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APPENDICES

Appendix A Adsorption of Surfactants onto Hydrophobic Silica

The adsorption isotherms of EO/PO triblock copolymer surfactants, which are P123, L64, and 25R4, without linker molecules, with lipophilic linker molecules, and with combined linker molecules (sodium dodecyl benzene sulfonate/dodecanol) onto hydrophobic silica at 29 °C, are shown in table A1, A2, A3, A4, A5, A6, A7, A8, and A9, respectively.

Weight of silica = 0.15 g

Volume of copolymer surfactant solution = 15 ml

Table A1 The adsorption isotherm of P123 without linker molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.0001	0.0099
0.50	0.0003	0.0499
1.00	0.0239	0.0974
1.10	0.0520	0.1047
1.20	0.1770	0.1023
1.25	0.2583	0.0989
1.30	0.3335	0.0963
1.40	0.4604	0.0939
1.50	0.6800	0.0818
1.75	0.9216	0.0826

Table A2 The adsorption isotherm of P123 with lipophilic linker (tetradecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.006667	0.009316
0.50	0.090333	0.040800
1.00	0.154667	0.083883
1.10	0.164333	0.093021
1.20	0.283667	0.091220
1.25	0.302333	0.094348
1.30	0.328667	0.096431
1.40	0.501000	0.089544
1.50	0.629333	0.086743
1.75	0.894000	0.089144

Table A3 The adsorption isotherm of P123 with combined linker (sodium dodecyl benzene sulfonate/dodecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.006667	0.0095
0.50	0.073333	0.0241
1.00	0.095025	0.0575
1.10	0.166133	0.0981
1.20	0.257667	0.0877
1.25	0.320233	0.0965
1.30	0.348667	0.0886
1.40	0.531010	0.0892
1.50	0.615293	0.0846
1.75	0.879000	0.0917

Table A4 The adsorption isotherm of L64 without linker molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.0001	0.0099
0.50	0.0002	0.0499
1.00	0.1590	0.0838
1.25	0.4911	0.0755
1.50	0.5923	0.0905
1.75	1.0102	0.0738
2.00	1.1834	0.0814
2.50	1.6185	0.0879
3.00	2.0386	0.0959
3.50	2.6267	0.0870

Table A5 The adsorption isotherm of L64 with lipophilic linker (tetradecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0	0.009965
0.50	0.063667	0.043492
1.00	0.317667	0.068079
1.25	0.485667	0.076110
1.50	0.581667	0.091616
1.75	0.951000	0.079718
2.00	1.142667	0.085543
2.50	1.714667	0.078446
3.00	2.037333	0.096051
3.50	2.742000	0.075541

Table A6 The adsorption isotherm of L64 with combined linker (sodium dodecyl benzene sulfonate/dodecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0	0.009755
0.50	0.042667	0.047569
1.00	0.263667	0.073208
1.25	0.473267	0.074737
1.50	0.575667	0.096233
1.75	0.973111	0.083544
2.00	1.163356	0.088637
2.50	1.714667	0.083214
3.00	2.123222	0.091051
3.50	2.71233	0.087554

Table A7 The adsorption isotherm of 25R4 without linker molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.0458	0.0054
0.30	0.1213	0.0178
0.50	0.1845	0.0314
0.75	0.4350	0.0314
1.00	0.6754	0.0323
1.25	0.9139	0.0335
1.50	1.0856	0.0412
1.75	1.3843	0.0364

Table A8 The adsorption isotherm of 25R4 with lipophilic linker (tetradecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.063667	0.003617
0.30	0.211333	0.008848
0.50	0.291667	0.020776
0.75	0.383333	0.036579
1.00	0.523333	0.047542
1.25	0.636333	0.061190
1.50	0.863333	0.063552
1.75	1.155000	0.059261
2.00	1.375667	0.06234
2.25	1.604667	0.064376

Table A9 The adsorption isotherm of 25R4 with combined linker (sodium dodecyl benzene sulfonate/dodecanol) molecules onto hydrophobic silica at 29 °C

Initial concentration (mM)	Equilibrium concentration (mM)	Adsorbed surfactant (mmol/g of silica)
0.10	0.051667	0.005221
0.30	0.133333	0.009748
0.50	0.271667	0.017078
0.75	0.416333	0.033369
1.00	0.573333	0.036442
1.25	0.753633	0.047312
1.50	0.893333	0.053552
1.75	1.155667	0.052126
2.00	1.335667	0.058340
2.25	1.437467	0.054694

Appendix B Adsolubilization of Organic Compounds

The adsolubilization of phenol in the adsorbed layer of EO/PO block copolymer surfactants, which are P123, L64, and 25R4 without linker molecules, with lipophilic linker molecules, and with combined linker molecules (sodium dodecyl benzene sulfonate/dodecanol) at 29 °C, are shown in table B1, B2, B3, B4, B5, B6, B7, B8, and B9, respectively.

