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APPENDICES

Appendix A : Figures

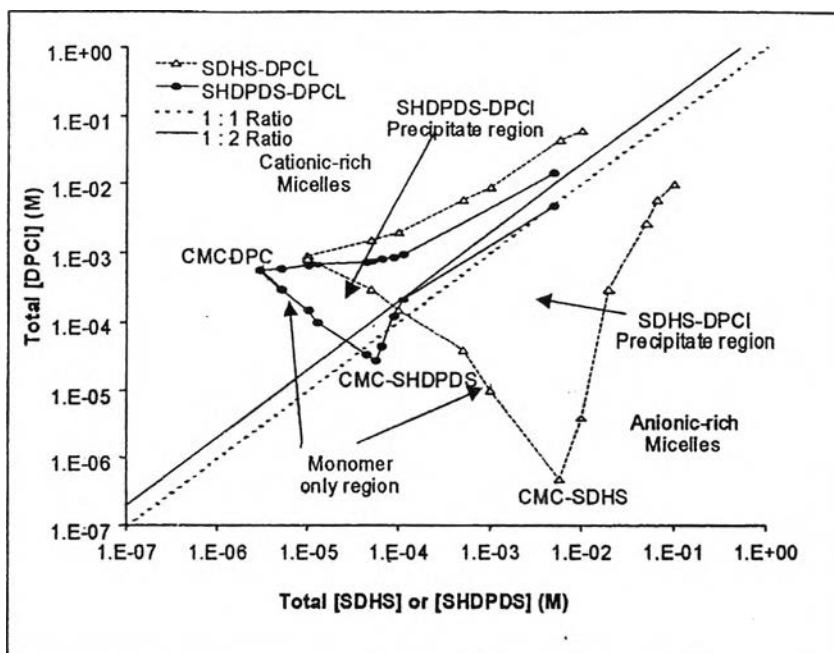


Figure 1.1 Precipitation diagram of mixed anionic and cationic surfactants for SHDPDS and DPC system (Doan et al., 2002)

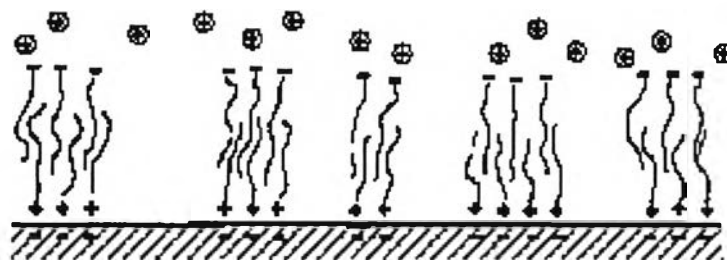


Figure 1.2 Schematic representation of the mixed anionic and cationic surfactant bilayer at the laponite-water interface (Capovilla et al., 1996)

Appendix B : Equations

1.1 Adsorption isotherm

Equation 2.1 was used to calculate the adsorption of the surfactant on the mineral oxide surface. In this equation, adsorption of water or salt is negligible and the adsorption of surfactant has no effect on the solution density (Lopata, 1988).

$$\Gamma_i = \frac{(C_{i,b} - C_{i,a})V}{W_g} \quad (2.1)$$

where;

- Γ_i = Adsorption of surfactant i (mole/g)
- V = Volume of sample (liter)
- $C_{i,b}$ = Concentration of surfactant at initial (mole/liter)
- $C_{i,a}$ = Concentration of surfactant at equilibrium (mole/liter)
- W_g = Weight of aluminum oxide (g)

1.2 Molecule per area

$$q = \frac{1g}{Am^2} \times \frac{(6.023 \times 10^{23} \text{ molecules})}{\text{mole}} \times \frac{1m^2}{10^{18} nm^2}$$

A = Surface area of alumina (133g/m³)

1.3 Micellar partition coefficient

$$K_{mic} = \frac{X_{mic}}{X_{aq}} \quad (4.1)$$

where;

X_{mic} is the mole fraction of the organic solute in the micelle pseudo-phase.

X_{aq} is the mole fraction of the organic solute in the aqueous phase. They are calculated

as

$$X_{mic} = \frac{C_0 - C_{eq}}{(C_0 - C_{eq}) + (S_0 - S_{eq})} \quad (4.2)$$

$$X_{aq} = \frac{C_{eq}}{C_{eq} + 55.55} \quad (4.3)$$

where;

C_0 is the concentration of organic solute at initial

C_{eq} is the concentration of organic solute at equilibrium

S_0 is the concentration of surfactant at initial

S_{eq} is the concentration of organic solute at equilibrium

55.55 represent 1 molar of water

The partitioning of organic solute is described by the molar solubilization ratio (MSR) which is the slope of the solubilization isotherm beyond the CMC value. MSR indicates the mole of organic solute per mole of micellar surfactant. The mole fraction of the organic solute in micelle is related to MSR by simple relation (Rouse et al., 1995).

$$X_{mic} = \frac{MSR}{(1 + MSR)} \quad (4.4)$$

$$K_{mic} = \frac{MSR/(1 + MSR)}{C_{eq}/(C_{eq} + 55.55)} \quad (4.5)$$

1.4 Admicellar partition coefficient

Admicellar partition coefficient (K_{adm}) is defined analogous to micellar partition coefficient (Nayyar et al., 1994).

$$K_{adm} = \frac{X_{adm}}{X_{aq}} \quad (4.6)$$

where X_{adm} is the molar fraction of organic solute in the admicelle phase

X_{aq} is the molar fraction of organic solute in the aqueous phase

For this study, they are calculated as:

$$X_{adm} = \frac{(C_{i,sty} - C_{f,sty})}{(C_{i,sty} - C_{f,sty}) + (S_{i,AIS} + S_{f,AIS}) + (S_{i,CIS} + S_{f,CIS})} \quad (4.7)$$

where

- X_{adm} = Molar fraction of organic solute in admicelle
- $C_{i,sty}$ = Initial concentration of organic solute (M)
- $C_{f,sty}$ = Final concentration of organic solute (M)
- $S_{i,AIS}$ = Initial concentration of anionic surfactant, (M)
- $S_{f,AIS}$ = Final concentration of anionic surfactant, (M)
- $S_{i,CIS}$ = Initial concentration of cationic surfactant, (M)
- $S_{f,CIS}$ = Final concentration of cationic surfactant, (M)

