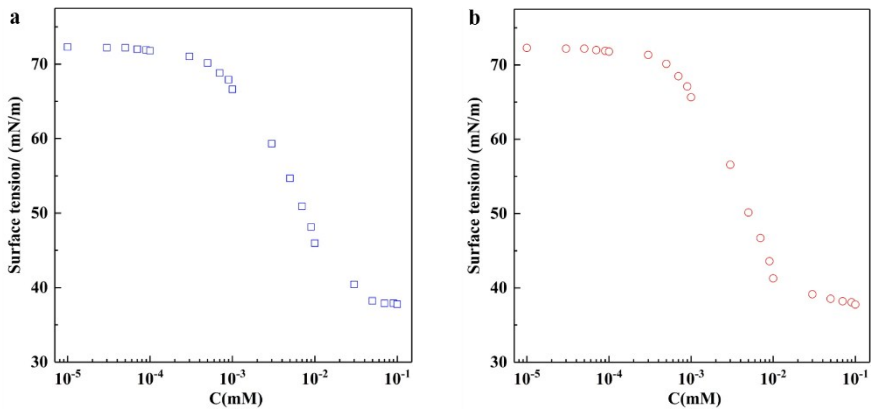


Fig.S1 Steady rheological curves of 15 mM EAPA solutions at different NaCl concentrations and 25 °C



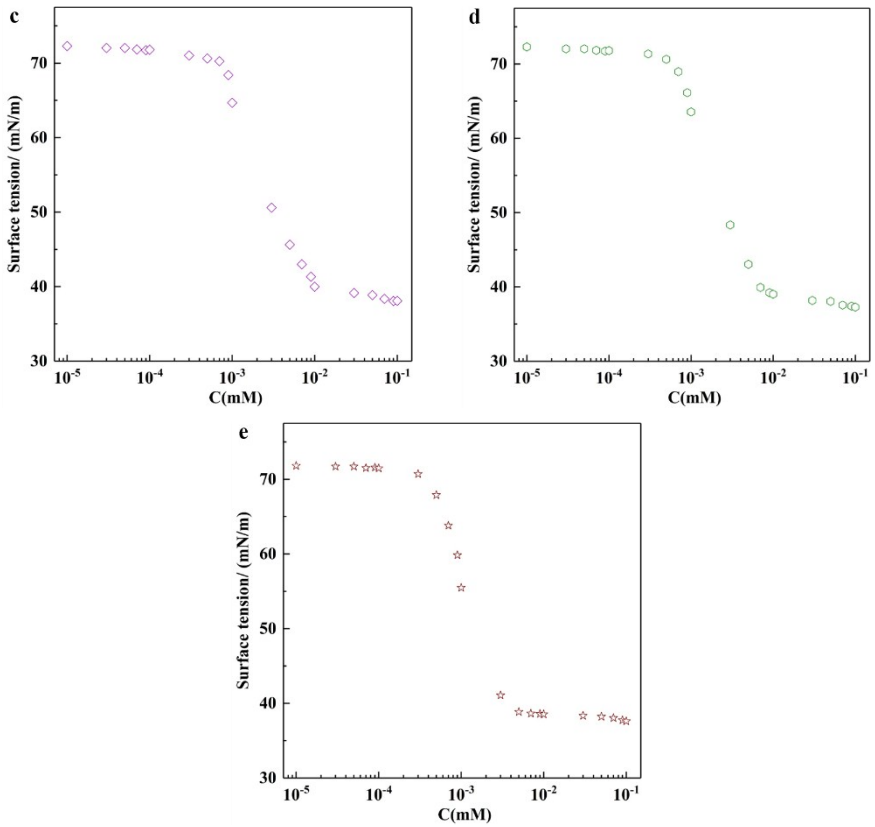


Fig.S2 Variation in surface tension with concentration of ***p***-EAPA at 25 °C (a: C(NaCl)=0 mM, b: C(NaCl)=50 mM, c: C(NaCl)=100 mM, d: C(NaCl)=200 mM, e: C(NaCl)=300 mM.)

The C(NaCl) refers to the NaCl concentration of 15 mM ***p***-EAPA, and different concentrations of ***p***-EAPA were obtained by diluting 15 mM ***p***-EAPA.

The minimum average area per surfactant molecule A_{min} was calculated by Gibbs adsorption equation:

$$\Gamma_{max} = -\frac{1}{2.303nRT}\left(\frac{\partial\gamma}{\partial \log C}\right)_T$$

$$A_{min} = \frac{1}{N_A\Gamma_{max}}$$

where, Γ_{max} (μmol/m^2) is the saturated adsorption amounts of the surfactants, $(\partial\gamma/\partial \log C)_T$ is the slope of the surface tension curve, R = 8.31 J / (mol·K), T = 298.15 K, N_A = 6.02 × 10^{23}, n is a constant which depends on the number of species constituting the surfactant and which are adsorbed at the interface. And n takes 2 for an ionic surfactant where the surfactant ion and the counterion are univalent, while n takes 3 for Gemini surfactants. Therefore, n takes 3 in this research.

The length lc(cm) and volume V(cm^3) of hydrophobic chain of surfactants was obtained by characteristic parameters of surfactants:

$$l_c = (1.50 + 1.265n_c) \times 10^{-8}$$

$$V = (27.4 + 26.9n_c) \times 10^{-24}$$

Where n_c is the number of carbon atoms in hydrophobic chain of surfactants and takes 21 according to the structure of $UC_{22}AMPM$.

According to the A_{min}, lc and v, the packing parameter p can be calculated by $p=V/A_{min}lc$. And the calculated results were listed in the Table.S1.

Table.S1 The Surface parameters of ***p***-EAPA system at different NaCl concentrations and 25 °C

C(NaCl)/mM	lc(nm)	V(nm^3)	A_{min}(nm^2)	p
0	2.8065	0.5923	0.653	0.3232
50			0.623	0.3388
100			0.578	0.3651
200			0.503	0.4196
300			0.459	0.4598