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APPENDICES

Appendix A Experimental data of microemulsion formation.

1. Solubilization parameter (SP)

The solubilization parameter of oil (SP_o) and water (SP_w) are designed as :

$$SP_o = \frac{V_o}{M_s} \quad \text{and} \quad SP_w = \frac{V_w}{M_s} \quad (\text{A.1})$$

Where V_o = volume of oil solubilized
 M_s = weight of surfactants
 V_w = volume of water solubilized

2. Interfacial tension (IFT)

The interfacial tension of each phase of microemulsion is calculated by following formulation :

$$IFT = e (Vd)^3 n^2 \Delta\rho \quad (\text{A.2})$$

where σ = interfacial tension (mN/m)
 n = number of revolution (rpm)
 $e = 3.427 \times 10^{-4}$ (mN cm³ min²/m g mm³)
 $V = 0.31$ (mm/sdv)
 D = measured drop diameter (sdv)
 $\Delta\rho$ = density difference of two liquids (g/cm³)

3. Experiment data of solubilization parameter

Table A-1 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 2wt% Dowfax8390, 3wt% AOT and 2wt% Span80 at different NaCl concentrations by using an oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.103	3.61	0	3.19	0.5312	0	0.4688	0.3503	14.2746	0.8907	0.5312	0
2	0.5025	3.63	0	3.16	0.5348	0	0.4652	0.3502	14.2764	0.9936	0.5348	0
3	0.809	3.64	0	3.13	0.5379	0	0.4621	0.3499	14.2888	1.0831	0.5379	0
4	1.004	3.66	0	3.12	0.5405	0	0.4595	0.3501	14.282	1.1568	0.5405	0
5	1.2005	3.69	0	3.11	0.5431	0	0.4569	0.3503	14.2735	1.2304	0.5431	0
6	1.401	3.71	0	3.07	0.5469	0	0.4531	0.3502	14.2772	1.3392	0.5469	0
7	1.6015	3.72	0	3.07	0.5483	0	0.4517	0.3501	14.2826	1.3797	0.5483	0
8	2.004	3.75	0	3.06	0.5511	0	0.4489	0.3506	14.2627	1.4577	0.5511	0
9	2.405	3.76	0	3.04	0.5536	0	0.4464	0.35	14.2869	1.5316	0.5536	0
10	2.6045	3.78	0	3.02	0.5562	0	0.4438	0.3507	14.2588	1.6027	0.5562	0
11	2.8035	3.8	0	3	0.5587	0	0.4413	0.3504	14.2699	1.6753	0.5587	0
12	3	3.81	0	2.97	0.5621	0	0.4379	0.3504	14.2675	1.772	0.5621	0
13	3.4	3.83	0	2.96	0.5642	0	0.4358	0.3503	14.2741	1.8328	0.5642	0
14	3.803	3.85	0	2.95	0.5667	0	0.4333	0.3499	14.2888	1.9061	0.5667	0
15	4.2025	3.86	0	2.93	0.5685	0	0.4315	0.35	14.2842	1.9569	0.5685	0
16	7.0035	2.73	1.13	2.91	0.4029	0.1675	0.4296	0.3503	2.7717	2.0095	0.5704	0.4029
17	10.0095	2.79	1.1	2.9	0.4106	0.1621	0.4273	0.35	2.5543	2.0772	0.5727	0.4106
18	15.0025	2.87	1.02	2.9	0.4232	0.1497	0.4271	0.3507	2.19	2.0788	0.5729	0.4232
19	20.006	2.96	0.92	2.92	0.4358	0.1354	0.4288	0.3501	1.8337	2.0336	0.5712	0.4358
20	25.0035	3	0.89	2.92	0.4411	0.1302	0.4287	0.3502	1.682	2.036	0.5713	0.4411