Table C.1 SHDPDS (or DF) adsorption onto alumina in single surfactant system, initial [DF] $10^{-5} - 10^{-1}$ M at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5, and temperature of $20 \pm 2^\circ\text{C}$

Tube-DF	g Alumina	DF ini	DF equi	DF equi m	DF equi μ	pH equi	DF ads	DF ads m	DF ads μ	DF Ads [q]
1-1	0.0060	1.00E-04	2.23E-05	2.23E-02	2.23E+01	6.72	1.19E-04	1.19E-01	118.89	0.54
1-2	0.0085	1.00E-04	7.97E-06	7.97E-03	7.97E+00	6.84	1.01E-04	1.01E-01	100.78	0.46
1-3+	0.0416	1.00E-03	4.98E-04	4.98E-01	4.98E+02	6.75	2.35E-04	2.35E-01	235.25	1.07
1-4	0.0911	1.00E-03	9.11E-05	9.11E-02	9.11E+01	7.10	1.52E-04	1.52E-01	151.96	0.69
1-5+	0.3040	1.00E-02	7.14E-03	7.14E+00	7.14E+03	7.10	2.32E-04	2.32E-01	231.89	1.05
1-6	0.5013	1.00E-02	2.54E-03	2.54E+00	2.54E+03	7.30	2.32E-04	2.32E-01	232.39	1.05
1-7	2.0045	1.00E-01	7.61E-02	7.61E+01	7.61E+04	7.35	2.46E-04	2.46E-01	245.62	1.11
1-8	3.5086	1.00E-01	3.70E-02	3.70E+01	3.70E+04	7.42	2.52E-04	2.52E-01	251.95	1.14
						av plateau	<u>2.40E-04</u>	<u>2.40E-01</u>	<u>240.46</u>	<u>1.09</u>

Table C.2 DPC adsorption onto alumina in single surfactant system, initial [DPC] = $10^{-5} - 10^{-1}$ M at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5, and temperature of $20 \pm 2^\circ\text{C}$

Tube-DPC	g Alumina	DPC ini	DPC equi	DPC equi m	DPC equi μ	pH equi	DPC ads	DPC ads m	DPC ads μ	DPC Ads [q]
1-1	0.0062	1.00E-05	8.26E-06	8.26E-03	8.26E+00	6.50	2.81E-06	2.81E-03	2.81E+00	0.01
1-2	0.0103	3.00E-05	2.68E-05	2.68E-02	2.68E+01	6.80	3.11E-06	3.11E-03	3.11E+00	0.01
1-3	0.0423	1.00E-04	8.23E-05	8.23E-02	8.23E+01	6.90	4.41E-06	4.41E-03	4.41E+00	0.02
1-4	0.0945	3.00E-04	2.14E-04	2.14E-01	2.14E+02	7.10	9.53E-06	9.53E-03	9.53E+00	0.04
1-5	0.3081	1.00E-03	7.07E-04	7.07E-01	7.07E+02	7.10	9.75E-06	9.75E-03	9.75E+00	0.04
1-6	0.5021	3.00E-03	2.12E-03	2.12E+00	2.12E+03	7.20	1.75E-05	1.75E-02	1.75E+01	0.08
1-7	2.0065	3.00E-02	2.32E-02	2.32E+01	2.32E+04	7.40	3.38E-05	3.38E-02	3.38E+01	0.15
1-8	3.5067	1.00E-01	8.96E-02	8.96E+01	8.96E+04	7.40	2.97E-05	2.97E-02	2.97E+01	0.13
						av plateau	<u>3.17E-05</u>	<u>3.17E-02</u>	<u>22.69</u>	<u>0.10</u>

Table C.3 Adsorption of mixed surfactant system 3:1 SHDPDS(or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5, and temperature of 20±2°C

Tube 3:1	g Alumina	DF ini	DPC ini	DF equi	DPC equi	T. equi	pH equi	DF ads	DPC ads	T. ads	DF Ads [q]	DPC ads [q]	T. Ads [q]
2-1	0.0062	1.00E-04	3.33E-05	2.08E-05	0	2.08E-05	6.60	1.24E-04	5.38E-05	1.78E-04	0.56	0.24	0.80
2-2	0.0085	1.00E-04	3.33E-05	9.68E-06	0	9.68E-06	6.80	1.03E-04	3.92E-05	1.43E-04	0.47	0.18	0.65
2-3	0.0417	1.00E-03	3.33E-04	5.55E-04	4.09E-05	5.96E-04	6.90	2.16E-04	7.41E-05	2.90E-04	0.98	0.33	1.31
2-4	0.0923	1.00E-03	3.33E-04	9.37E-05	5.73E-06	9.94E-05	7.15	1.47E-04	6.35E-05	2.11E-04	0.67	0.16	0.83
2-5	0.3029	1.00E-02	3.33E-03	7.45E-03	1.09E-03	8.54E-03	7.15	2.22E-04	7.41E-05	2.97E-04	1.01	0.34	1.34
2-6	0.5012	1.00E-02	3.33E-03	3.02E-03	1.53E-04	3.17E-03	7.50	2.23E-04	6.35E-05	2.86E-04	1.01	0.29	1.30
2-7	2.0024	1.00E-01	3.33E-02	8.50E-02	1.42E-02	9.92E-02	7.10	2.24E-04	9.56E-05	3.20E-04	1.02	0.43	1.45
2-8	3.5045	1.00E-01	3.33E-02	4.61E-02	7.11E-03	5.32E-02	7.25	2.39E-04	7.48E-05	3.14E-04	1.08	0.34	1.42
							av.plateau	<u>2.25E-04</u>	<u>7.64E-05</u>	<u>3.01E-04</u>	<u>1.02</u>	<u>0.34</u>	<u>1.36</u>

