Supplementary Information

Effects of additives on the viscoelastic responses of cationic gemini surfactant solution

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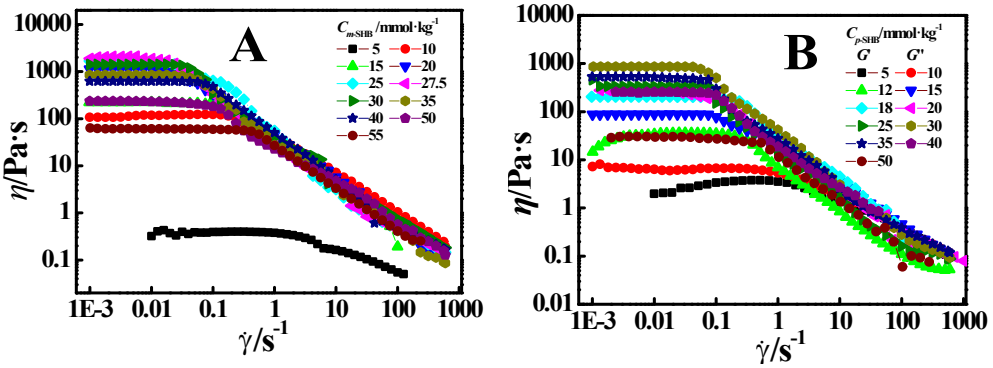
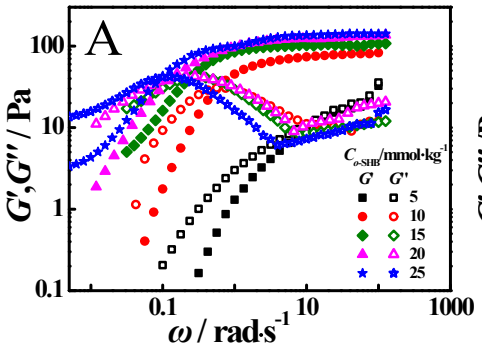
1. ^{1}H NMR and elemental analysis data of the 14-3(OH)-14(2Cl)

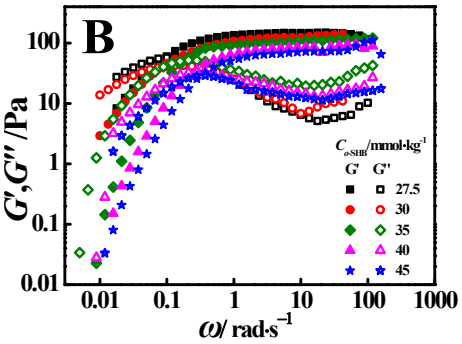
	^{1}HNMR（δ,$CDCl_3$）	Anal.found %(Calculated values %)
	0.88 (t,6, 2$\underline{CH_3}CH_2$)	H,12.48 (12.44)
	1.24~1.47 (m,44H，$2CH_3(\underline{CH_2})_{11}$),	C,68.88 (68.74)
	1.672~1.83 (t,4H, $2CH_3(CH_2)_9\underline{CH_2}$)	N,4.63 (4.58)
$G_{14}Cl$	2.16 (m,1H,O$\underline{H}$)	
	3.39~3.42 (s,12H,N($\underline{CH_3}$)$_2$)	
	3.457~3.578(t,8H,$2CH_3(CH_2)_{10}\underline{CH_2}\underline{NCH_2}$)	
	5.19(m,1H)	

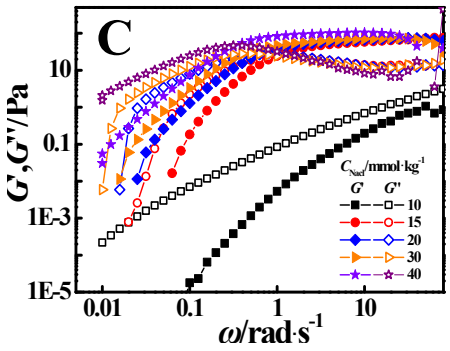
2. Curves of apparent viscosity (η) versus shear rate ($\dot{\gamma}$) for aqueous solutions of 80 mmol·kg^{-1} 14-3(OH)-14(2Cl) at different salt concentrations: (A) *m*-SHB; (B) *p*-SHB.