Table A-2 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 2wt% Dowfax8390, 4wt% AOT and 2wt% Span80 at different NaCl concentrations by using initial oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.1015	3.68	0	3.12	0.5412	0	0.4588	0.4003	12.4918	1.0293	0.5412	0
2	0.5005	3.69	0	3.09	0.5436	0	0.4564	0.4	12.5	1.09	0.5436	0
3	0.801	3.7	0	3.07	0.5467	0	0.4533	0.4001	12.4954	1.1671	0.5467	0
4	1.002	3.72	0	3.07	0.5483	0	0.4517	0.4002	12.4929	1.2068	0.5483	0
5	1.2055	3.74	0	3.04	0.5511	0	0.4489	0.4	12.5015	1.2777	0.5511	0
6	1.4045	3.76	0	3.03	0.5532	0	0.4468	0.4001	12.4959	1.3296	0.5532	0
7	1.6025	3.77	0	3.03	0.5549	0	0.4451	0.4001	12.4974	1.3722	0.5549	0
8	2.001	3.79	0	3.01	0.5578	0	0.4422	0.4002	12.4935	1.4442	0.5578	0
9	2.404	3.8	0	2.99	0.5592	0	0.4408	0.4001	12.4976	1.4797	0.5592	0
10	2.6065	3.8	0	2.99	0.5603	0	0.4397	0.3999	12.5036	1.5079	0.5603	0
11	2.801	3.8	0	2.97	0.5615	0	0.4385	0.4001	12.4974	1.5372	0.5615	0
12	3.002	3.82	0	2.96	0.5631	0	0.4369	0.4	12.4994	1.5774	0.5631	0
13	3.4	3.83	0	2.94	0.5652	0	0.4348	0.4003	12.491	1.6288	0.5652	0
14	3.8005	3.84	0	2.94	0.5667	0	0.4333	0.4004	12.486	1.6656	0.5667	0
15	4.2045	2.55	1.42	2.83	0.3745	0.2093	0.4162	0.4001	3.1365	2.0944	0.5838	0.3745
16	7.007	2.62	1.36	2.81	0.3852	0.2004	0.4144	0.4002	2.8686	2.139	0.5856	0.3852
17	10.006	2.72	1.27	2.81	0.3996	0.1866	0.4138	0.4002	2.509	2.1541	0.5862	0.3996
18	15.0045	2.88	1.11	2.8	0.4239	0.1636	0.4125	0.4001	1.9021	2.1871	0.5875	0.4239
19	20.001	2.92	1.04	2.81	0.4311	0.1555	0.4134	0.4	1.7223	2.1647	0.5866	0.4311
20	25.0015	2.95	1.02	2.81	0.4356	0.1498	0.4146	0.4004	1.6084	2.1328	0.5854	0.4356

Table A-3 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 2wt% Dowfax8390, 5wt% AOT and 2wt% Span80 at different NaCl concentrations by using initial oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.1005	3.76	0	3.03	0.5532	0	0.4468	0.45	11.1103	1.1821	0.5532	0
2	0.502	3.79	0	2.99	0.5587	0	0.4413	0.4503	11.1046	1.3037	0.5587	0
3	0.8015	3.82	0	2.96	0.5638	0	0.4362	0.4502	11.105	1.417	0.5638	0
4	1.001	3.85	0	2.94	0.5664	0	0.4336	0.45	11.1109	1.4755	0.5664	0
5	1.2025	3.86	0	2.92	0.5691	0	0.4309	0.4501	11.1092	1.5353	0.5691	0
6	1.4005	3.89	0	2.9	0.5736	0	0.4264	0.4504	11.1014	1.6341	0.5736	0
7	1.6	3.93	0	2.87	0.5785	0	0.4215	0.4502	11.106	1.7436	0.5785	0
8	2.001	3.96	0	2.84	0.5822	0	0.4178	0.4501	11.1086	1.8263	0.5822	0
9	2.406	3.99	0	2.8	0.5869	0	0.4131	0.4501	11.1098	1.9309	0.5869	0
10	2.6015	3.92	0	2.89	0.5752	0	0.4248	0.4502	11.1071	1.6705	0.5752	0
11	2.8025	3.98	0	2.8	0.5867	0	0.4133	0.4503	11.1029	1.9252	0.5867	0
12	3.0005	4.03	0	2.76	0.5935	0	0.4065	0.4502	11.105	2.0766	0.5935	0
13	3.4	4.07	0	2.73	0.5986	0	0.4014	0.4501	11.1075	2.1904	0.5986	0
14	3.801	2.38	1.68	2.71	0.3515	0.2478	0.4007	0.4499	3.3007	2.2072	0.5993	0.3515
15	4.2035	2.47	1.62	2.69	0.3642	0.2392	0.3966	0.4505	3.0146	2.2954	0.6034	0.3642
16	7.045	2.54	1.54	2.7	0.3751	0.2272	0.3977	0.4502	2.7744	2.2724	0.6023	0.3751
17	10.003	2.67	1.44	2.69	0.3924	0.2117	0.3959	0.4502	2.3901	2.3124	0.6041	0.3924
18	15.0005	2.82	1.3	2.68	0.4146	0.1909	0.3945	0.4504	1.8962	2.3425	0.6055	0.4146
19	20.0055	2.85	1.23	2.7	0.4206	0.1812	0.3982	0.4503	1.7634	2.2609	0.6018	0.4206
20	25.0025	2.93	1.18	2.69	0.4309	0.1728	0.3963	0.4499	1.5358	2.3048	0.6037	0.4309

