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APPENDICES

APPENDIX A

HPLC CONDITION USED FOR ANALYSIS

TABLE A-1 The condition used for analysis by HPLC

Substance	Flow rate (ml/min)	Wave length (nm)	Detector	Column	Mobile phase
SDS	1.5	-	Conductivity	Supelcosil LC-18	Equilibrium solvent: 10/90 HPLC grade MeOH/triple distilled and filtered water for 1.5 minutes; swich to 100% HPLC grade MeOH for 1.5-3 minutes
$NP(EO)_{10}$	1.5	277	UV	ODS Hypersil Hewlett Packard	90/10 HPLC grade methanol/triple distilled and filtered water
ODCB	1.5	254	UV	ODS Hypersil Hewlett Packard	85/15 HPLC grade methanol/triple distelled and filtered water

APPENDIX B

EXPERIMENTAL DATA OF THE MICROEMULSION FORMATION STUDY

TABLE B-1 Volume fraction of microemulsion at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30^0C

	Volume Fraction at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 1 wt.%											
Oil Phase	0.55	0.55	0.55	0.53	0.53	0.54	0.53	0.53	0.53	0.53	0.55
Water Phase	0.45	0.45	0.45	0.47	0.47	0.46	0.47	0.47	0.47	0.47	0.45
ISC = 3 wt.%											
Oil Phase	0.59	0.55	0.55	0.55	0.52	0.52	0.52	0.52	0.55	0.64	0.53
Water Phase	0.41	0.45	0.45	0.45	0.48	0.48	0.48	0.48	0.45	0.36	0.47
ISC = 5 wt.%											
Oil Phase	0.59	0.56	0.55	0.52	0.52	0.50	0.50	0.52	0.55	0.55	0.50
Middle Phase	0.00	0.00	0.00	0.34	0.31	0.28	0.40	0.29	0.17	0.24	0.00
Water Phase	0.41	0.44	0.45	0.14	0.17	0.22	0.10	0.19	0.28	0.21	0.50

TABLE B-1 Continued

	Volume Fraction at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 7 wt.%											
Oil Phase	0.64	0.56	0.52	0.48	0.45	0.45	0.45	0.48	0.53	0.57	0.50
Middle Phase	0.00	0.00	0.00	0.24	0.31	0.33	0.45	0.31	0.31	0.00	0.00
Water Phase	0.36	0.44	0.48	0.28	0.24	0.22	0.10	0.21	0.16	0.43	0.50
ISC = 9 wt.%											
Oil Phase	0.64	0.52	0.48	0.47	0.47	0.45	0.45	0.41	0.45	0.48	0.48
Water Phase	0.36	0.48	0.52	0.53	0.53	0.55	0.55	0.59	0.55	0.52	0.52

TABLE B-2 Total surfactant concentration in various phases at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30^0C

	Total surfactants concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 1 wt.%											
Water Phase	0.00	0.003	0.007	0.01	0.012	0.015	0.017	0.018	0.02	0.019	0.019
Oil Phase	0.021	0.018	0.015	0.013	0.012	0.009	0.008	0.007	0.005	0.005	0.005
ISC = 3 wt.%											
Water Phase	0.00	0.018	0.029	0.035	0.043	0.047	0.051	0.054	0.061	0.076	0.068
Oil Phase	0.058	0.048	0.039	0.033	0.026	0.022	0.018	0.016	0.013	0.011	0.005
ISC = 5 wt.%											
Water Phase	0.00	0.031	0.051	0.068	0.075	0.084	0.083	0.082	0.098	0.088	0.11
Middle Phase	-	-	-	0.071	0.078	0.074	0.088	0.091	0.127	0.13	-
Oil Phase	0.088	0.079	0.066	0.048	0.044	0.027	0.03	0.03	0.015	0.013	0.003

TABLE B-2 Continued

	Total surfactants concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 7 wt.%											
Water Phase	0.00	0.058	0.079	0.078	0.09	0.104	0.108	0.108	0.105	0.131	0.1421
Middle Phase	-	-	-	0.098	0.131	0.135	0.13	0.128	0.123	-	-
Oil Phase	0.123	0.098	0.081	0.072	0.039	0.027	0.024	0.037	0.047	0.041	0.017
ISC = 9 wt.%											
Water Phase	0.00	0.032	0.118	0.132	0.149	0.15	0.151	0.151	0.155	0.152	0.151
Oil Phase	0.162	0.169	0.087	0.069	0.055	0.047	0.046	0.041	0.041	0.049	0.05