Table C.4 Adsorption of mixed surfactant system 10:1 SHDPDS (or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5, and temperature of 20±2°C

Tube 10:1	g Alumina	DF ini	DPC ini	DF equi	DPC equi	T. equi	pH equi	DF ads	DPC ads	T. ads	DF Ads [q]	DPC ads [q]	T. Ads [q]
3-1	0.0065	1.00E-04	1.00E-05	2.00E-05	5.65E-06	2.57E-05	6.95	1.21E-04	6.70E-06	1.28E-04	0.55	0.03	0.58
3-2	0.0086	1.00E-04	1.00E-05	8.92E-06	0	8.92E-06	7.10	1.04E-04	1.16E-05	1.16E-04	0.47	0.05	0.52
3-3	0.0420	1.00E-03	1.00E-04	4.31E-04	3.46E-05	4.65E-04	7.05	2.42E-04	1.56E-05	2.58E-04	1.10	0.07	1.17
3-4	0.0912	1.00E-03	1.00E-04	6.79E-05	1.81E-05	8.61E-05	6.80	1.51E-04	8.98E-06	1.60E-04	0.68	0.04	0.72
3-5	0.3035	1.00E-02	1.00E-03	7.36E-03	2.49E-04	7.61E-03	7.20	2.57E-04	2.48E-05	2.81E-04	1.16	0.11	1.27
3-6	0.5056	1.00E-02	1.00E-03	3.12E-03	1.05E-04	3.23E-03	7.10	2.38E-04	1.77E-05	2.56E-04	1.08	0.08	1.16
3-7	2.0024	1.00E-01	1.00E-02	8.71E-02	4.08E-03	9.12E-02	7.10	2.61E-04	2.96E-05	2.90E-04	1.18	0.13	1.31
3-8	3.5056	1.00E-01	1.00E-02	4.01E-02	1.80E-03	4.19E-02	7.25	2.83E-04	2.34E-05	3.07E-04	1.28	0.11	1.39
							av.plateau	<u>2.56E-04</u>	<u>2.22E-05</u>	<u>2.78E-04</u>	<u>1.16</u>	<u>0.10</u>	<u>1.26</u>

Table C.5 Adsorption of mixed surfactant system 30:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5, and temperature of 20±2°C

Tube 30:1	g Alumina	DF ini	DPC ini	DF equi	DPC equi	T. equi	pH equi	DF ads	DPC ads	T. ads	DF Ads [q]	DPC ads [q]	T. Ads [q]
4-1	0.0062	1.00E-04	3.33E-06	2.19E-05	0	2.19E-05	6.71	1.20E-04	5.38E-06	1.25E-04	0.54	0.02	0.57
4-2	0.0081	1.00E-04	3.33E-06	9.30E-06	0	9.30E-06	7.05	1.07E-04	3.24E-06	1.10E-04	0.48	0.01	0.50
4-3	0.0413	1.00E-03	3.33E-05	4.61E-04	1.76E-05	4.78E-04	7.15	2.29E-04	3.82E-06	2.33E-04	1.04	0.02	1.06
4-4	0.0934	1.00E-03	3.33E-05	9.37E-05	1.46E-05	1.08E-04	6.90	1.41E-04	2.06E-06	1.43E-04	0.64	0.01	0.65
4-5	0.3032	1.00E-02	3.33E-04	8.38E-03	5.25E-05	8.44E-03	7.20	2.42E-04	9.29E-06	2.51E-04	1.10	0.04	1.14
4-6	0.5012	1.00E-02	3.33E-04	2.41E-03	2.74E-05	2.44E-03	7.10	2.66E-04	6.10E-06	2.72E-04	1.20	0.03	1.23
4-7	2.0150	1.00E-01	3.33E-03	8.70E-02	1.20E-03	8.82E-02	7.15	2.39E-04	1.06E-05	2.50E-04	1.08	0.05	1.13
4-8	3.5032	1.00E-01	3.33E-03	4.90E-02	6.03E-04	4.96E-02	7.20	2.46E-04	7.78E-06	2.54E-04	1.11	0.04	1.15
							<u>av.plateau</u>	<u>2.44E-04</u>	<u>7.52E-06</u>	<u>2.52E-04</u>	<u>1.11</u>	<u>0.03</u>	<u>1.14</u>

Table C.6 Styrene solubilization in SHDPDS (or DF) alone at electrolyte concentration of 0.015 M NaCl

Tube	DF	Response			Styrene	Styrene
DF	M	1	2	average	ppm	M
1-1	1.00E-05	439453	425779	432616	366.00	3.18E-03
1-2	1.00E-05	421131	445121	433126	366.43	3.19E-03
1-3	3.00E-05	461953	439901	450927	381.49	3.32E-03
1-4	1.00E-04	430812	480456	455634	385.48	3.35E-03
1-5	1.00E-04	410812	420456	415634	351.64	3.06E-03
1-6	3.00E-04	499424	455464	477444	403.93	3.51E-03
1-7	5.00E-04	449955	489845	469900	397.55	3.46E-03
1-8	1.00E-03	493292	559297	526295	445.26	3.87E-03
1-9	1.00E-03	565622	584505	575064	486.52	4.23E-03
1-10	1.50E-03	619980	621841	620911	525.30	4.57E-03
1-11	3.00E-03	747409	701185	724297	612.77	5.33E-03
1-12	5.00E-03	1426981	1325411	1376196	1164.29	1.01E-02
1-13	1.00E-02	1689994	1752455	1721225	1456.20	1.27E-02
1-14	1.00E-02	1971888	1955399	1963644	1661.29	1.44E-02
1-15	1.50E-02	2191801	2075282	2133542	1805.03	1.57E-02
1-16	3.00E-02	4648630	4648630	4648630	3932.85	3.42E-02
1-17	1.00E-01	1298925	1367546	13332355	11279.49	9.81E-02
1-18	1.00E-01	1235635	1237189	12364120	10460.34	9.10E-02