Table A-4 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 2wt% Dowfax8390, 5wt% AOT and 4wt% Span80 at different NaCl concentrations by using initial oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.101	3.82	0	2.97	0.5633	0	0.4367	0.55	9.0907	1.1509	0.5633	0
2	0.5015	3.85	0	2.95	0.5662	0	0.4338	0.5503	9.0858	1.203	0.5662	0
3	0.8045	3.87	0	2.92	0.5693	0	0.4307	0.5501	9.0888	1.2597	0.5693	0
4	1.0025	3.89	0	2.91	0.5716	0	0.4284	0.55	9.0906	1.3018	0.5716	0
5	1.2055	3.9	0	2.9	0.5734	0	0.4266	0.55	9.0912	1.3346	0.5734	0
6	1.402	3.92	0	2.88	0.5759	0	0.4241	0.5502	9.0881	1.3796	0.5759	0
7	1.6005	3.93	0	2.87	0.5778	0	0.4222	0.5502	9.0883	1.4141	0.5778	0
8	2.0005	3.94	0	2.86	0.5799	0	0.4201	0.5505	9.0832	1.4515	0.5799	0
9	2.403	2.17	2.14	2.47	0.3203	0.3152	0.3645	0.5501	3.2668	2.4633	0.6355	0.3203
10	2.6015	2.27	2.05	2.46	0.3348	0.3025	0.3627	0.5501	3.0032	2.496	0.6373	0.3348
11	2.807	2.3	2.04	2.46	0.3378	0.3001	0.3621	0.5503	2.9474	2.5058	0.6379	0.3378
12	3	2.31	2.01	2.46	0.3411	0.2963	0.3626	0.5501	2.8886	2.4978	0.6374	0.3411
13	3.401	2.35	1.98	2.47	0.3455	0.2911	0.3634	0.5502	2.808	2.4827	0.6366	0.3455
14	3.8025	2.37	1.96	2.47	0.3489	0.2885	0.3626	0.5505	2.7447	2.4959	0.6374	0.3489
15	4.2035	2.41	1.92	2.47	0.3548	0.2824	0.3628	0.55	2.6398	2.4943	0.6372	0.3548
16	7.0055	2.47	1.87	2.47	0.3625	0.275	0.3625	0.5501	2.4997	2.4997	0.6375	0.3625
17	10.001	2.51	1.81	2.45	0.3702	0.2676	0.3622	0.5502	2.3589	2.5043	0.6378	0.3702
18	15.007	2.55	1.78	2.46	0.3761	0.2619	0.362	0.5502	2.2517	2.508	0.638	0.3761
19	20.001	2.6	1.72	2.46	0.3836	0.2536	0.3628	0.5503	2.1151	2.4931	0.6372	0.3836
20	25.0005	2.65	1.68	2.45	0.3891	0.2483	0.3626	0.5499	2.0168	2.4988	0.6374	0.3891

Table A-5 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 2wt% Dowfax8390, 5wt% AOT and 5wt% Span80 at different NaCl concentrations by using initial oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.105	3.88	0	2.89	0.5732	0	0.4268	0.6002	8.3308	1.2196	0.5732	0
2	0.5025	4.03	0	2.77	0.5929	0	0.4071	0.6	8.3332	1.5483	0.5929	0
3	0.8005	4.08	0	2.71	0.6014	0	0.3986	0.6004	8.3281	1.6889	0.6014	0
4	1.0045	2.08	2.41	2.3	0.3063	0.3552	0.3385	0.6002	3.2275	2.6909	0.6615	0.3063
5	1.2005	2.11	2.39	2.31	0.3096	0.3514	0.339	0.6002	3.172	2.6822	0.661	0.3096
6	1.4015	2.13	2.36	2.3	0.3134	0.3476	0.339	0.6002	3.1092	2.6827	0.661	0.3134
7	1.6005	2.14	2.33	2.32	0.3152	0.3432	0.3416	0.6	3.0798	2.6399	0.6584	0.3152
8	2.002	2.17	2.29	2.34	0.3187	0.3369	0.3444	0.6006	3.0188	2.5909	0.6556	0.3187
9	2.406	2.19	2.26	2.32	0.3237	0.3331	0.3432	0.6	2.9382	2.6132	0.6568	0.3237
10	2.6035	2.21	2.24	2.32	0.3265	0.3308	0.3427	0.5999	2.8921	2.6221	0.6573	0.3265
11	2.8025	2.25	2.22	2.33	0.3312	0.3264	0.3424	0.6003	2.8118	2.6252	0.6576	0.3312
12	3.006	2.27	2.19	2.33	0.335	0.3221	0.3429	0.6001	2.7496	2.6179	0.6571	0.335
13	3.4	2.3	2.17	2.32	0.3384	0.3197	0.3419	0.6001	2.6927	2.6344	0.6581	0.3384
14	3.8005	2.33	2.15	2.32	0.3426	0.3163	0.3411	0.6001	2.6227	2.6477	0.6589	0.3426
15	4.2	2.36	2.12	2.3	0.3478	0.3134	0.3388	0.6001	2.5364	2.6864	0.6612	0.3478
16	7.001	2.38	2.11	2.31	0.3496	0.31	0.3404	0.6	2.5065	2.6599	0.6596	0.3496
17	10	2.4	2.06	2.32	0.3541	0.3035	0.3424	0.6001	2.4314	2.6264	0.6576	0.3541
18	15.01	2.45	2.03	2.32	0.3607	0.2983	0.341	0.6003	2.3206	2.6488	0.659	0.3607
19	20.005	2.51	1.98	2.32	0.3684	0.2907	0.3409	0.6006	2.1912	2.6491	0.6591	0.3684
20	25.01	2.56	1.91	2.34	0.3762	0.2806	0.3432	0.6002	2.0625	2.6123	0.6568	0.3762

