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APPENDICES

Appendix A CMC determination of surfactants

The CMC of block copolymer surfactants; Pluronics L64, Pluronics 10R5, Pluronics P123, Pluronics 25R4, Pluronics L31, and Pluronics 17R2; with the HLB values of 6-15, are shown in table A1, A2, A3, A4, A5, and A6, respectively.

Table A1 CMC determination of Pluronics L64 ($PEO_{13}PPO_{30}PEO_{13}$); HLB 15, triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0	72.0
1	0.3448	43.9
2	0.6897	42.9
3	1.0345	42.5
4	1.3793	42.3
5	1.7241	**41.7**
6	2.0690	**41.5**
7	2.4138	**41.5**
8	2.7586	**41.7**
9	3.1034	**41.6**
10	3.4483	**41.7**
11	3.7931	**41.7**
12	4.1379	**41.8**

Table A2 CMC determination of Pluronics 10R5 ($PEO_8PPO_{23}PEO_8$); HLB 15, reversed-triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0.0000	70.3
1	0.5128	46.6
2	1.0256	44.3
3	1.5385	43.7
4	2.0513	43.6
5	2.5641	**41.8**
6	3.0769	**42.3**
7	3.5897	**41.9**

8	4.1026	**42.1**
9	4.6154	**42.4**
10	5.1282	**42.4**
11	5.6410	**42.2**
12	6.1538	**42.3**

Table A3 CMC determination of Pluronics P123 ($PEO_{19}PPO_{69}PEO_{19}$); HLB 8, triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0.0000	71.9
1	0.1739	32.4
2	0.3478	**31.5**
3	0.5217	**31.4**
4	0.6957	**31.4**
5	0.8696	**31.3**
6	1.0435	**31.5**
7	1.2174	**31.2**
8	1.3913	**31.4**
9	1.5652	**31.2**
10	1.7391	**31.2**
11	1.9130	**31.4**
12	2.0870	**31.5**

Table A4 CMC determination of Pluronics 25R4 ($PEO_{19}PPO_{33}PEO_{19}$); HLB 8, reversed-triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0.0000	72.0
0.5	0.1389	42.1
1	0.2778	41.7
1.5	0.4167	41.4
2	0.5556	41.2
2.5	0.6944	**41.1**
3	0.8333	**41.1**
3.5	0.9722	**41.0**
4	1.1111	**40.9**
4.5	1.2500	**41.1**
5	1.3889	**41.0**
6	1.6667	**40.9**
7	1.9444	**40.9**

8	2.2222	**41.0**
9	2.5000	**41.1**
10	2.7778	**41.1**
11	3.0556	**41.0**
12	3.3333	**41.0**

Table A5 CMC determination of Pluronics L31; HLB 6.8 ($PEO_1PPO_{17}PEO_1$); triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0.0000	71.9
0.1	0.0909	64.4
0.2	0.1818	58.2
0.3	0.2727	54.7
0.4	0.3636	50.4
0.5	0.4545	**47.8**
0.6	0.5455	**46.3**
0.7	0.6364	**46.1**
0.8	0.7273	**45.9**
0.9	0.8182	**45.9**
1	0.9091	**45.7**
2	1.8182	**45.5**
3	2.7273	**45.4**
4	3.6364	**45.2**
5	4.5455	**45.2**
6	5.4545	**44.8**
7	6.3636	**44.7**
8	7.2727	**44.5**
9	8.1818	**44.6**
10	9.0909	**44.1**
11	10.0000	**43.9**
12	10.9091	**43.8**

Table A6 CMC determination of Pluronics 17R2 ($PEO_{15}PPO_{10}PEO_{15}$); HLB 6, reversed-triblock copolymers

Concentration (g/l)	Concentration (mM)	Surface tension (mN/m)
0	0.0000	72.0
0.1	0.0465	62.7
0.2	0.0930	54.3
0.3	0.1395	47.8

0.4	0.1860	45.5
0.5	0.2326	**44.3**
0.6	0.2791	**43.6**
0.7	0.3256	**43.2**
0.8	0.3721	**43.1**
0.9	0.4186	**43.0**
1	0.4651	**43.0**
2	0.9302	**42.9**
3	1.3953	**42.7**
4	1.8605	**42.6**
5	2.3256	**42.4**
6	2.7907	**42.5**
7	3.2558	**42.3**
8	3.7209	**42.3**
9	4.1860	**42.1**
10	4.6512	**42.0**
11	5.1163	**41.9**
12	5.5814	**41.8**

Appendix B Adsorption of surfactants onto silica

The adsorption isotherms of block copolymer surfactants; Pluronics L64, Pluronics 10R5, Pluronics P123, Pluronics 25R4, Pluronics L31, and Pluronics 17R2; with the HLB values of 6-15 onto silica at 29°C, are shown in table B1, B2, B3, B4, B5, and B6, respectively.