Table C.7 Styrene solubilization in DPC alone at electrolyte concentration of electrolyte concentration of 0.015 M NaCl

Tube	DPC	Response			Styrene	Styrene
DPC	M	1	2	average	ppm	M
5-1	1.00E-05	431174	426286	428730	430.61	3.75E-03
5-2	1.00E-05	432174	396286	414230	416.04	3.62E-03
5-3	3.00E-05	375068	360711	367890	369.50	3.21E-03
5-4	1.00E-04	358531	343070	350801	352.34	3.06E-03
5-5	1.00E-04	345121	331214	338168	339.65	2.95E-03
5-6	3.00E-04	387741	327403	357572	359.14	3.12E-03
5-7	1.00E-03	369208	325610	347409	348.93	3.04E-03
5-8	1.00E-03	345121	335411	340266	341.76	2.97E-03
5-9	3.00E-03	325756	312900	319328	320.73	2.79E-03
5-10	1.00E-02	487196	496158	491677	493.83	4.30E-03
5-11	1.00E-02	496521	488212	492367	494.52	4.30E-03
5-12	3.00E-02	905174	996521	950848	955.01	8.31E-03
5-13	1.00E-01	2905174	2996521	2950848	2963.77	2.58E-02
5-14	1.00E-01	3050174	2823221	2936698	2949.56	2.57E-02

Table C.8 Styrene solubilization in 3:1 SHDPDS(or DF):DPC molar ratio, at electrolyte concentration of 0.015 M NaCl

Tube 3:1	DF M	DPC M	Response			Styrene ppm	Styrene M
			1	2	average		
2-1	1.00E-05	3.33E-06	438701	433007	435854	368.74	3.21E-03
2-2	1.00E-05	3.33E-06	421523	401531	411527	348.16	3.03E-03
2-3	3.00E-05	1.00E-05	490947	456621	473784	400.83	3.49E-03
2-4	1.00E-04	3.33E-05	498939	417599	458269	387.71	3.37E-03
2-5	1.00E-04	3.33E-05	456219	423329	439774	372.06	3.24E-03
2-6	3.00E-04	1.00E-04	435868	494603	465236	393.60	3.42E-03
2-7	1.00E-03	3.33E-04	543536	520794	532165	450.22	3.92E-03
2-8	1.00E-03	3.33E-04	541446	592316	566881	479.59	4.17E-03
2-9	1.50E-03	5.00E-04	928020	740087	834054	705.63	6.14E-03
2-10	3.00E-03	1.00E-03	894546	922146	908346	768.48	6.68E-03
2-11	5.00E-03	1.67E-03	1104046	1104651	1104349	934.30	8.13E-03
2-12	1.00E-02	3.33E-03	2198587	2239741	2219164	1877.47	1.63E-02
2-13	1.00E-02	3.33E-03	2147470	2149346	2148408	1817.60	1.58E-02
2-14	1.50E-02	5.00E-03	-	-	-	-	-
2-15	3.00E-02	1.00E-02	4417868	4628432	4523150	3826.69	3.33E-02
2-16	5.00E-02	1.67E-02	-	-	-	-	-
2-17	1.00E-01	3.33E-02	219946	221382	22066400	18668.70	1.62E-01
2-18	1.00E-01	3.33E-02	239946	201382	22066400	18668.70	1.62E-01

Table C.9 Styrene solubilization in 10:1 SHDPDS(or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl

Tube 10:1	DF M	DPC M	Response			Styrene ppm	Styrene M
			1	2	average		
3-1	1.00E-05	1.00E-06	418493	423457	420975	356.15	3.10E-03
3-2	1.00E-05	1.00E-06	423193	431000	427097	361.33	3.14E-03
3-3	3.00E-05	3.00E-06	436312	482364	459338	388.61	3.38E-03
3-4	1.00E-04	1.00E-05	424498	480172	452335	382.69	3.33E-03
3-5	1.00E-04	1.00E-05	423513	445212	434363	367.48	3.20E-03
3-6	3.00E-04	3.00E-05	460977	426621	443799	375.46	3.27E-03
3-7	1.00E-03	1.00E-04	574516	518210	546363	462.24	4.02E-03
3-8	5.00E-04	5.00E-05	505130	472201	488666	413.42	3.60E-03
3-9	1.00E-03	1.00E-04	522356	536223	529290	447.79	3.89E-03
3-10	1.50E-03	1.50E-04	670940	699821	685381	579.85	5.04E-03
3-11	3.00E-03	3.00E-04	937103	932259	934681	790.76	6.88E-03
3-12	5.00E-03	5.00E-04	1692072	1714121	1703097	1440.86	1.25E-02
3-13	1.00E-02	1.00E-03	1876355	1851513	1863934	1576.93	1.37E-02
3-14	1.00E-02	1.00E-03	1874491	1879464	1876978	1587.97	1.38E-02
3-15	1.50E-02	1.50E-03	4035802	4135212	4085507	3456.44	3.01E-02
3-16	3.00E-02	3.00E-03	5502515	5399808	5451162	4611.81	4.01E-02
3-17	1.00E-01	1.00E-02	223956	212392	21817400	18458.04	1.61E-01
3-18	1.00E-01	1.00E-02	203956	202355	20315550	17187.44	1.49E-01

Table C.10 Styrene solubilization in 30:1 SHDPDS(or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl

Tube 30:1	DF M	DPC M	Response			Styrene ppm	Styrene M
			1	2	average		
4-1	1.00E-05	3.33E-07	458416	458738	458577	387.97	3.37E-03
4-2	1.00E-05	3.33E-07	461246	437841	449544	380.32	3.31E-03
4-3	3.00E-05	1.00E-06	436312	482364	459338	388.61	3.38E-03
4-4	1.00E-04	3.33E-06	424498	480172	452335	382.69	3.33E-03
4-5	1.00E-04	3.33E-06	432531	442142	437337	370.00	3.22E-03
4-6	3.00E-04	1.00E-05	421541	424376	422959	357.83	3.11E-03
4-7	5.00E-04	1.67E-05	515666	54698	285182	241.27	2.10E-03
4-8	1.00E-03	3.33E-05	556857	549977	553417	468.20	4.07E-03
4-9	1.00E-03	3.33E-05	510235	521215	515725	436.32	3.80E-03
4-10	1.50E-03	5.00E-05	638771	643843	641307	542.56	4.72E-03
4-11	3.00E-03	1.00E-04	892308	884564	888436	751.64	6.54E-03
4-12	5.00E-03	1.67E-04	1980881	187688	1084284	917.33	7.98E-03
4-13	1.00E-02	3.33E-04	1856027	1857410	1856719	1570.83	1.37E-02
4-14	1.00E-02	3.33E-04	2021304	1956243	1988774	1682.55	1.46E-02
4-15	1.50E-02	5.00E-04	-	-	-	-	-
4-16	3.00E-02	1.00E-03	5087721	5023226	5055474	4277.05	3.72E-02
4-17	1.00E-01	3.33E-03	1902180	1942387	19222835	16262.97	1.41E-01
4-18	1.00E-01	3.33E-03	1932180	2046258	19892190	16829.26	1.46E-01

Table C.11 Ethylcyclohexane solubilization by SHDPDS (or DF) alone at electrolyte concentration of 0.015 M NaCl

Tube DF	DF M	Response Ethyl.			Ethyl. ppm	Ethyl. M
		1	2	average		
1-1	1.00E-05	23879	23879	23879	237.67	1.53E-03
1-2	3.00E-05	21466	22700	22083	219.80	1.42E-03
1-3	1.00E-04	25263	23766	24515	244.00	1.57E-03
1-4	3.00E-04	28338	28298	28318	281.86	1.82E-03
1-5	1.00E-03	53885	49438	51662	514.20	3.32E-03
1-6	3.00E-03	84615	84478	84547	841.51	5.43E-03
1-7	1.00E-02	297613	300991	299302	2979.02	1.92E-02
1-8	3.00E-02	95037	99319	971780	9672.34	6.24E-02
1-9	1.00E-01	323939	362892	3434155	34180.90	2.21E-01

Table C.12 Ethylcyclohexane solubilization by DPC alone at electrolyte concentration of 0.015 M NaCl

Tube DPC	DPC M	Response Ethyl.			Ethyl. ppm	Ethyl. M
		1	2	average		
5-1	1.00E-05	12390	12405	12398	126.93	8.19E-04
5-2	3.00E-05	11615	11405	11510	117.85	7.60E-04
5-3	1.00E-04	17380	15595	16488	168.81	1.09E-03
5-4	3.00E-04	17767	23492	20630	211.22	1.36E-03
5-5	1.00E-03	17235	16921	17078	174.85	1.13E-03
5-6	3.00E-03	18235	18823	18529	189.71	1.22E-03
5-7	1.00E-02	46494	23885	35190	360.29	2.32E-03
5-8	3.00E-02	64093	68231	66162	677.40	4.37E-03
5-9	1.00E-01	123450	132154	127802	1308.51	8.44E-03

Table C.13 Ethylcyclohexane solubilization by 3:1 SHDPDS (or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl

Tube 3:1	DF M	DPC M	Response Ethyl.			Ethyl. ppm	Ethyl. M
			1	2	average		
2-1	1.00E-05	3.33E-06	15929	15892	15911	158.39	1.02E-03
2-2	3.00E-05	1.00E-05	21700	23214	22457	223.56	1.44E-03
2-3	1.00E-04	3.33E-05	36319	33270	34795	346.39	2.24E-03
2-4	3.00E-04	1.00E-04	29324	28651	28988	288.58	1.86E-03
2-5	1.00E-03	3.33E-04	36912	35538	36225	360.63	2.33E-03
2-6	3.00E-03	1.00E-03	100664	133361	117013	1164.88	7.52E-03
2-7	1.00E-02	3.33E-03	329408	323101	326255	3247.93	2.10E-02
2-8	3.00E-02	1.00E-02	133862	132121	1329915	13239.57	8.54E-02
2-9	1.00E-01	3.33E-02	451310	453511	4524105	45038.38	2.91E-01

Table C.14 Ethylcyclohexane solubilization by 10:1 SHDPDS (or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl

Tube 10:1	DF M	DPC M	Response Ethyl.			Ethyl. ppm	Ethyl. M
			1	2	average		
3-1	1.00E-05	1.00E-06	16080	17541	16811	167.32	1.08E-03
3-2	3.00E-05	3.00E-06	21990	23210	22600	224.94	1.45E-03
3-3	1.00E-04	1.00E-05	23214	22123	22669	225.62	1.46E-03
3-4	3.00E-04	3.00E-05	25343	26451	25897	257.76	1.66E-03
3-5	1.00E-03	1.00E-04	51303	51021	51162	509.23	3.29E-03
3-6	3.00E-03	3.00E-04	91267	87421	89344	889.26	5.74E-03
3-7	1.00E-02	1.00E-03	292143	304975	298559	2971.62	1.92E-02
3-8	3.00E-02	3.00E-03	104950	126032	1154910	11495.07	7.42E-02
3-9	1.00E-01	1.00E-02	402649	391411	3970300	39517.27	2.55E-01

Table C.15 Ethylcyclohexane solubilization by 30:1 SHDPDS (or DF):DPC molar ratio at electrolyte concentration of 0.015 M NaCl