Table A-6 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 1.5wt% Dowfax8390, 5wt% AOT and 5wt% Span80 at different NaCl concentrations by using initial oil to water ratio by 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.101	3.87	0	2.93	0.5697	0	0.4303	0.5749	8.6976	1.2124	0.5697	0
2	0.503	3.88	0	2.9	0.5723	0	0.4277	0.5751	8.6935	1.2571	0.5723	0
3	0.806	3.92	0	2.87	0.5777	0	0.4223	0.575	8.6952	1.3512	0.5777	0
4	1.0015	2.24	2.22	2.34	0.3295	0.3261	0.3444	0.5748	2.9661	2.7069	0.6556	0.3295
5	1.2	2.25	2.21	2.34	0.331	0.3248	0.3442	0.5752	2.9382	2.7087	0.6558	0.331
6	1.4005	2.27	2.19	2.35	0.3334	0.3215	0.3451	0.5752	2.8962	2.6928	0.6549	0.3334
7	1.601	2.28	2.17	2.34	0.3357	0.3201	0.3442	0.575	2.8575	2.7097	0.6558	0.3357
8	2.0065	2.29	2.15	2.34	0.338	0.3171	0.3449	0.5752	2.8163	2.6964	0.6551	0.338
9	2.4045	2.31	2.14	2.34	0.3401	0.3151	0.3448	0.5751	2.7804	2.6987	0.6552	0.3401
10	2.6	2.32	2.12	2.33	0.3425	0.3132	0.3443	0.575	2.7391	2.7078	0.6557	0.3425
11	2.8005	2.34	2.12	2.34	0.3443	0.3113	0.3444	0.5752	2.7069	2.7051	0.6556	0.3443
12	3.001	2.35	2.1	2.34	0.3458	0.3097	0.3445	0.5752	2.6807	2.7033	0.6555	0.3458
13	3.402	2.36	2.09	2.34	0.3481	0.3077	0.3442	0.5751	2.6414	2.7092	0.6558	0.3481
14	3.8085	2.38	2.08	2.34	0.3502	0.3052	0.3446	0.5749	2.6055	2.7029	0.6554	0.3502
15	4.203	2.4	2.05	2.34	0.3531	0.3025	0.3444	0.5749	2.5553	2.7066	0.6556	0.3531
16	7.005	2.44	2.01	2.34	0.3587	0.2964	0.3449	0.5752	2.4566	2.6966	0.6551	0.3587
17	10.001	2.47	1.98	2.34	0.3641	0.2912	0.3447	0.5751	2.3631	2.7005	0.6553	0.3641
18	15	2.51	1.93	2.35	0.3701	0.2848	0.3451	0.5748	2.2599	2.6949	0.6549	0.3701
19	20.0055	2.54	1.91	2.34	0.3745	0.2808	0.3447	0.5751	2.1821	2.7003	0.6553	0.3745
20	25.003	2.58	1.87	2.34	0.3803	0.275	0.3447	0.5752	2.081	2.6999	0.6553	0.3803

Table A-7 Volume fractions of water, middle, and oil phase and solubilization parameters of oil and water phases in microemulsion formation with 3wt% Dowfax8390, 5wt% AOT and 5wt% Span80 at different NaCl concentrations by using initial oil to water ratio of 1:1

