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APPENDICES

Appendix A Critical Micelle Concentration (CMC) Determination of Surfactants

The criticle micelle concentration (CMC) of single surfactants; cationic surfactant, cetyltrimethyl ammonium bromide (CTAB); anionic surfactant, sodium dodecyl sulfate (SDS); nonionic surfactant, polyoxyethylene octyl phenol ether ($OPEO_{10}$ or Triton X-100); triblock copolymer, Pluronic L64 ($PEO_{13}PPO_{30}PEO_{13}$) are shown in table A1, A2, A3,and A4, respectively.

The criticle micelle concentration (CMC) of mixed surfactant system, cationic surfactant-triblock copolymer; cetyltrimethyl ammonium bromide (CTAB)–Pluronic L64, anionic surfactant-triblock copolymer; sodium dodecyl sulfate (SDS)–Pluronic L64, nonionic surfactant-triblock copolymer; polyoxyethylene octyl phenol ether (Triton X-100)–Pluronic L64 are shown in table A5, A6, and A7, respectively.

Table A1 CMC determination of cetyltrimethyl ammonium bromide (CTAB)

Concentration (mM)	Surface tension (mN/m)
0	72.14
0.10	70.12
0.20	68.82
0.30	62.74
0.40	58.46
0.50	51.87
0.60	49.68
0.70	49.02
0.80	46.78
0.83	46.04
0.86	45.98
0.90	45.82
0.92	45.80
0.95	45.79
0.98	45.81
1.00	45.81
1.10	45.80
1.20	45.79
1.60	45.80
1.90	45.80
2.30	45.80
2.80	45.79
3.20	45.80

Table A2 CMC determination of sodium dodecyl sulfate (SDS)

Concentration (mM)	Surface tension (mN/m)
0	72.14
0.10	70.40
0.50	69.45
0.90	68.45
1.20	66.25
1.90	61.53
2.20	59.45
2.50	59.10
2.80	58.70
3.10	57.42
3.40	53.23
3.80	51.41
4.20	50.98
4.60	49.82
4.80	46.68
5.60	44.47
6.70	42.80
7.20	42.68
7.50	41.25
7.80	40.25
8.00	40.25
8.10	40.25
8.20	40.25
8.40	40.25
9.00	40.25
9.60	40.25
10.00	40.25
10.20	40.26
10.50	40.25
10.90	40.25
11.10	40.27
11.40	40.26
11.70	40.25
12.00	40.25

Table A3 CMC determination of polyoxyethylene octyl phenol ether, ($OPEO_{10}$ or Triton X-100)

Concentration (mM)	Surface tension (mN/m)
0	71.14
0.05	68.35
0.10	58.47
0.15	52.21
0.17	49.23
0.20	45.70
0.22	43.07
0.24	38.84
0.26	38.84
0.28	38.84
0.30	38.83
0.34	38.83
0.40	38.84
0.50	38.84
0.70	38.84

Table A4 CMC determination of triblock copolymer; Pluronic L64

Concentration (mM)	Surface tension (mN/m)
0	71.14
0.345	68.32
0.69	54.26
1.03	48.39
1.38	43.52
1.72	40.48
2.07	37.43
2.41	37.44
2.76	37.44
3.10	37.45
3.45	37.44
3.79	37.44
4.14	37.43
4.48	37.42
4.83	37.44
5.17	37.43

Table A5 CMC determination of cetyltrimethyl ammonium bromide (CTAB)–Pluronic L64

Concentration (mM)	Surface tension (mN/m)
0.21	72.14
0.41	67.33
0.62	56.37
0.72	45.04
0.77	44.95
0.83	44.74
0.89	44.74
0.97	44.74
1.03	44.74
1.24	44.74
1.45	44.79
1.66	44.74
1.86	45.01
2.07	44.74
4.14	44.74
6.21	44.74
8.28	44.93
10.34	44.93