Tube 30:1	DF M	DPC M	Response Ethyl.			Ethyl. ppm	Ethyl. M
			1	2	average		
4-1	1.00E-05	1.00E-06	15367	16035	15701	156.28	1.01E-03
4-2	3.00E-05	3.00E-06	16234	17747	16991	169.11	1.09E-03
4-3	1.00E-04	1.00E-05	20376	21794	21085	209.86	1.35E-03
4-4	3.00E-04	3.00E-05	21069	21888	21479	213.78	1.38E-03
4-5	1.00E-03	1.00E-04	38325	42355	40340	401.51	2.59E-03
4-6	3.00E-03	3.00E-04	96312	103320	99816	993.49	6.41E-03
4-7	1.00E-02	1.00E-03	366078	369037	367558	3658.38	2.36E-02
4-8	3.00E-02	3.00E-03	103950	91902	979260	9746.79	6.29E-02
4-9	1.00E-01	1.00E-02	382632	373606	3781190	37635.02	2.43E-01

Table C.16 Adsolubilization of styrene onto alumina by SHDPDS at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample SHDPDS	SHDPDS (M)			DPC (M)			Styrene (M)				pH _{eq}	X _{ads}	Adsolu. mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	5.21E-04	4.79E-04	0	0	0	2.17E-04	1.04E-04	1.14E-04	0.19	7.20	0.19	2.53E-04	1.03
2	1.00E-03	5.67E-04	4.33E-04	0	0	0	4.35E-04	2.57E-04	1.78E-04	0.46	6.90	0.29	3.95E-04	0.63
3	1.00E-03	5.67E-04	4.33E-04	0	0	0	6.52E-04	4.21E-04	2.31E-04	0.76	7.20	0.35	5.13E-04	0.46
4	1.00E-03	5.80E-04	4.20E-04	0	0	0	9.23E-04	5.83E-04	3.39E-04	1.05	7.15	0.45	7.54E-04	0.43
5	1.00E-03	5.67E-04	4.33E-04	0	0	0	1.30E-03	7.07E-04	5.98E-04	1.27	7.20	0.58	1.33E-03	0.46
6	1.00E-03	5.09E-04	4.91E-04	0	0	0	1.74E-03	7.78E-04	9.61E-04	1.40	7.15	0.66	2.14E-03	0.47
7	1.00E-03	5.67E-04	4.33E-04	0	0	0	2.17E-03	1.05E-03	1.12E-03	1.90	7.20	0.72	2.49E-03	0.38
8	1.00E-03	5.67E-04	4.33E-04	0	0	0	2.61E-03	1.25E-03	1.36E-03	2.25	7.25	0.76	3.03E-03	0.34
9	1.00E-03	5.67E-04	4.33E-04	0	0	0	3.04E-03	1.56E-03	1.48E-03	2.81	7.20	0.77	3.29E-03	0.28
10	1.00E-03	5.67E-04	4.33E-04	0	0	0	3.48E-03	2.25E-03	1.23E-03	4.05	7.20	0.74	2.73E-03	0.18

Table C.17 Adsolubilization of styrene by 3:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 3:1	SHDPDS (M)			DPC (M)			Styrene (M)				pH _{eq}	X _{ads}	Adsolu. mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	2.59E-04	7.41E-04	3.33E-04	1.51E-05	3.18E-04	2.17E-04	1.02E-04	1.15E-04	0.18	7.10	0.10	2.56E-04	0.53
2	1.00E-03	1.92E-04	8.08E-04	3.33E-04	9.45E-06	3.24E-04	4.35E-04	2.68E-04	1.67E-04	0.48	7.15	0.13	3.70E-04	0.27
3	1.00E-03	1.82E-04	8.18E-04	3.33E-04	1.51E-05	3.18E-04	6.52E-04	3.49E-04	3.04E-04	0.63	7.10	0.21	6.75E-04	0.34
4	1.00E-03	1.77E-04	8.23E-04	3.33E-04	1.38E-05	3.20E-04	8.70E-04	4.37E-04	4.33E-04	0.79	7.20	0.27	9.61E-04	0.35
5	1.00E-03	1.19E-04	8.81E-04	3.33E-04	1.58E-05	3.18E-04	1.30E-03	6.92E-04	6.13E-04	1.25	7.20	0.34	1.36E-03	0.27
6	1.00E-03	1.49E-04	8.51E-04	3.33E-04	1.55E-05	3.18E-04	1.74E-03	8.85E-04	8.55E-04	1.59	7.20	0.42	1.90E-03	0.27
7	1.00E-03	1.61E-04	8.39E-04	3.33E-04	6.21E-06	3.27E-04	2.17E-03	1.04E-03	1.13E-03	1.88	7.10	0.49	2.51E-03	0.26
8	1.00E-03	1.53E-04	8.47E-04	3.33E-04	1.78E-05	3.16E-04	2.61E-03	1.42E-03	1.19E-03	2.55	7.15	0.51	2.65E-03	0.20
9	1.00E-03	1.53E-04	8.47E-04	3.33E-04	1.71E-05	3.16E-04	3.04E-03	1.85E-03	1.19E-03	3.33	7.20	0.51	2.65E-03	0.15
10	1.00E-03	2.32E-04	7.68E-04	3.33E-04	1.97E-05	3.14E-04	3.48E-03	2.26E-03	1.22E-03	4.06	7.15	0.53	2.72E-03	0.13