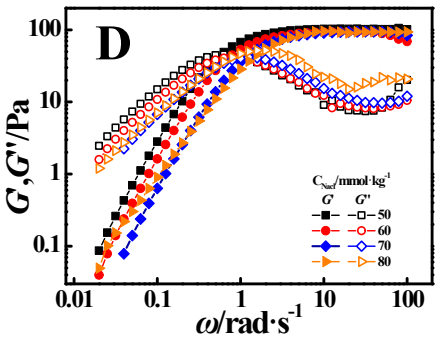


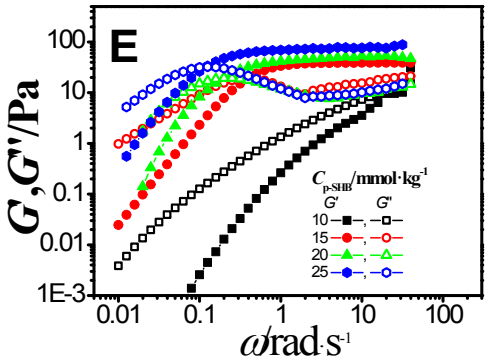
3. Storage modulus (closed symbols) and loss modulus (open symbols) as a function of the angular frequency for the 80 mmol·kg^{-1} 14-3(OH)-14(2Cl) solution at different salt concentrations: (A) and (B) *o*-SHB; (C) and (D) NaCl; (E) and (F) *p*-SHB；(G) and (H) *m*-SHB at 298.15 K.