Sample number	%NaCl (actual)	Phase height (cm)			Relative volume			Ms	Solubilization		Rel. vol. Water+Mid	Rel. vol. Water
		Water	Middle	Oil	Water	Middle	Oil		Spw	Spo		
1	0.105	3.88	0	2.89	0.5732	0	0.4268	0.6002	8.3308	1.2196	0.5732	0
2	0.5025	4.03	0	2.77	0.5929	0	0.4071	0.6	8.3332	1.5483	0.5929	0
3	0.8005	4.08	0	2.71	0.6014	0	0.3986	0.6004	8.3281	1.6889	0.6014	0
4	1.0045	4.09	0	2.69	0.6018	0	0.3982	0.6002	8.3311	1.6962	0.6018	0
5	1.2005	4.09	0	2.69	0.602	0	0.398	0.6002	8.3299	1.6993	0.602	0
6	1.4015	4.09	0	2.69	0.6022	0	0.3978	0.6002	8.3312	1.7029	0.6022	0
7	1.6005	2.14	2.23	2.42	0.3151	0.3284	0.3565	0.6	3.0815	2.3915	0.6435	0.3139
8	2.002	2.15	2.23	2.42	0.3165	0.3274	0.3561	0.6006	3.0555	2.3961	0.6439	0.3217
9	2.406	2.16	2.2	2.41	0.3194	0.3245	0.3561	0.6	3.0098	2.3982	0.6439	0.3257
10	2.6035	2.18	2.18	2.41	0.3213	0.3225	0.3562	0.5999	2.9788	2.397	0.6438	0.3275
11	2.8025	2.18	2.19	2.42	0.3209	0.3227	0.3564	0.6003	2.9834	2.392	0.6436	0.3299
12	3.006	2.2	2.17	2.42	0.3238	0.3202	0.356	0.6001	2.9362	2.3996	0.644	0.3321
13	3.4	2.24	2.14	2.42	0.3297	0.3143	0.356	0.6001	2.8377	2.3994	0.644	0.3344
14	3.8005	2.28	2.1	2.42	0.3354	0.3086	0.356	0.6001	2.7427	2.3994	0.644	0.3369
15	4.2	2.32	2.04	2.42	0.3426	0.3011	0.3563	0.6001	2.623	2.3947	0.6437	0.3396
16	7.001	2.42	1.95	2.42	0.3562	0.2874	0.3564	0.6	2.3965	2.3932	0.6436	0.3436
17	10	2.47	1.9	2.42	0.3631	0.2805	0.3564	0.6001	2.2815	2.3931	0.6436	0.3561
18	15.01	2.49	1.88	2.42	0.3669	0.2767	0.3564	0.6003	2.2173	2.3922	0.6436	0.3627
19	20.005	2.51	1.86	2.42	0.3696	0.2742	0.3562	0.6006	2.1712	2.3943	0.6438	0.3684
20	25.01	2.53	1.86	2.42	0.3715	0.2725	0.356	0.6002	2.1409	2.3991	0.644	0.3742

4. Experiment data of interfacial tension

Table A-8 Interfacial tension as a function of NaCl concentration with the formulation of 1.5wt%Dowfax8390, 5wt%AOT and 5wt%Span80 at an oil to water volumetric ratio of 1:1

% Actual NaCl	Density measurement									IFT measurement					
	Oil phase			Middle phase			Water phase			middle phase/oil phase			middle phase/water phase		
	wt (g)	Volume (μL)	ρ (g/mL)	wt (g)	Volume (μL)	ρ (g/mL)	wt (g)	Volume (μL)	ρ (g/mL)	d (mm)	speed (rpm)	IFT _{m/o} (mN/m)	d (mm)	Speed (rpm)	IFT _{m/w} (mN/m)
0.101	0.1528	200	0.764	0.0962	100	0.962	-	-	-	1.1194	2040	0.0118	-	-	-
0.503	0.1442	200	0.721	0.0953	100	0.953	-	-	-	1.2357	1583	0.0112	-	-	-
0.806	0.1552	200	0.776	0.0945	100	0.945	-	-	-	0.8712	2331	0.0062	-	-	-
1.0015	0.1608	200	0.804	0.0921	100	0.921	-	-	-	1.0724	2018	0.006	-	-	-
1.2	0.1654	200	0.827	0.0904	100	0.904	0.1994	200	0.997	1.3114	1793	0.0057	0.8046	2144	0.0022
1.4005	0.166	200	0.83	0.0881	100	0.881	0.2026	200	1.013	1.3447	2103	0.0056	0.75	2011	0.0023
1.601	0.1664	200	0.832	0.0892	100	0.892	0.204	200	1.02	1.3496	1876	0.0053	0.817	1873	0.0025
2.0065	0.1674	200	0.837	0.0877	100	0.877	0.2054	200	1.027	1.4809	1922	0.0049	0.7801	1891	0.0026
2.4045	0.1646	200	0.823	0.0872	100	0.872	0.2038	200	1.019	1.38	1850	0.0045	0.7958	1924	0.0028
2.6	0.1662	200	0.831	0.0869	100	0.869	0.2006	200	1.003	1.388	2036	0.0043	0.8047	2017	0.0029
2.8005	0.1668	200	0.834	0.087	100	0.87	0.2022	200	1.011	1.2139	2274	0.0034	0.8356	1952	0.0032
3.001	0.1672	200	0.836	0.0876	100	0.876	0.202	200	1.01	1.2608	2008	0.0033	0.9212	1783	0.0034
3.402	0.1624	200	0.812	0.0881	100	0.881	0.203	200	1.015	0.9831	2117	0.003	0.8691	1974	0.0035
3.8085	0.167	200	0.835	0.0882	100	0.882	0.2024	200	1.012	1.1426	1906	0.0026	0.9273	1895	0.0038
4.203	0.168	200	0.84	0.0884	100	0.884	0.201	200	1.005	1.0829	2008	0.0023	1.0222	1966	0.0051
7.005	-	-	-	0.0887	100	0.887	0.2032	200	1.016	-	-	-	1.3395	2003	0.0127

