

Supporting Information for

‘The impact of multivalent counterions, Al^{3+} , on the surface adsorption and self-assembly of the anionic surfactant alkyloxyethylene sulfate and anionic / nonionic surfactant mixtures’

Table S1. Micelle model parameters for 20 mM SLES / $\text{C}_{12}\text{E}_{12}$ in AlCl_3 / NaCl and CaCl_2 / NaCl.

(a) 95/5 mole ratio SLES / $\text{C}_{12}\text{E}_{12}$ in CaCl_2 / NaCl.

CaCl_2 / NaCl conc(mM)	Aggregation number, ν	Charge, z (± 1)	R_1 (± 1 Å)	R_2 (± 1 Å)	ee (± 0.1)	ext (± 0.05)
4.8 / 57.6	148 $\pm$ 7	4	20	24	1.6	1.2
9.6 / 42	138	4	20	24	1.4	1.2
12 / 36	169	2	20	24	1.8	1.2
14.4 / 28.8	176	2	20	24	1.8	1.2
19.2 / 14.4	186 $\pm$ 10	0	20	24	1.9	1.2
24 / 0.0	255	0	20	24	2.7 $\pm$ 0.2	1.2

(b) 90/10 mole ratio SLES / $\text{C}_{12}\text{E}_{12}$ in CaCl_2 / NaCl.

CaCl_2 / NaCl conc(mM)	Aggregation number, ν	Charge, z (± 1)	R_1 (± 1 Å)	R_2 (± 1 Å)	ee (± 0.1)	ext (± 0.05)
4.8 / 57.6	136 $\pm$ 7	4	19	24	1.6	1.1
9.6 / 42	109	5	19	24	1.3	1.1
12 / 36	153	4	19	24	1.8	1.1
14.4 / 28.8	161	4	19	24	1.7	1.1
19.2 / 14.4	171 $\pm$ 10	2	19	24	1.8	1.1
24 / 0.0	179	1	19	24	1.9	1.1

(c) 95/5 mole ratio SLES / $\text{C}_{12}\text{E}_{12}$ in AlCl_3 / NaCl.

AlCl_3 / NaCl conc(mM)	Aggregation number, ν	Charge, z (± 1)	R_1 (± 1 Å)	R_2 (± 1 Å)	ee (± 0.1)	ext (± 0.05)
0.0 / 72	125 $\pm$ 7	4	19	23	1.5	1.1
2.4 / 57.6	150	4	19	23	1.7	1.1
4.8 / 43.2	193 $\pm$ 10	0	19	23	2.2 $\pm$ 0.2	1.1
6.0 / 36	286 $\pm$ 20	0	19	23	3.6 $\pm$ 0.2	1.1
7.2 / 28.8	418 $\pm$ 30	0	19	23	5.3 $\pm$ 5	1.1

(d) 90/10 mole ratio SLES / C₁₂E₁₂ in AlCl₃ / NaCl.

AlCl ₃ / NaCl conc(mM)	Aggregation number, v	Charge, z (±1)	R ₁ (±1 Å)	R ₂ (±1 Å)	ee (±0.1)	ext (±0.05)
0.0 / 72	116±7	4	19	24	1.6	1.2
2.4 / 57.6	140	4	19	24	1.6	1.2
4.8 / 43.2	171±10	2	19	24	2.0	1.2
6.0 / 36	223	0	19	24	2.5±0.2	1.2
7.2 / 28.8	337±20	0	19	24	3.7±0.2	1.2
9.6 / 14.4	570±30	0	19	24	6.3±0.5	1.2
12.0 / 0.0	734±50	0	19	24	8.3±1	1.2

(e) 80/20 mole ratio SLES / C₁₂E₁₂ in AlCl₃ / NaCl

AlCl ₃ / NaCl conc(mM)	Aggregation number, v	Charge, z (±1)	R ₁ (±1 Å)	R ₂ (±1 Å)	ee (±0.1)	ext (±0.05)
0.0 / 72	108±7	4	18	24	1.5	1.1
2.4 / 57.6	132	4	18	24	1.6	1.1
4.8 / 43.2	152	3	18	24	1.9	1.1
6.0 / 36	161±10	2	18	24	1.9	1.1
7.2 / 28.8	178	0	18	24	2.2±0.2	1.1
9.6 / 14.4	210	0	18	24	2.6±0.2	1.1
12.0 / 0.0	261	0	18	24	3.3±0.2	1.1

Table S2. Micelle model parameters for 5 mM SLES / C₁₂E₁₂ in AlCl₃ / NaCl

SLES / C ₁₂ E ₁₂ composition (mole % SLES)	AlCl ₃ / NaCl conc(mM)	Aggregation number, ν	Charge , z (± 1)	R_1 (± 1 Å)	R_2 (± 1 Å)	ee (± 0.1)	ext (± 0.05)
100/0	0 / 15	103 $\pm$ 7	3	17	20	1.7	1.0
	0.6 / 12	134	1	18	22	1.7	1.1
	1.2 / 9	193 $\pm$ 10	0	20	24	2.0	1.2
	1.5 / 7.5	282	0	19	23	3.3	1.1
93.5 / 6.5	0 / 15	105 $\pm$ 7	1	17	21	1.7	1.0
	1.8 / 6	531 $\pm$ 30	0	18	22	7.0	1.1
95/5	0 / 15	106 $\pm$ 7	5	17	21	1.6	1.0
	1.8 / 6	548 $\pm$ 30	0	18	22	6.9	1.1
90/10	0/15	95 $\pm$ 7	4	17	21	1.5	1.0
	0.6/12	113	1	17	21	1.9	1.0
	1.2/9	159 $\pm$ 10	1	18	23	2.0	1.1
	1.8/6	284 $\pm$ 20	1	18	23	3.6	1.1

Table S3. SLES adsorption, monolayer model parameters.