Weight of silica = 0.15 g

Volume of copolymer surfactant solution = 15 ml

Table B1 The adsorption isotherm of Pluronics L64 ($PEO_{13}PPO_{30}PEO_{13}$); HLB 15, triblock copolymers; onto silica

Initial concentration		Equilbrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.1178	0.0406	-0.0041
1	0.3448	0.4296	0.1481	0.0197
2	0.6897	0.9511	0.3280	0.0362
3	1.0345	1.7486	0.6030	0.0432
4	1.3793	2.1997	0.7585	0.0621
5	1.7241	3.0417	1.0489	0.0675
6	2.0690	3.5517	1.2247	0.0844
7	2.4138	4.5158	1.5572	0.0857
8	2.7586	5.0690	1.7479	0.1011
9	3.1034	6.1422	2.1180	0.0985
10	3.4483	7.5718	2.6110	0.0837

Table B2 The adsorption isotherm of Pluronics 10R5 ($PEO_8PPO_{23}PEO_8$); HLB 15, reversed-triblock copolymers; onto silica

Initial concentration		Equilbrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.0523	0.0268	-0.0027
0.2	0.1026	0.1794	0.0920	0.0011
0.4	0.2051	0.0882	0.0452	0.0160
0.6	0.3077	0.2900	0.1487	0.0159
0.8	0.4103	0.2063	0.1058	0.0304
1	0.5128	0.4933	0.2530	0.0260
2	1.0256	0.6756	0.3465	0.0679
3	1.5385	1.4619	0.7497	0.0789
4	2.0513	1.7414	0.8930	0.1158
5	2.5641	2.4290	1.2456	0.1318
6	3.0769	3.3109	1.6979	0.1379
7	3.5897	3.8251	1.9616	0.1628
8	4.1026	4.8954	2.5104	0.1592
9	4.6154	6.0613	3.1084	0.1507
10	5.1282	7.2167	3.7009	0.1427

Table B3 The adsorption isotherm of Pluronics P123 ($PEO_{19}PPO_{69}PEO_{19}$); HLB 8, triblock copolymers; onto silica

Initial concentration		Equilbrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.1043	0.0181	-0.0018
1	0.1739	0.3065	0.0533	0.0121

2	0.3478	0.6284	0.1093	0.0239
3	0.5217	0.7739	0.1346	0.0387
4	0.6957	0.8659	0.1506	0.0545
5	0.8696	1.4598	0.2539	0.0616
6	1.0435	1.3927	0.2422	0.0801
7	1.2174	1.8659	0.3245	0.0893
8	1.3913	2.5000	0.4348	0.0957
9	1.5652	3.4732	0.6040	0.0961
10	1.7391	4.4406	0.7723	0.0967

Table B4 The adsorption isotherm of Pluronics 25R4 ($PEO_{19}PPO_{33}PEO_{19}$); HLB 8, reversed-triblock copolymers; onto silica

Initial concentration		Equilibrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.1676	0.0465	-0.0047
1	0.2778	0.5544	0.1540	0.0124
2	0.5556	0.7629	0.2119	0.0344
3	0.8333	1.4528	0.4035	0.0430
4	1.1111	2.0000	0.5556	0.0556
5	1.3889	2.4528	0.6813	0.0708
6	1.6667	3.1373	0.8715	0.0795
7	1.9444	4.1765	1.1601	0.0784
8	2.2222	5.4474	1.5132	0.0709
9	2.5000	6.5811	1.8281	0.0672
10	2.7778	7.4973	2.0826	0.0695

Table B5 The adsorption isotherm of Pluronics L31; HLB 6.8 ($PEO_1PPO_{17}PEO_1$); triblock copolymers; onto silica

Initial concentration		Equilibrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.1873	0.1703	-0.0170
1	0.9091	0.9656	0.8779	0.0031
2	1.8182	2.0326	1.8479	-0.0030
3	2.7273	3.0876	2.8069	-0.0080
4	3.6364	4.0876	3.7160	-0.0080
5	4.5455	5.0859	4.6236	-0.0078
6	5.4545	5.9261	5.3874	0.0067
7	6.3636	7.0481	6.4074	-0.0044
8	7.2727	8.0258	7.2962	-0.0023
9	8.1818	9.0464	8.2240	-0.0042
10	9.0909	9.9828	9.0753	0.0016

Table B6 The adsorption isotherm of Pluronics 17R2 ($PEO_{15}PPO_{10}PEO_{15}$); HLB 6, reversed-triblock copolymers; onto silica