Table A-9 Interfacial tension as a function of NaCl concentration with the formulation of 1.5wt%Dowfax8390, 5wt%AOT and 5wt%Span80 at an oil to water volumetric ratio of 1:4

% Actual NaCl	Density measurement						IFT measurement		
	Upper phase			Lower phase			Upper phase/Lower phase		
	wt (g)	Volume (μ L)	ρ (g/mL)	wt (g)	Volume (μ L)	ρ (g/mL)	d (mm)	speed (rpm)	IFT (mN/m)
1.0015	0.0411	50	0.821	0.104	100	1.040	2.260	3552	0.3258
2.0065	0.0427	50	0.854	0.1025	100	1.025	1.666	2911	0.0684
2.8361	0.0434	50	0.867	0.1011	100	1.011	1.043	1567	0.0041
4.0020	0.0435	50	0.870	0.1034	100	1.034	1.797	2924	0.0831
5.0237	0.0440	50	0.879	0.1057	100	1.057	2.417	3895	0.3895
6.0017	0.0441	50	0.881	0.1066	100	1.066	2.791	3924	0.6322

Table A-10 Interfacial tension as a function of NaCl concentration of with formulation of 1.5wt%Dowfax8390, 5wt%AOT and 5wt%Span80 at an oil to water volumetric ratio of 1:9

% Actual NaCl	Density measurement						IFT measurement		
	Upper phase			Lower phase			Upper phase/Lower phase		
	wt (g)	Volume (μ L)	ρ (g/mL)	wt (g)	Volume (μ L)	ρ (g/mL)	d (mm)	speed (rpm)	IFT (mN/m)
1.0017	0.0401	50	0.801	0.1042	100	1.042	2.652	3729	0.6381
2.0036	0.0415	50	0.830	0.1021	100	1.021	1.437	3128	0.0566
2.8501	0.0423	50	0.845	0.1034	100	1.034	1.074	1610	0.0062
4.0113	0.0429	50	0.858	0.1047	100	1.047	1.313	3133	0.0429
5.0006	0.0431	50	0.862	0.1058	100	1.058	2.329	3921	0.3887
6.0003	0.0434	50	0.867	0.1066	100	1.066	2.748	3876	0.6334

Table A-11 Interfacial tension as a function of NaCl concentration of with formulation of 1.5wt%Dowfax8390, 5wt%AOT and 5wt%Span80 at an oil to water volumetric ratio of 1:19

% Actual NaCl	Density measurement						IFT measurement		
	Upper phase			Lower phase			Upper phase/Lower phase		
	wt (g)	Volume (μ L)	ρ (g/mL)	wt (g)	Volume (μ L)	ρ (g/mL)	d (mm)	speed (rpm)	IFT (mN/m)
1.0025	0.0401	50	0.801	0.1039	100	1.039	2.079	3806	0.3165
2.0103	0.0411	50	0.822	0.1036	100	1.036	1.066	3271	0.0283
2.8411	0.0423	50	0.845	0.1048	100	1.048	0.704	2038	0.0030
4.0007	0.0413	50	0.825	0.1053	100	1.053	1.282	2957	0.0429
5.0064	0.0416	50	0.832	0.1061	100	1.061	2.448	3907	0.5236
6.0012	0.0422	50	0.843	0.1057	100	1.057	2.630	3954	0.6215

Appendix B Experimental data of detergency experiment.