Weight of silica = 0.15 g

Volume of phenol- surfactant solution = 15 ml

Aqueous solubility limit of phenol = 882.97 mM

Table B1 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics P123 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.0354	1.8695
100	0.0815	1.8005
150	0.1256	3.8876
200	0.1719	4.8086
300	0.2655	6.5410
400	0.3497	9.0933
500	0.4320	11.80320

Table B2 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics P123 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.025485	2.736393
100	0.080494	2.877857
200	0.154389	6.338392
300	0.249933	7.892968
400	0.355050	9.802192
500	0.439013	12.7881100
600	0.514056	14.5456900

Table B3 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronic P123 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.037655	1.667062
100	0.088876	2.141569
200	0.143947	7.255971
300	0.213123	11.1274400
400	0.260296	15.4437600
500	0.314238	21.7129600
600	0.330189	30.5550700

Table B4 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronic L64 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.0426	1.2349
100	0.0818	2.7701
150	0.1382	2.7885
200	0.1803	4.0645
300	0.2759	5.6334
400	0.3625	7.9545
500	0.4441	10.76900

Table B5 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics L64 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.036607	1.760688
100	0.075630	3.304610
200	0.176564	4.388466
300	0.261112	6.907770
400	0.350461	9.007171
500	0.431154	11.8724100
600	0.519898	14.0293700

Table B6 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics L64 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.022293	3.016865
100	0.060348	4.647599
200	0.154566	6.322731
300	0.249022	7.973251
400	0.322229	11.4921700
500	0.401978	14.4517600
600	0.441424	20.9307600

Table B7 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics 25R4 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.0484	0.7217
100	0.0937	1.7205
150	0.1517	1.5979
200	0.1997	2.3658
300	0.2953	3.9099
400	0.3921	5.3578
500	0.4862	7.0484

Table B8 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronics 25R4 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.038856	1.560175
100	0.079209	2.992087
200	0.167301	5.198880
300	0.267279	6.364707
400	0.371737	7.738921
500	0.455604	9.717634
600	0.539680	12.2868400

Table B9 The adsolubilization of phenol in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0	0	0
50	0.021948	3.047192
100	0.067815	3.991790
200	0.142309	7.068098
300	0.249933	7.892968
400	0.341460	9.802192
500	0.420892	12.7881100
600	0.484011	17.1868000

The adsolubilization of 2-naphthol in the adsorbed layer of EO/PO block copolymer surfactants, which are P123, L64, and 25R4 without linker molecules, with lipophilic linker molecules, and with combined linker molecules (sodium dodecyl benzene sulfonate/dodecanol) at 29 °C, are shown in table B10, B11, B12, B13, B14, B15, B16, B17, and B18, respectively.

Weight of silica = 0.15 g

Volume of 2-naphthol- surfactant solution = 15 ml

Aqueous solubility limit of 2-naphthol = 5.1389 mM

Table B10 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic P123 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.0172	0.0411
1.00	0.0270	0.0859
1.50	0.0351	0.1315
2.50	0.0498	0.2233
3.50	0.0648	0.3161
4.50	0.0841	0.4054
5.14	0.0895	0.4516

Table B11 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic P123 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.006412	0.046446
1.00	0.008642	0.095030
1.50	0.011209	0.143505
2.50	0.015851	0.240677
3.50	0.050288	0.322500
4.50	0.077639	0.407828
5.14	0.093241	0.463603

Table B12 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic P123 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.003656	0.047918
1.00	0.005507	0.096633
1.50	0.009264	0.144500
2.50	0.019094	0.239017
3.50	0.030833	0.332453
4.50	0.042524	0.425777
5.14	0.048874	0.486284

Table B13 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic L64 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.0270	0.0360
1.00	0.0497	0.0743
1.50	0.0636	0.1167
2.50	0.0939	0.2007
3.50	0.1240	0.2854
4.50	0.1581	0.3668
5.14	0.1649	0.4132

Table B14 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic L64 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0	0.049713
1.00	0.020642	0.088896
1.50	0.040848	0.128263
2.50	0.082415	0.206446
3.50	0.099224	0.297413
4.50	0.138147	0.376816
5.14	0.158094	0.430444

Table B15 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic L64 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0	0.049724
1.00	0.009846	0.094413
1.50	0.017062	0.140512
2.50	0.030176	0.233349
3.50	0.054147	0.320530
4.50	0.057901	0.417917
5.14	0.062809	0.479161