Initial concentration		Equilibrium concentration		Amount of surfactant adsorbed (mmol/g of silica)
g/l	mM	g/l	mM	
0	0.0000	0.0856	0.0398	-0.0040
1	0.4651	1.0417	0.4845	-0.0019
2	0.9302	2.1829	1.0153	-0.0085
3	1.3953	3.2569	1.5149	-0.0120
4	1.8605	4.1690	1.9391	-0.0079
5	2.3256	4.9745	2.3137	0.0012

6	2.7907	6.0926	2.8338	-0.0043
7	3.2558	7.2593	3.3764	-0.0121
8	3.7209	8.3449	3.8814	-0.0160
9	4.1860	8.9907	4.1817	0.0004
10	4.6512	9.9468	4.6264	0.0025

Appendix C Adsolubilization of organics

The adsolubilization of phenol in the adsorbed layer of block copolymer surfactants; Pluronics L64, Pluronics 10R5, Pluronics P123, and Pluronics 25R4 at 29°C, are shown in table C1, C2, C3, and C4, respectively.

Weight of silica = 0.2 g

Volume of phenol- surfactant solution = 20 ml

Aqueous solubility limit of phenol = 71.3207 mM

Table C1 The adsolubilization of phenol in an adsorbed layer of silica modified with Pluronics L64 ($PEO_{13}PPO_{30}PEO_{13}$); HLB 15, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
6.9145	3.6301	0.3284
13.8290	8.0450	0.5784
20.7435	13.7414	0.7002
27.6580	20.0616	0.7596
34.5725	22.7629	1.1810
41.4870	29.5169	1.1970
48.4015	35.6077	1.2794
55.3160	43.6976	1.1618
62.2305	48.7588	1.3472
69.1450	57.1238	1.2021

Table C2 The adsolubilization of phenol in an adsorbed layer of silica modified with Pluronics 10R5 ($PEO_8PPO_{23}PEO_8$); HLB 15, reversed-triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
6.8086	5.9132	0.0895
13.6172	11.9606	0.1657
20.4258	16.3754	0.4050
27.2344	23.3340	0.3900
34.0431	27.4076	0.6635
40.8517	34.4546	0.6397
47.6603	40.9575	0.6703
54.4689	48.3490	0.6120
61.2775	55.8122	0.5465
68.0861	61.9116	0.6175

Table C3 The adsolubilization of phenol in an adsorbed layer of silica modified with Pluronics P123 ($PEO_{19}PPO_{69}PEO_{19}$); HLB 8, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
6.9815	3.6258	0.3356
13.9631	8.9397	0.5023
20.9446	15.3647	0.5580
27.9262	22.1191	0.5807
34.9077	28.6889	0.6219
41.8892	36.2145	0.5675
48.8708	43.0654	0.5805

55.8523	50.2209	0.5631
62.8339	57.0740	0.5760
69.8154	64.1790	0.5636

Table C4 The adsolubilization of phenol in an adsorbed layer of silica modified with Pluronics 25R4 ($PEO_{19}PPO_{33}PEO_{19}$); HLB 8, reversed-triblock copolymers

Initial Concentration (mM)	**Equilibrium concentration (mM)**	**Adsolubilized amount (mmol/g ofsilica)**
0.0000	0.0000	0.0000
6.9696	4.4600	0.2510
13.9392	9.1990	0.4740
20.9087	15.7095	0.5199
27.8783	22.2796	0.5599
34.8479	28.1600	0.6688
41.8175	36.0128	0.5805
48.7871	42.0243	0.6763
55.7566	49.2960	0.6461
62.7262	56.8510	0.5875
69.6958	63.3217	0.6374

The adsolubilization of 2-naphthol in the adsorbed layer of block copolymer surfactants; Pluronics L64, Pluronics 10R5, Pluronics P123, and Pluronics 25R4 at 29°C, are shown in table C5, C5, C7, and C8, respectively.

Weight of silica = 0.2 g

Volume of 2-naphthol- surfactant solution = 20 ml

Aqueous solubility limit of 2-naphthol = 5.1165 mM

Table C5 The adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Pluronics L64 ($PEO_{13}PPO_{30}PEO_{13}$); HLB 15, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.2838	0.2789	0.0005
0.5675	0.5176	0.0050
0.8513	0.5525	0.0299
1.1351	0.8645	0.0271
1.4188	0.8591	0.0560
1.7026	1.1146	0.0588
1.9864	1.1346	0.0852
2.2701	1.2471	0.1023
2.5539	1.4485	0.1105
2.8377	1.7158	0.1122
3.1214	1.7213	0.1400
3.4052	1.7789	0.1626
3.6890	2.1064	0.1583
3.9727	2.2154	0.1757
4.2565	2.5142	0.1742