1. %Detergency (%D)

The detergency performance can be determined by %Detergency, it is calculated from the following equation :

$$\% \text{ Detergency} = [(A-B)/(Co-Bo)] \times 100$$

where A = average reflectance of the soiled swatches after washing
 B = average reflectance of the soiled swatches before washing
 Co = average reflectance of the unsoiled swatches before washing

2. %Oil Removal

The oil removal is calculated from the calibration curve for colored motor oil.

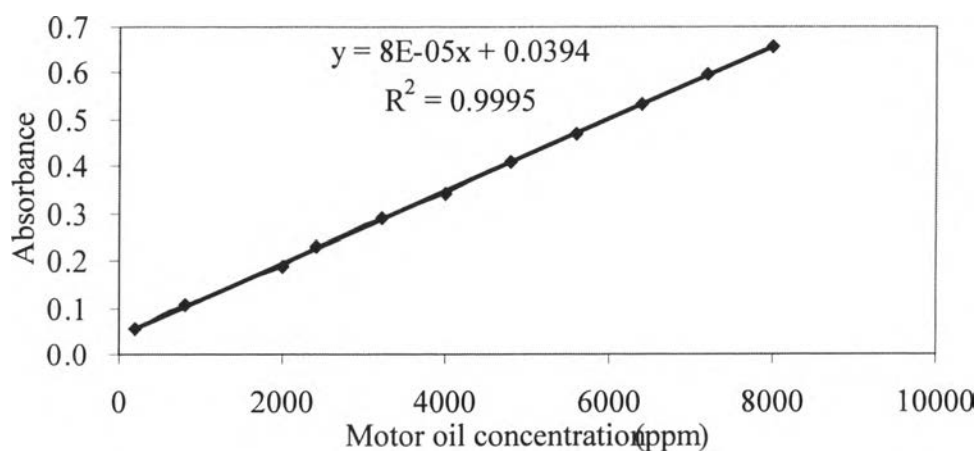


Figure B-1 Relationship between colored motor oil concentration and the absorbance measured at 520 nm.

Table B-1 Relationship between colored motor oil concentration and the absorbance measured at 520 nm

Motor oil concentration (%w/v)	Motor oil concentration (ppm)	Absorbance
2	200	0.0554
8	800	0.1069
20	2000	0.1862
24	2400	0.2291
32	3200	0.2883
40	4000	0.3408
48	4800	0.4082
56	5600	0.4708
64	6400	0.5317
72	7200	0.5990
80	8000	0.6572

3. Experiment data of oil removal at different active surfactant concentration

Table B-2 Motor oil removal from pure cotton fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

%Active surfactant	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8080	96.0750	0.7809	92.6875	3.3875	3.3958
	2	0.8080	96.0750	0.7807	92.6625	3.4125	
	3	0.8080	96.0750	0.7809	92.6875	3.3875	
0.02	1	0.8125	96.6375	0.3195	35.0125	61.6250	61.5917
	2	0.8125	96.6375	0.3212	35.2250	61.4125	
	3	0.8125	96.6375	0.3186	34.9000	61.7375	
0.05	1	0.8091	96.2125	0.1921	19.0875	77.1250	77.1042
	2	0.8091	96.2125	0.193	19.2000	77.0125	
	3	0.8091	96.2125	0.1917	19.0375	77.1750	
0.1	1	0.8087	96.1625	0.1393	12.4875	83.6750	83.7042
	2	0.8087	96.1625	0.1389	12.4375	83.7250	
	3	0.8087	96.1625	0.1390	12.4500	83.7125	
0.2	1	0.8080	96.075	0.1115	9.0125	87.0625	86.9458
	2	0.8080	96.075	0.1132	9.2250	86.8500	
	3	0.8080	96.075	0.1126	9.1500	86.9250	
0.3	1	0.8093	96.2375	0.099	7.4500	88.7875	88.8167
	2	0.8093	96.2375	0.0986	7.4000	88.8375	
	3	0.8093	96.2375	0.0987	7.4125	88.8250	
0.4	1	0.8084	96.125	0.0870	5.9500	90.1750	90.1625
	2	0.8084	96.125	0.0867	5.9125	90.2125	
	3	0.8084	96.125	0.0876	6.0250	90.1000	

Table B-3 Motor oil removal from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