TABLE B-3 $NP(EO)_{10}$ concentration in various phases at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30^0C

	$NP(EO)_{10}$ concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 1 wt.%											
Water Phase	0.00	0.001	0.003	0.004	0.004	0.005	0.005	0.005	0.005	0.002	0
Oil Phase	0.021	0.018	0.014	0.012	0.01	0.006	0.004	0.002	0.003	0.001	0.00
ISC = 3 wt.%											
Water Phase	0	0.012	0.017	0.018	0.022	0.022	0.019	0.015	0.013	0.008	0
Oil Phase	0.058	0.046	0.036	0.028	0.02	0.013	0.009	0.006	0.002	0.001	0
ISC = 5 wt.%											
Water Phase	0	0.022	0.03	0.038	0.038	0.037	0.03	0.024	0.022	0.011	0
Middle Phase	-	-	-	0.04	0.038	0.038	0.032	0.026	0.023	0.012	-
Oil Phase	0.089	0.076	0.062	0.044	0.035	0.022	0.016	0.01	0.002	0.001	0

TABLE B-3 Continued

	$NP(EO)_{10}$ concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 7 wt.%											
Water Phase	0	0.042	0.052	0.039	0.048	0.058	0.039	0.033	0.022	0.015	0
Middle Phase	-	-	-	0.059	0.074	0.064	0.056	0.049	0.039	-	-
Oil Phase	0.123	0.097	0.076	0.065	0.03	0.014	0.006	0.004	0.001	0.003	0
ISC = 9 wt.%											
Water Phase	0	0.016	0.094	0.089	0.089	0.081	0.064	0.05	0.035	0.019	0
Oil Phase	0.162	0.165	0.07	0.054	0.035	0.016	0.013	0.005	0.002	0.001	0

TABLE B-4 SDS concentration in various phases at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30^0C

	SDS concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 1 wt.%											
Water Phase	0	0.002	0.004	0.006	0.008	0.01	0.012	0.013	0.015	0.017	0.019
Oil Phase	0	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.004	0.005	0.005
ISC = 3 wt.%											
Water Phase	0	0.006	0.012	0.017	0.022	0.026	0.032	0.038	0.048	0.068	0.068
Oil Phase	0	0.001	0.003	0.005	0.007	0.009	0.01	0.01	0.01	0.01	0.005
ISC = 5 wt.%											
Water Phase	0	0.01	0.021	0.03	0.038	0.047	0.052	0.058	0.076	0.077	0.11
Middle Phase	-	-	-	0.031	0.041	0.057	0.056	0.065	0.104	0.118	-
Oil Phase	0	0.003	0.005	0.004	0.008	0.005	0.015	0.02	0.013	0.012	0.003

TABLE B-4 Continued

	SDS concentration at different X_{SDS}										
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
ISC = 7 wt.%											
Water Phase	0	0.017	0.027	0.039	0.042	0.047	0.068	0.076	0.083	0.116	0.142
Middle Phase	-	-	-	0.04	0.057	0.071	0.073	0.078	0.084	-	-
Oil Phase	0	0.001	0.005	0.007	0.009	0.013	0.018	0.033	0.046	0.038	0.017
ISC = 9 wt.%											
Water Phase	0	0.016	0.024	0.043	0.061	0.069	0.087	0.101	0.119	0.133	0.151
Oil Phase	0	0.004	0.016	0.016	0.02	0.036	0.031	0.033	0.039	0.049	0.05

TABLE B-5 Composition of microemulsion phase at initial surfactants concentration = 5 wt.%, initial oil/water volume ratio =1/1 and temperature = 30^0C

		Composition at different X_{SDS}										
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Water Phase	Water	100	94.34	90.01	84.6	84.01	81.44	81.4	81.78	82.99	84.00	82.28
	Total Surfactants	0.00	3.28	5.13	7.09	7.28	8.32	8.22	8.75	8.61	9.15	10.87
	ODCB	0.00	2.37	4.86	8.32	8.71	10.24	10.38	9.47	8.40	6.85	6.86
Middle Phase	Water	-	-	-	83.79	81.71	78.55	80.15	81.33	80.13	79.24	-
	Total Surfactants	-	-	-	6.98	7.89	9.60	8.53	8.78	10.71	12.77	-
	ODCB	-	-	-	9.23	10.4	11.85	11.32	9.89	9.17	7.99	-