Table A6 CMC determination of sodium dodecyl sulfate (SDS)–Pluronic L64

Concentration (mM)	Surface tension (mN/m)
0.21	72.14
0.83	71.39
1.45	69.34
2.07	68.02
3.10	67.59
3.93	64.86
4.34	61.38
4.97	53.19
5.59	51.11
6.00	49.48
6.41	45.01
6.62	43.12
6.83	42.06
7.03	42.06
7.24	42.06
8.28	42.06
10.34	42.07
12.41	42.09

Table A7 CMC determination of polyoxyethylene octyl phenol ether (Triton X-100)– Pluronic L64

Concentration (mM)	**Surface tension (mN/m)**
0.21	72.14
1.03	66.32
1.86	54.09
2.07	42.98
2.28	40.57
2.48	38.12
2.69	38.12
2.90	38.12
3.10	38.12
3.31	38.11
4.14	38.12
6.21	38.12
8.28	38.12
10.34	38.12

Appendix B Adsorption of surfactants onto silica

The adsorption isotherms of single surfactant system cetyltrimethyl ammonium bromide (CTAB) and polyoxyethylene octyl phenol ether, ($OPEO_{10}$ or Triton X-100) at 30°C, are shown in table B1, and B2, respectively.

Weight of silica = 0.15 g

Volume of surfactant solution = 15 ml

Table B1 The adsorption isotherm of cetyltrimethyl ammonium bromide (CTAB) onto silica

Initial concentration (μM)	Equilibrium concentration (μM)	Adsorbed surfactant (μmole/g of silica)
200	37.68	16.232
1000	71.70	92.830
1500	465.18	103.482
2000	917.05	108.295
2500	1374.66	112.534
3000	1832.79	116.721
3500	2306.18	119.382
4000	2779.88	122.012
4500	3265.59	123.441
5000	3759.16	124.084

Table B2 The adsorption isotherm of polyoxyethylene octyl phenol ether, ($OPEO_{10}$ or Triton X-100) onto silica

Initial concentration (μM)	**Equilibrium concentration (μM)**	**Adsorbed surfactant (μmole/g of silica)**
200	157.55	4.245
230	167.09	6.291
280	166.29	11.371
320	175.14	14.486
360	179.17	18.083
400	190.41	20.959
200	145.16	5.484
400	188.84	21.116
440	187.17	25.283
480	206.24	27.376
500	209.20	29.080
550	217.41	33.259
600	242.04	35.796
650	220.39	42.961
700	224.40	47.560
750	222.47	52.753
900	220.71	67.929
1000	231.08	76.892
2000	350.53	164.947
3000	411.24	258.876
4000	1130.13	286.987
5000	2073.31	292.669
6000	3151.09	284.891
7000	3940.66	305.934
8000	4848.74	315.126

Table B2 The adsorption isotherm of polyoxyethylene octyl phenol ether, ($OPEO_{10}$ or Triton X-100) onto silica (Cont.)

Initial concentration (μM)	**Equilibrium concentration (μM)**	**Adsorbed surfactant (μmole/g of silica)**
9000	5807.80	319.220
10000	6899.14	310.086
12000	8927.26	307.274
14000	11535.93	246.407
16000	13275.00	272.500
20000	17838.26	216.175

Appendix C Adsolubilization of organics

The adsolubilization of phenol in the adsorbed layer of CTAB–Pluronic L64, SDS–Pluronic L64, Triton X-100–Pluronic L64, and Pluronics L64 at 30°C, are shown in table C1, C2, C3, and C4, respectively.