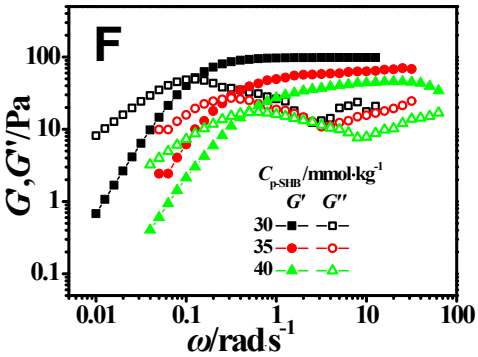

A
G',G'' / Pa
ω / rad·s-1
C o-SHB/mmol·kg-1
G' G''
5
10
15
20
25

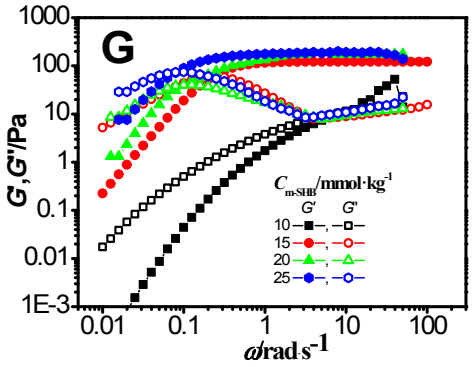

B
G',G'' /Pa
ω/ rad·s-1
C o-SHB/mmol·kg-1
G' G''
27.5
30
35
40
45

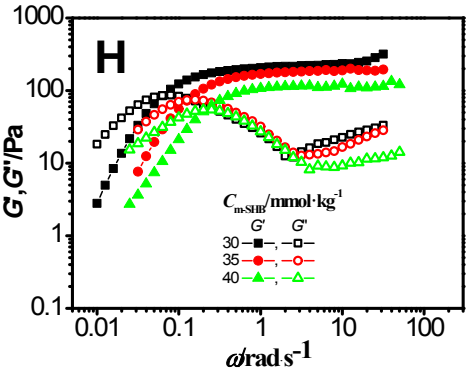

C
G',G''/Pa
ω/rad·s-1
C NaCl/mmol·kg-1
G' G''
10
15
20
30
40


D
G',G''/Pa
ω/rad·s-1
C NaCl/mmol·kg-1
G' G''
50
60
70
80


E
G',G''/Pa
ω/rad·s-1
C p-SHB/mmol·kg-1
G' G''
10
15
20
25


F
G',G''/Pa
ω/rad·s-1
C p-SHB/mmol·kg-1
G' G''
30
35
40

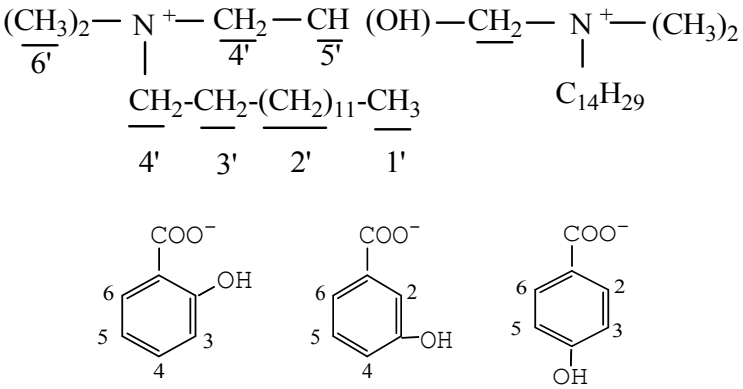

G
G',G''/Pa
ω/rad·s-1
C m-SHB/mmol·kg-1
G' G''
10
15
20
25

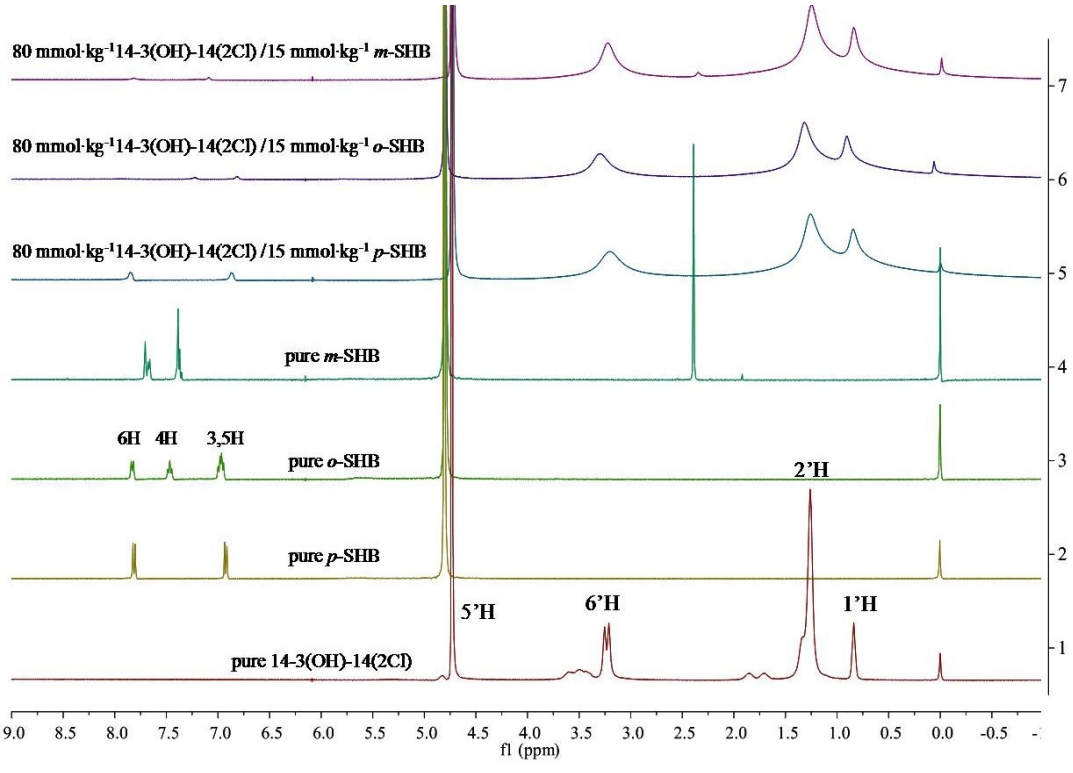

H
G',G''/Pa
ω/rad·s-1
C m-SHB/mmol·kg-1
G' G''
30
35
40

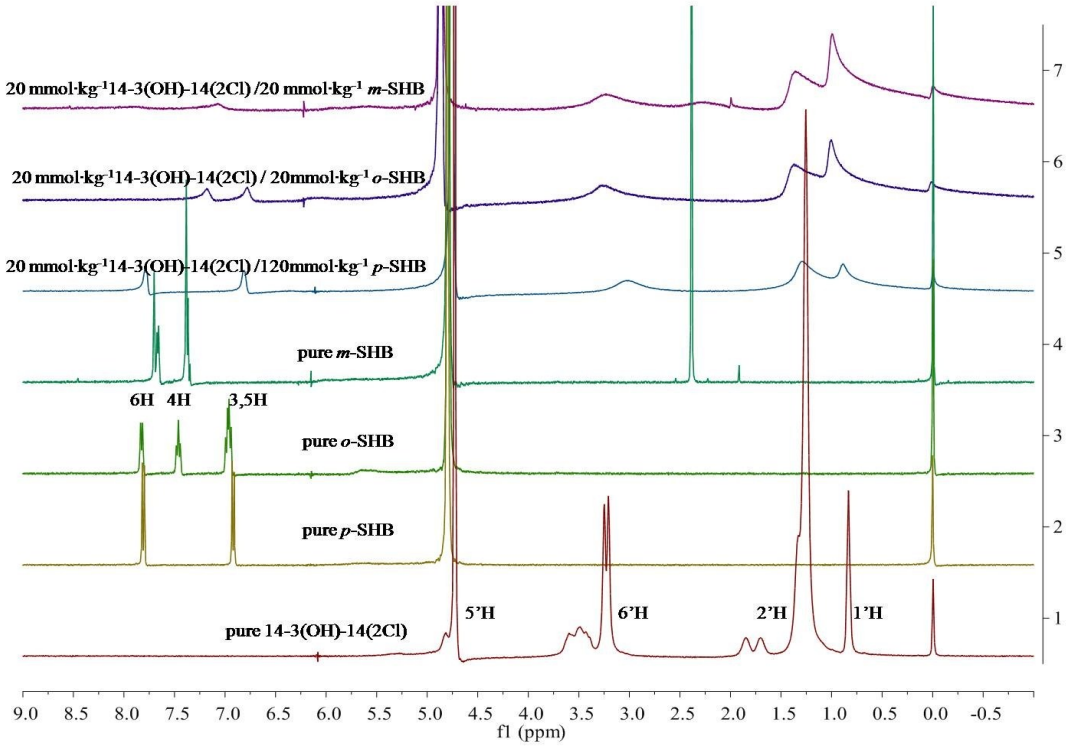
4. The structural parameters of 14-3(OH)-14(2Cl)/*o*-SHB crystal

Compound	14-3(OH)-14(2Cl)+*o*-SHB
Formula	C_{42} H_{79} Cl N_2 O_8
Formula wt	775.55
Cryst syst	Triclinic
Space group	P-1
a. Å	9.2108(8)
b. Å	9.4525(8)
c. Å	29.308(3)
α. °	87.928(2)
β. °	83.1320(1)