TABLE B-5 Continued

		Composition at different X_{SDS}										
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Oil Phase	Water	18.67	13.40	19.08	17.35	10.82	11.48	9.08	10.71	16.46	12.96	4.87
	Total Surfactants	5.96	5.59	4.44	3.20	3.22	1.93	2.25	2.25	1.12	0.98	0.25
	ODCB	75.37	81.01	76.48	79.45	85.96	86.59	88.67	87.04	82.42	86.05	94.88

TABLE B-6 Composition of microemulsion phase at initial surfactants concentration = 7 wt.%, initial oil/water volume ratio =1/1 and temperature = 30^0C

		Composition at different X_{SDS}										
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Water Phase	Water	100.	87.28	80.47	77.11	73.92	74.61	71.99	72.59	76.78	76.53	84.39
	Total Surfactants	0.00	5.81	7.72	7.49	9.17	9.05	10.11	10.32	9.90	12.59	13.92
	ODCB	0.00	6.91	11.81	15.40	16.91	16.34	18.01	17.09	13.24	10.88	1.69
Middle Phase	Water	-	-	-	74.61	68.61	70.14	68.45	68.67	68.75	-	-
	Total Surfactants	-	-	-	9.29	12.88	12.11	12.27	12.03	11.66	-	-
	ODCB	-	-	-	16.10	18.52	17.75	19.28	19.30	19.58	-	-
Oil Phase	Water	6.41	14.39	8.62	2.91	3.25	1.09	1.56	1.79	19.84	27.11	2.70
	Total Surfactants	10.2	6.84	6.03	5.62	2.01	1.34	2.69	2.54	3.23	2.70	1.27
	ODCB	83.39	78.78	85.35	91.46	93.79	96.78	96.54	95.14	76.76	70.19	96.03

APPENDIX C

EXPERIMENTAL DATA OF FROTH FLOTATION STUDY

TABLE C-1 Removal efficiency of ODCB at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30 ^{0}C

		ODCB removal efficiency at different X_{SDS}					
		0	0.2	0.4	0.6	0.8	1
ISC = 5 wt.%	20 min	0	7.84	5.77	13.41	31.24	0.15
	60 min	0	40.63	26.46	46.04	83.7	0.24
	120 min	0	77.59	59.2	90.47	96.51	1.03
ISC = 7 wt.%	20 min	0	12.85	25.80	30.76	37.33	5.48
	60 min	0	44.39	67.83	84.94	91.66	18.37
	120 min	0	89.95	99.27	99.59	99.99	47.15

TABLE C-2 Removal efficiency of $NP(EO)_{10}$ at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30 ^{0}C

		$NP(EO)_{10}$ removal efficiency at different X_{SDS}					
		0	0.2	0.4	0.6	0.8	1
ISC = 5 wt.%	20 min	0	7.20	5.99	13.90	34.01	-
	60 min	0	42.33	28.66	49.04	89.13	-
	120 min	0	76.31	63.78	94.19	99.84	-
ISC = 7 wt.%	20 min	0	13.09	30.69	30.46	31.05	-
	60 min	0	42.13	70.70	81.25	81.97	-
	120 min	0	84.41	97.60	95.32	89.01	-

TABLE C-3 Removal efficiency of SDS at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1 and temperature = 30 ^{0}C

		$NP(EO)_{10}$ removal efficiency at different X_{SDS}					
		0	0.2	0.4	0.6	0.8	1
ISC = 5 wt.%	20 min	0	7.31	5.49	11.76	27.00	3.88
	60 min	0	42.27	26.03	40.92	70.23	11.79
	120 min	0	69.81	56.62	76.48	78.76	31.57
ISC = 7 wt.%	20 min	0	12.47	19.52	24.45	22.62	7.33
	60 min	0	39.56	53.69	64.83	60.92	23.57
	120 min	0	78.22	76.00	75.86	67.13	49.97

TABLE C-4 ODCB and water contents in foam fraction at different initial surfactants concentration (ISC) with initial oil/water volume ratio = 1/1, temperature = 30°C and operating time = 120 min

	Contents in foam fraction at X_{SDS}					
	0	0.2	0.4	0.6	0.8	1
ISC = 5 wt.%						
ODCB	0	60.17	56.68	66.11	64.15	5.06
H_2O	0	34.73	38.22	28.55	31.04	81.37
ISC = 7 wt.%						
ODCB	0	65.00	68.18	64.70	67.90	51.61
H_2O	0	0	27.39	24.35	28.66	26.10

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