Table C.18 Adsolubilization of styrene 10:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 10:1	SHDPDS (M)			DPC (M)			Styrene (M)				pH _{eq}	X _{ads}	Adsolu. mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	2.10E-04	7.90E-04	1.00E-04	0	1.00E-04	2.17E-04	8.16E-05	1.36E-04	0.15	7.10	0.13	3.02E-04	0.90
2	1.00E-03	2.73E-04	7.27E-04	1.00E-04	0	1.00E-04	4.35E-04	2.04E-04	2.31E-04	0.37	7.25	0.22	5.13E-04	0.59
3	1.00E-03	2.52E-04	7.48E-04	1.00E-04	0	1.00E-04	6.52E-04	3.86E-04	2.67E-04	0.69	7.15	0.24	5.93E-04	0.34
4	1.00E-03	2.42E-04	7.58E-04	1.00E-04	0	1.00E-04	8.70E-04	4.41E-04	4.28E-04	0.79	7.20	0.33	9.52E-04	0.42
5	1.00E-03	2.09E-04	7.91E-04	1.00E-04	0	1.00E-04	1.30E-03	7.03E-04	6.01E-04	1.27	7.20	0.40	1.34E-03	0.32
6	1.00E-03	1.89E-04	8.11E-04	1.00E-04	0	1.00E-04	1.74E-03	9.64E-04	7.75E-04	1.74	7.30	0.46	1.72E-03	0.26
7	1.00E-03	2.37E-04	7.63E-04	1.00E-04	0	1.00E-04	2.17E-03	1.07E-03	1.10E-03	1.93	7.20	0.56	2.45E-03	0.29
8	1.00E-03	2.43E-04	7.57E-04	1.00E-04	0	1.00E-04	2.61E-03	1.18E-03	1.43E-03	2.12	7.15	0.63	3.19E-03	0.30
9	1.00E-03	2.71E-04	7.29E-04	1.00E-04	0	1.00E-04	3.04E-03	1.52E-03	1.53E-03	2.73	7.10	0.65	3.39E-03	0.24
10	1.00E-03	2.52E-04	7.48E-04	1.00E-04	0	1.00E-04	3.48E-03	2.02E-03	1.46E-03	3.63	7.30	0.63	3.25E-03	0.17

Table C.19 Adsolubilization of styrene 30:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 30:1	SHDPDS (M)			DPC (M)			Styrene (M)				pH _{eq}	X _{ads}	Adsolu. mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	5.36E-04	4.64E-04	3.33E-05	0	3.33E-05	2.17E-04	1.88E-04	2.90E-05	0.34	6.90	0.06	6.44E-05	0.16
2	1.00E-03	5.21E-04	4.79E-04	3.33E-05	0	3.33E-05	4.35E-04	3.71E-04	6.37E-05	0.67	7.20	0.11	1.42E-04	0.17
3	1.00E-03	5.37E-04	4.63E-04	3.33E-05	0	3.33E-05	6.52E-04	4.72E-04	1.80E-04	0.85	7.20	0.27	4.00E-04	0.31
4	1.00E-03	4.82E-04	5.18E-04	3.33E-05	0	3.33E-05	8.70E-04	5.09E-04	3.61E-04	0.92	7.20	0.40	8.02E-04	0.43
5	1.00E-03	5.27E-04	4.73E-04	3.33E-05	0	3.33E-05	1.30E-03	7.13E-04	5.92E-04	1.28	7.20	0.54	1.31E-03	0.42
6	1.00E-03	4.90E-04	5.10E-04	3.33E-05	0	3.33E-05	1.74E-03	7.61E-04	9.78E-04	1.37	7.25	0.64	2.17E-03	0.47
7	1.00E-03	5.29E-04	4.71E-04	3.33E-05	0	3.33E-05	2.17E-03	1.13E-03	1.04E-03	2.03	7.15	0.67	2.32E-03	0.33
8	1.00E-03	5.18E-04	4.82E-04	3.33E-05	0	3.33E-05	2.61E-03	1.32E-03	1.29E-03	2.38	7.3	0.71	2.86E-03	0.30
9	1.00E-03	5.64E-04	4.36E-04	3.33E-05	0	3.33E-05	3.04E-03	1.71E-03	1.34E-03	3.07	7.20	0.74	2.98E-03	0.24
10	1.00E-03	5.06E-04	4.94E-04	3.33E-05	0	3.33E-05	3.48E-03	1.89E-03	1.59E-03	3.40	7.30	0.75	3.54E-03	0.22

Table C.20 Adsolubilization of ethylcyclohexane onto alumina by SHDPDS at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample SHDPDS	SHDPDS (M)			DPC (M)			Ethyl. (M)				pH _{eq}	X _{ads}	Adsolu mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	1.51E-04	8.49E-04	0	0	0	3.53E-04	3.20E-04	3.26E-05	0.58	7.10	0.04	6.53E-05	0.06
2	1.00E-03	1.26E-04	8.74E-04	0	0	0	4.84E-04	3.67E-04	1.17E-04	0.66	7.20	0.12	2.34E-04	0.18
3	1.00E-03	1.30E-04	8.70E-04	0	0	0	6.45E-04	3.93E-04	2.52E-04	0.71	7.20	0.22	5.04E-04	0.32
4	1.00E-03	1.61E-04	8.39E-04	0	0	0	9.68E-04	4.85E-04	4.83E-04	0.87	7.15	0.37	9.65E-04	0.42
5	1.00E-03	1.47E-04	8.53E-04	0	0	0	1.29E-03	5.08E-04	7.83E-04	0.91	7.20	0.48	1.57E-03	0.52
6	1.00E-03	1.78E-04	8.22E-04	0	0	0	1.61E-03	5.14E-04	1.10E-03	0.93	7.15	0.57	2.20E-03	0.62
7	1.00E-03	1.18E-04	8.82E-04	0	0	0	1.94E-03	5.94E-04	1.34E-03	0.97	7.20	0.60	2.68E-03	0.62
8	1.00E-03	1.08E-04	8.92E-04	0	0	0	2.58E-03	7.33E-04	1.85E-03	1.32	7.15	0.67	3.70E-03	0.51