γ. °	71.2010(1)
V. Å^3	2398.3(4)
Z	2
$D_{calc.}$ (g cm^{-3})	1.074
F(000)	870
M(Mo *K*α) (mm^{-1})	0.133
Theta range	2.38 -25.02
Reflections measured	12289
Unique reflections	8344
R(int)	0.11
Final R_1 [I>2σ(I)]	0.11
Final wR_2 [I>2σ(I)]	0.34

5. ^{1}H NMR spectra for 14-3(OH)-14(2Cl)/additives systems: (a) the bottom spectrum is 80 mmol·kg^{-1} 14-3(OH)-14(2Cl) in D_2O. Then, from bottom to top, 15 mmol·kg^{-1} salts (*p*-SHM, *o*-SHM and *m*-SHM) were added into 80 mmol·kg^{-1} 14-3(OH)-14(2Cl) solutions; (b) the bottom spectrum is 14-3(OH)-14(2Cl) in D_2O. Then, from bottom to top, 20 mmol·kg^{-1} salts (*p*-SHM, *o*-SHM and *m*-SHM) were added into 20 mmol·kg^{-1} 14-3(OH)-14(2Cl) solutions.






20 mmol·kg⁻¹14-3(OH)-14(2Cl) /20 mmol·kg⁻¹ m-SHB
20 mmol·kg⁻¹14-3(OH)-14(2Cl) / 20mmol·kg⁻¹ o-SHB
20 mmol·kg⁻¹14-3(OH)-14(2Cl) /120mmol·kg⁻¹ p-SHB
pure m-SHB
6H 4H 3,5H
pure o-SHB
pure p-SHB
5'H
6'H
2'H
1'H
pure 14-3(OH)-14(2Cl)
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)
7 6 5 4 3 2 1