Weight of silica = 0.15 g

Volume of phenol-surfactant solution = 15 ml

Aqueous solubility limit of phenol = 71.3207 mM

Table C1 Adsolubilization of phenol in an adsorbed layer of silica modified with CTAB–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized phenol (mmol/g of silica)
3	0.2	0.28
6	0.7	0.58
9	1.4	0.76
15	2.7	1.23
17	3.5	1.35
19	4.1	1.49
22	6.8	1.52
25	4.9	2.01
28	7.2	2.08
30	8.8	2.12
33	11.4	2.16
35	11.9	2.31
40	16.5	2.35
48	18.8	2.92
50	22	2.8
55	26.1	3.05
60	28.8	3.12
65	34.9	3.01
70	42.9	2.71
75	48.9	2.61

Table C2 Adsolubilization of phenol in an adsorbed layer of silica modified with SDS–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized phenol (mmol/g of silica)
3	2.6	0.04
6	4.4	0.16
9	1.4	0.76
17	8.9	0.81
19	8.6	1.04
22	10.2	1.18
25	12.1	1.29
28	14.5	1.35
30	16.1	1.39
33	18.7	1.43
35	19.1	1.59
38	21.6	1.64
40	22.9	1.71
45	26.9	1.81
48	29.5	1.85
55	35.8	1.92
60	40.3	1.97
65	44.6	2.04
70	49.2	2.08

Table C3 Adsolubilization of phenol in an adsorbed layer of silica modified with Triton X-100–Pluronic L64

Initial concentration (mM)	**Equilibrium concentration (mM)**	**The amount of adsolubilized phenol (mmol/g of silica)**
3	2.8	0.02
6	5.66	0.034
9	1.4	0.76
12	11.14	0.086
15	14.07	0.093
28	17.6	1.04
34	22.3	1.17
38	25.64	1.236
42	29.13	1.287
46	32.94	1.306
54	40.24	1.376
60	45.65	1.435
65	47.1	1.79

Table C4 Adsolubilization of phenol in an adsorbed layer of silica modified with Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized phenol (mmol/g of silica)
3	1.7	0.13
6	2.2	0.38
15	2.6	1.24
20	4.7	1.53
25	7.8	1.72
30	11.7	1.83
35	15.5	1.95
40	19.7	2.03
45	23	2.2
50	27.4	2.26
55	31.6	2.34
60	36.2	2.38
65	40.9	2.41
70	46.4	2.36

The adsolubilization of 2-naphthol in the adsorbed layer of CTAB–Pluronic L64, SDS–Pluronic L64, Triton X-100–Pluronic L64, and Pluronics L64 at 30°C, are shown in table C5, C5, C7, and C8, respectively.

Weight of silica = 0.15 g

Volume of 2-naphthol-surfactant solution = 15 ml

Aqueous solubility limit of 2-naphthol = 5.1165 mM

Table C5 Adsolubilization of 2-naphthol in an adsorbed layer of silica modified with CTAB–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized 2-naphthol (mmol/g of silica)
0.02	0.011	0.0013
0.25	0.030	0.0225
0.61	0.180	0.0433
0.84	0.316	0.0519
1.21	0.384	0.0826
1.69	0.600	0.1079
2.01	0.554	0.1460
2.64	0.831	0.1810
2.95	1.001	0.1940
3.17	0.998	0.2170
3.54	1.324	0.2215
3.95	1.493	0.2460
4.12	1.689	0.2430
4.35	1.745	0.2610
4.63	2.084	0.2543
5.23	2.784	0.2450
5.62	3.268	0.2356

Table C6 Adsolubilization of 2-naphthol in an adsorbed layer of silica modified with SDS–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized 2-naphthol (mmol/g of silica)
0.25	0.170	0.009
0.41	0.232	0.018
0.84	0.586	0.025
1.21	0.727	0.048
1.68	1.094	0.058
2.01	1.287	0.073
2.64	1.655	0.099
2.95	1.916	0.103
3.54	2.389	0.115
3.95	2.883	0.107
4.12	2.999	0.112
4.36	3.415	0.094
4.63	3.607	0.102