Table C.21 Adsolubilization of ethylcyclohexane by 3:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 3:1	SHDPDS (M)			DPC (M)			Ethyl. (M)				pH _{eq}	X _{ads}	Adsolu mole/g	K _{adm}
	ini	final	ini-fin		mole/g		ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	1.77E-04	8.23E-04	3.33E-04	8.59E-05	2.47E-04	3.23E-04	1.61E-04	1.61E-04	0.29	7.30	0.13	3.22E-04	0.45
2	1.00E-03	2.48E-04	7.52E-04	3.33E-04	9.18E-05	2.42E-04	4.84E-04	2.23E-04	2.61E-04	0.40	7.20	0.21	5.23E-04	0.52
3	1.00E-03	1.88E-04	8.12E-04	3.33E-04	9.17E-05	2.42E-04	6.45E-04	2.39E-04	4.06E-04	0.43	7.15	0.28	8.13E-04	0.65
4	1.00E-03	2.13E-04	7.87E-04	3.33E-04	1.06E-04	2.27E-04	9.68E-04	2.96E-04	6.72E-04	0.53	7.20	0.40	1.34E-03	0.75
5	1.00E-03	3.20E-04	6.80E-04	3.33E-04	8.80E-05	2.45E-04	1.29E-03	3.67E-04	9.23E-04	0.66	7.10	0.50	1.85E-03	0.76
6	1.00E-03	2.28E-04	7.72E-04	3.33E-04	7.49E-05	2.58E-04	1.61E-03	4.41E-04	1.17E-03	0.79	7.20	0.53	2.34E-03	0.67
7	1.00E-03	2.24E-04	7.76E-04	3.33E-04	8.60E-05	2.47E-04	1.94E-03	5.40E-04	1.40E-03	0.97	7.20	0.58	2.79E-03	0.59
8	1.00E-03	2.24E-04	7.76E-04	3.33E-04	8.60E-05	2.47E-04	2.58E-03	7.00E-04	1.88E-03	1.26	7.10	0.65	3.76E-03	0.51

Table C.22 Adsolubilization of ethylcyclohexane 10:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 10:1	SHDPDS (M)			DPC (M)			Ethyl. (M)				pH _{eq}	X _{ads}	Adsolu mole/g	K _{adm}
	ini	final	ini-fin		mole/g		ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	2.11E-04	7.89E-04	1.00E-04	1.17E-05	8.83E-05	3.23E-04	2.02E-04	1.20E-04	0.36	7.20	0.12	2.41E-04	0.33
2	1.00E-03	1.54E-04	8.46E-04	1.00E-04	9.45E-06	9.05E-05	4.84E-04	2.12E-04	2.72E-04	0.38	7.20	0.23	5.44E-04	0.59
3	1.00E-03	1.41E-04	8.59E-04	1.00E-04	1.17E-05	8.83E-05	6.45E-04	2.89E-04	3.56E-04	0.52	7.25	0.27	7.12E-04	0.52
4	1.00E-03	2.09E-04	7.91E-04	1.00E-04	4.32E-06	9.57E-05	9.68E-04	3.87E-04	5.81E-04	0.70	7.20	0.40	1.16E-03	0.57
5	1.00E-03	1.54E-04	8.46E-04	1.00E-04	9.45E-06	9.05E-05	1.29E-03	4.52E-04	8.39E-04	0.81	7.10	0.47	1.68E-03	0.58
6	1.00E-03	2.06E-04	7.94E-04	1.00E-04	8.91E-06	9.11E-05	1.61E-03	4.41E-04	1.17E-03	0.79	7.15	0.57	2.34E-03	0.72
7	1.00E-03	3.12E-04	6.88E-04	1.00E-04	9.99E-06	9.00E-05	1.94E-03	5.28E-04	1.41E-03	0.97	7.20	0.64	2.82E-03	0.66
8	1.00E-03	2.59E-04	7.41E-04	1.00E-04	1.23E-05	8.77E-05	2.58E-03	5.53E-04	2.03E-03	1.00	7.10	0.71	4.06E-03	0.71

Table C.23 Adsolubilization of ethylcyclohexane 30:1 SHDPDS:DPC molar ratio at electrolyte concentration of 0.015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C

Sample 30:1	SHDPDS (M)			DPC (M)			Ethyl. (M)				pH _{eq}	X _{ads}	Adsolu mole/g	K _{adm}
	ini	final	ini-fin	ini	final	ini-fin	ini	final	ini-fin	X _{aq} (10 ⁻⁵)				
1	1.00E-03	2.80E-04	7.20E-04	3.33E-05	0	3.33E-05	3.23E-04	2.22E-04	1.01E-04	0.40	7.10	0.12	2.02E-04	0.30
2	1.00E-03	2.53E-04	7.47E-04	3.33E-05	0	3.33E-05	4.84E-04	2.79E-04	2.05E-04	0.50	7.20	0.21	4.09E-04	0.41
3	1.00E-03	2.15E-04	7.85E-04	3.33E-05	0	3.33E-05	6.45E-04	2.92E-04	3.54E-04	0.52	7.30	0.30	7.07E-04	0.57
4	1.00E-03	2.83E-04	7.17E-04	3.33E-05	0	3.33E-05	9.68E-04	3.35E-04	6.33E-04	0.60	7.25	0.46	1.27E-03	0.76
5	1.00E-03	2.57E-04	7.43E-04	3.33E-05	0	3.33E-05	1.29E-03	3.92E-04	8.99E-04	0.71	7.10	0.54	1.80E-03	0.76
6	1.00E-03	2.96E-04	7.04E-04	3.33E-05	0	3.33E-05	1.61E-03	5.36E-04	1.08E-03	0.96	7.20	0.59	2.15E-03	0.62
7	1.00E-03	2.75E-04	7.25E-04	3.33E-05	0	3.33E-05	1.94E-03	6.74E-04	1.26E-03	1.21	7.20	0.62	2.52E-03	0.52
8	1.00E-03	3.11E-04	6.89E-04	3.33E-05	0	3.33E-05	2.58E-03	8.54E-04	1.73E-03	1.54	7.15	0.71	3.45E-03	0.46

BIOGRAPHY

Miss Ampira Charoensaeng was born in Bangkok, Thailand, on 21 March 1980. In year 2001, she graduated in Bachelor of Science, Department of General Science, Faculty of Science at Chulalongkorn University, Bangkok, Thailand. At the time of this study, she was an M.S. student with a major in Environmental Management at the National Research Center for Environmental and Hazardous Waste Management (NRC-EHWM), Chulalongkorn University, Bangkok, Thailand.