Table C6 The adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Pluronics 10R5 ($PEO_8PPO_{23}PEO_8$); HLB 15, reversed-triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.2027	0.1649	0.0038
0.4054	0.2967	0.0109
0.6081	0.4830	0.0125
0.8108	0.6083	0.0203
1.0135	0.6824	0.0331
1.2162	0.9476	0.0269
1.4189	1.0504	0.0368
1.6216	1.2169	0.0405
1.8243	1.3636	0.0461
2.0270	1.5380	0.0489
2.2297	1.6423	0.0587
2.4324	1.8413	0.0591
2.6351	1.9985	0.0637
2.8378	2.2154	0.0622
3.0405	2.4212	0.0619

Table C7 The adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Pluronics P123 ($PEO_{19}PPO_{69}PEO_{19}$); HLB 8, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.2023	0.0641	0.0138
0.4045	0.1356	0.0269

0.6068	0.2015	0.0405
0.8090	0.3965	0.0412
1.0113	0.5026	0.0509
1.2135	0.6536	0.0560
1.4158	0.8547	0.0561
1.6180	1.0321	0.0586
1.8203	1.2687	0.0552
2.0225	1.4808	0.0542

Table C8 The adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Pluronics 25R4 ($PEO_{19}PPO_{33}PEO_{19}$); HLB 8, reversed-triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.2458	0.1512	0.0095
0.4917	0.3116	0.0180
0.7375	0.4505	0.0287
0.9833	0.6943	0.0289
1.2292	0.7240	0.0505
1.4750	0.8771	0.0598
1.7208	1.0263	0.0695
1.9666	1.2180	0.0749
2.2125	1.4461	0.0766
2.4583	1.6746	0.0784

The adsolubilization of naphthalene in the adsorbed layer of block copolymer surfactants; Pluronics L64, Pluronics 10R5, Pluronics P123, and Pluronics 25R4 at 29°C, are shown in table C9, C10, C11, and C12, respectively.

Weight of silica = 0.2 g

Volume of naphthalene- surfactant solution = 20 ml

Aqueous solubility limit of naphthalene = 0.234 mM

Table C9 The adsolubilization of naphthalene in an adsorbed layer of silica modified with Pluronics L64 ($PEO_{13}PPO_{30}PEO_{13}$); HLB 15, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.0229	0.0070	0.0016
0.0457	0.0102	0.0036
0.0686	0.0262	0.0042
0.0915	0.0247	0.0067
0.1144	0.0329	0.0081
0.1372	0.0469	0.0090
0.1601	0.0512	0.0109
0.1830	0.0517	0.0131
0.2058	0.0644	0.0141
0.2287	0.0809	0.0148

Table C10 The adsolubilization of naphthalene in an adsorbed layer of silica modified with Pluronics 10R5 ($PEO_8PPO_{23}PEO_8$); HLB 15, reversed-triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.0201	0.0129	0.0007
0.0402	0.0165	0.0024
0.0602	0.0332	0.0027
0.0803	0.0361	0.0044
0.1004	0.0443	0.0056
0.1205	0.0497	0.0071
0.1406	0.0604	0.0080
0.1606	0.0774	0.0083
0.1807	0.1032	0.0078
0.2008	0.1128	0.0088

Table C11 The adsolubilization of naphthalene in an adsorbed layer of silica modified with Pluronics P123 ($PEO_{19}PPO_{69}PEO_{19}$); HLB 8, triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.0227	0.0086	0.0014
0.0454	0.0155	0.0030
0.0681	0.0215	0.0047
0.0908	0.0337	0.0057
0.1135	0.0527	0.0061
0.1362	0.0747	0.0061
0.1589	0.0926	0.0066

0.1816	0.1151	0.0066
0.2043	0.1416	0.0063
0.2270	0.1586	0.0068

Table C12 The adsolubilization of naphthalene in an adsorbed layer of silica modified with Pluronics 25R4 ($PEO_{19}PPO_{33}PEO_{19}$); HLB 8, reversed-triblock copolymers

Initial Concentration (mM)	Equilibrium concentration (mM)	Adsolubilized amount (mmol/g ofsilica)
0.0000	0.0000	0.0000
0.0223	0.0105	0.0012
0.0446	0.0162	0.0028
0.0670	0.0391	0.0028
0.0893	0.0484	0.0041
0.1116	0.0616	0.0050
0.1339	0.0830	0.0051
0.1562	0.1003	0.0056
0.1786	0.1265	0.0052
0.2009	0.1424	0.0058
0.2232	0.1725	0.0051

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