Table C7 Adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Triton X-100–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized 2-naphthol (mmol/g of silica)
0.02	0.015	0.0008
0.25	0.253	0.0001
0.41	0.373	0.004
0.61	0.491	0.0120
0.84	0.665	0.0170
1.21	1.036	0.0174
1.54	1.327	0.0214
1.68	1.416	0.0262
2.01	1.731	0.0283
2.64	2.080	0.0561
3.17	2.446	0.0723
3.54	2.826	0.0713
3.95	3.227	0.0724
4.22	3.495	0.0721

Table C8 Adsolubilization of 2-naphthol in an adsorbed layer of silica modified with Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized 2-naphthol (mmol/g of silica)
0.02	0.022	0.0002
0.25	0.114	0.014
0.61	0.341	0.027
0.84	0.362	0.047
1.21	0.630	0.058
1.54	0.830	0.071
2.01	0.914	0.110
2.64	1.301	0.134
2.95	1.525	0.142
3.17	1.509	0.166
3.54	1.709	0.183
3.72	1.827	0.189
3.95	2.008	0.195
4.22	2.393	0.182
4.36	2.555	0.180
4.63	2.813	0.181
5.23	3.441	0.179
5.62	3.864	0.176

The adsolubilization of naphthalene in the adsorbed layer of CTAB–Pluronic L64, SDS–Pluronic L64, Triton X-100–Pluronic L64, and Pluronics L64 at 30°C, are shown in table C9, C10, C11, and C12, respectively.

Weight of silica = 0.15 g

Volume of naphthalene- surfactant solution = 15 ml

Aqueous solubility limit of naphthalene = 0.234 mM

Table C9 Adsolubilization of naphthalene in an adsorbed layer of silica modified with CTAB–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized naphthalene (mmol/g of silica)
0.0078	0.003	0.0005
0.0234	0.008	0.0015
0.0468	0.023	0.0023
0.0702	0.026	0.0044
0.0858	0.029	0.0057
0.1170	0.039	0.0078
0.1260	0.0446	0.0081
0.1482	0.053	0.0095
0.1532	0.054	0.0099
0.1638	0.058	0.0106
0.1942	0.071	0.0122
0.2106	0.092	0.0118
0.2305	0.114	0.0116
0.2321	0.120	0.0112
0.2340	0.127	0.0107

Table C10 Adsolubilization of naphthalene in an adsorbed layer of silica modified with SDS–Pluronic L64

Initial concentration (mM)	**Equilibrium concentration (mM)**	**The amount of adsolubilized naphthalene (mmol/g of silica)**
0.0078	0.007	0.00008
0.0234	0.018	0.0005
0.0468	0.039	0.0008
0.0702	0.060	0.0010
0.0858	0.0642	0.0021
0.1170	0.083	0.0034
0.1370	0.077	0.0039
0.1482	0.095	0.0053
0.2110	0.142	0.0069

Table C11 Adsolubilization of naphthalene in an adsorbed layer of silica modified with Triton X-100–Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized naphthalene (mmol/g of silica)
0.0078	0.004	0.0004
0.0234	0.021	0.0002
0.0468	0.033	0.0014
0.0702	0.050	0.0020
0.0858	0.063	0.0022
0.1170	0.091	0.0026
0.1370	0.085	0.0032
0.1482	0.115	0.0034
0.1644	0.133	0.0031
0.2106	0.170	0.0040

Table C12 Adsolubilization of naphthalene in an adsorbed layer of silica modified with Pluronic L64

Initial concentration (mM)	Equilibrium concentration (mM)	The amount of adsolubilized naphthalene (mmol/g of silica)
0.0078	0.000	0.0004
0.0234	0.001	0.0013
0.0468	0.002	0.0024
0.0702	0.037	0.0037
0.0858	0.005	0.0048
0.0101	0.005	0.0052
0.0117	0.007	0.0068
0.1260	0.007	0.0072
0.1482	0.007	0.0077
0.1532	0.008	0.0112
0.1638	0.008	0.0175
0.1942	0.010	0.0153
0.2106	0.010	0.0164
0.2305	0.010	0.0173

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Presentation

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