Table B16 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.0731	0.0124
1.00	0.1149	0.0409
1.50	0.1428	0.0765
2.50	0.2139	0.1398
3.50	0.2647	0.2131
4.50	0.3166	0.2864
5.14	0.3453	0.3221

Table B17 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.037370	0.030608
1.00	0.058270	0.069647
1.50	0.070512	0.113103
2.50	0.125543	0.184405
3.50	0.167441	0.262826
4.50	0.222829	0.334057
5.14	0.252372	0.382677

Table B18 The adsolubilization of 2-naphthol in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.00	0	0
0.50	0.006718	0.046290
1.00	0.044082	0.076914
1.50	0.043611	0.126936
2.50	0.068029	0.213988
3.50	0.103065	0.295514
4.50	0.129406	0.381367
5.14	0.163431	0.427716

The adsolubilization of naphthalene in the adsorbed layer of EO/PO block copolymer surfactants, which are P123, L64, and 25R4 without linker molecules, with lipophilic linker molecules, and with combined linker molecules (sodium dodecyl benzene sulfonate/dodecanol) at 29 °C, are shown in table B19, B20, B21, B22, B23, B24, B25, B26, and B27, respectively.

Weight of silica = 0.15 g

Volume of naphthalene- surfactant solution = 15 ml

Aqueous solubility limit of naphthalene = 0.2344 mM

Table B19 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic P123 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.10290	0.00760
0.1500	0.14160	0.01170
0.2500	0.24427	0.01923
0.3500	0.32765	0.02725
0.4500	0.39075	0.03575
0.5500	0.46005	0.04410
0.6700	0.57383	0.05339

Table B20 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic P123 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.013644	0.009674
0.1500	0.031651	0.014255
0.2500	0.047959	0.023844
0.3500	0.134507	0.031825
0.4500	0.227202	0.039774
0.5500	0.277060	0.048573
0.6700	0.363011	0.058721

Table B21 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic P123 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.058310	0.042325
0.1500	0.086901	0.057167
0.2500	0.146370	0.073715
0.3500	0.232112	0.086457
0.4500	0.308832	0.115207
0.5500	0.368428	0.117847
0.6700	0.465079	0.155885

Table B22 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic L64 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.07080	0.00830
0.1500	0.10560	0.01250
0.2500	0.19220	0.02040
0.3500	0.28160	0.02830
0.4500	0.38445	0.03585
0.5500	0.48295	0.04350
0.6700	0.61772	0.05241

Table B23 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic L64 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.022277	0.009471
0.1500	0.040118	0.014057
0.2500	0.135364	0.021879
0.3500	0.196677	0.030484
0.4500	0.291107	0.038335
0.5500	0.380242	0.046361
0.6700	0.507392	0.055419

Table B24 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic L64 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.1000	0.046640	0.041799
0.1500	0.073300	0.056513
0.2500	0.163780	0.068470
0.3500	0.239130	0.075325
0.4500	0.337780	0.104205
0.5500	0.431596	0.117963
0.6700	0.562556	0.143035

Table B25 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 without linker molecules at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.0500	0.0422	0.0040
0.1000	0.1066	0.0075
0.1500	0.1342	0.0118
0.2000	0.1766	0.0158
0.2500	0.1972	0.0203
0.3000	0.2237	0.0246
0.3400	0.2547	0.0280

Table B26 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 with lipophilic linker molecules (tetradecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.0500	0.013292	0.004684
0.1000	0.031079	0.009265
0.1500	0.040134	0.014075
0.2000	0.067308	0.018435
0.2500	0.085086	0.023063
0.3000	0.111907	0.027409
0.3400	0.136415	0.030877

Table B27 The adsolubilization of naphthalene in an adsorbed layer of hydrophobic silica modified with Pluronic 25R4 with combined linker molecules (sodium dodecyl benzene sulfonate /dodecanol) at 29 °C

Initial concentration (mM)	Reduced bulk concentration	Adsolubilized amount (mmol/g of silica)
0.0000	0	0
0.0500	0.027745	0.025000
0.1000	0.068839	0.045062
0.1500	0.087167	0.064170
0.2000	0.121954	0.074900
0.2500	0.141143	0.084243
0.3000	0.167800	0.094458
0.3400	0.195557	0.097255

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Proceedings:

Banjai, P., Malakul, P., Nithitanakul, M., and O'Haver, J. (2012, April 24)
Impact of Linker Molecules on Adsolubilization of Organic Compounds by
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Proceedings of the 18th PPC Symposium on Petroleum. Petrochemicals,
and Polymers. Bangkok, Thailand.

Presentations:

1. Banjai, P., Malakul, P., Nithitanakul, M., and O'Haver, J. (2012, April 24)
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