SLES concentration (M)	d (± 1 Å)	ρ ($\pm 0.1 \times 10^{-6} \text{ Å}^{-2}$)	A (Å^2)	Γ ($\pm 0.1 \times 10^{-10} \text{ mol cm}^{-2}$)
3.1×10^{-6}	-	-	-	-
1.25×10^{-5}	32	0.3	212 $\pm$ 10	0.8
4×10^{-5}	21	1.8	80 $\pm$ 4	2.0
5×10^{-5}	19	1.9	80 $\pm$ 4	2.0
2×10^{-4}	23	2.8	45 $\pm$ 2	3.7
2.5×10^{-4}	23	2.5	51	3.3
4×10^{-4}	22	3.2	41	4.0
8×10^{-4}	23	3.3	38	4.4
5×10^{-3}	22	3.2	41	4.0

Table S4. 5 mM SLES adsorption for different isotopic combinations, in 10 mM CaCl₂, monolayer model parameters.

Isotopic composition	d (±1Å)	ρ (± 0.1 x10⁻⁶ Å⁻²)	A (±2Å²)	Γ (±0.1x10⁻¹⁰ mol cm⁻²)
d-SLES	24	3.4	36	4.6
50/50 d, h-SLES	25	1.8	33	5.0

Table S5. 5 mM SLES / C₁₂E₁₂ in AlCl₃ / NaCl, surface layer model parameters.

SLES / C ₁₂ E ₁₂ composition (mole ratio)	AlCl ₃ / NaCl conc(mM)	d ₁ (±1Å)	ρ ₁ (± 0.1 ×10 ⁻⁶ Å ⁻²)	d ₂ (±1Å)	ρ ₂ (± 0.1 ×10 ⁻⁶ Å ⁻²)	d ₃ (±1Å)	ρ ₃ (± 0.1 ×10 ⁻⁶ Å ⁻²)
95/5	1.8/5.0	27	2.5	-	-	-	-
95/5	2.1/3.25	24	2.7	-	-	-	-
SLES / C ₁₂ E ₁₂ composition (mole ratio)	AlCl ₃ / NaCl conc(mM)	d ₁ (±0.2Å)	ρ ₁ (± 0.1 ×10 ⁻⁶ Å ⁻²)	d ₂ (±0.2Å)	ρ ₂ (± 0.1 ×10 ⁻⁶ Å ⁻²)	N	ΔQ
95/5	2.4/2.5	25.2	3.1	25.2	1.7	40	0.05
SLES / C ₁₂ E ₁₂ composition (mole ratio)	AlCl ₃ / NaCl conc(mM)	d ₁ (±1Å)	ρ ₁ (± 0.1 ×10 ⁻⁶ Å ⁻²)	d ₂ (±1Å)	ρ ₂ (± 0.1 ×10 ⁻⁶ Å ⁻²)	d ₃ (±1Å)	ρ ₃ (± 0.1 ×10 ⁻⁶ Å ⁻²)
93.5/6.5	2.4/2.5	24	2.7	-	-	-	-
	2.7/1.25	25	2.4	-	-	-	-
92/8	2.4/2.5	24	2.7	-	-	-	-
90/10	0.0/15	26	2.2	-	-	-	-
	1.8/5	27	2.5	-	-	-	-
	2.4/2.5	22	2.7	-	-	-	-
	2.7/1.25	25	2.4	-	-	-	-
	3.0/0.0	24	3.1	-	-	-	-

Table S6. 1mM SLES / C₁₂E₁₂ / AlCl₃ / NaCl

SLES / C ₁₂ E ₁₂ composition (mole ratio)	AlCl ₃ / NaCl conc(mM)	d ₁ (±1Å)	ρ ₁ (± 0.1 x10 ⁻⁶ Å ⁻²)	d ₂ (±1Å)	ρ ₂ (± 0.1 x10 ⁻⁶ Å ⁻²)	d ₃ (±1Å)	ρ ₃ (± 0.1 x10 ⁻⁶ Å ⁻²)
90/10	0.12/2.4	19	3.1	-	-	-	-
90/10	0.24/1.8	19	3.2	17	1.2	25	3.1
90/10	0.3/1.5	24	3.2	17	1.3	20	3.3
90/10	0.35/1.2	18	3.8	17	1.0	25	2.5
90/10	0.48/0.6	18	3.8	17	1.0	25	2.5
SLES / C ₁₂ E ₁₂ composition (mole ratio)	AlCl ₃ / NaCl conc(mM)	d ₁ (±0.2Å)	ρ ₁ (± 0.1 x10 ⁻⁶ Å ⁻²)	d ₂ (±0.2Å)	ρ ₂ (± 0.1 x10 ⁻⁶ Å ⁻²)	N	ΔQ
90/10	0.6/0.0	21.4	3.5	21.8	1.4	3	0.1