% Active surfactant	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8091	96.2125	0.7822	92.8500	3.3625	3.3292
	2	0.8091	96.2125	0.7824	92.8750	3.3375	
	3	0.8091	96.2125	0.7828	92.9250	3.2875	
0.02	1	0.8082	96.1000	0.3884	43.6250	52.4750	52.4333
	2	0.8082	96.1000	0.3879	43.5625	52.5375	
	3	0.8082	96.1000	0.3899	43.8125	52.2875	
0.05	1	0.8072	95.9750	0.2501	26.3375	69.6375	69.6917
	2	0.8072	95.9750	0.2491	26.2125	69.7625	
	3	0.8072	95.9750	0.2498	26.3000	69.6750	
0.1	1	0.8107	96.4125	0.1503	13.8625	82.5500	82.5875
	2	0.8107	96.4125	0.1493	13.7375	82.6750	
	3	0.8107	96.4125	0.1504	13.8750	82.5375	
0.2	1	0.8059	95.8125	0.1166	9.6500	86.1625	86.0208
	2	0.8059	95.8125	0.1185	9.8875	85.9250	
	3	0.8059	95.8125	0.1181	9.8375	85.9750	
0.3	1	0.8156	97.0250	0.1146	9.4000	87.6250	87.6167
	2	0.8156	97.0250	0.1152	9.4750	87.5500	
	3	0.8156	97.0250	0.1142	9.3500	87.6750	
0.4	1	0.8056	95.7750	0.0866	5.9000	89.8750	89.8708
	2	0.8056	95.7750	0.0862	5.8500	89.9250	
	3	0.8056	95.7750	0.0871	5.9625	89.8125	

Table B-4 Motor oil removal from pure polyester fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

% Active surfactant	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8091	96.2125	0.7840	93.0750	3.1375	3.1417
	2	0.8091	96.2125	0.7845	93.1375	3.0750	
	3	0.8091	96.2125	0.7834	93.0000	3.2125	
0.02	1	0.8098	96.2971	0.4750	54.4500	41.8471	41.9429
	2	0.8098	96.2971	0.4733	54.2375	42.0596	
	3	0.8098	96.2971	0.4744	54.3750	41.9221	
0.05	1	0.8052	95.7250	0.3231	35.4625	60.2625	60.2458
	2	0.8052	95.7250	0.3243	35.6125	60.1125	
	3	0.8052	95.7250	0.3223	35.3625	60.3625	
0.1	1	0.8078	96.0500	0.1754	17.0000	79.0500	78.9292
	2	0.8078	96.0500	0.1773	17.2375	78.8125	
	3	0.8078	96.0500	0.1764	17.1250	78.9250	
0.2	1	0.8061	95.8375	0.1367	12.1625	83.6750	83.6708
	2	0.8061	95.8375	0.1363	12.1125	83.7250	
	3	0.8061	95.8375	0.1372	12.2250	83.6125	
0.3	1	0.8084	96.1250	0.1145	9.3875	86.7375	86.8042
	2	0.8084	96.1250	0.1139	9.3125	86.8125	
	3	0.8084	96.1250	0.1135	9.2625	86.8625	
0.4	1	0.8081	96.0875	0.0949	6.9375	89.1500	89.0208
	2	0.8081	96.0875	0.0971	7.2125	88.8750	
	3	0.8081	96.0875	0.0958	7.0500	89.0375	

Table B-5 %Detergency from pure cotton fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

%Active surfactant	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	87.21	68.87	68.96	0.4907	0.5267
	2	87.25	68.91	69.01	0.5453	
	3	87.23	68.85	68.95	0.5441	
0.02	1	87.26	68.90	74.24	29.0850	29.1417
	2	87.21	68.86	74.22	29.2098	
	3	87.23	68.83	74.19	29.1304	
0.05	1	87.19	68.87	76.82	43.3952	43.3976
	2	87.24	68.92	76.88	43.4498	
	3	87.24	68.90	76.85	43.3479	
0.1	1	87.26	68.87	78.84	54.2142	54.1962
	2	87.21	68.80	78.76	54.1010	
	3	87.20	68.83	78.80	54.2733	
0.2	1	87.24	68.84	79.87	59.9457	59.7967
	2	87.25	68.89	79.85	59.6950	
	3	87.22	68.86	79.83	59.7495	
0.3	1	87.18	68.92	80.11	61.2815	61.2829
	2	87.23	68.87	80.15	61.4379	
	3	87.25	68.83	80.09	61.1292	
0.4	1	87.24	68.86	80.63	64.0370	64.2508
	2	87.20	68.89	80.66	64.2818	
	3	87.27	68.91	80.74	64.4336	

Table B-6 %Detergency from polyester/cotton blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

%Active surfactant	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %detergency
0	1	84.91	69.14	71.42	14.4548	4.9860
	2	84.72	68.73	68.76	0.1876	
	3	84.97	69.12	69.17	0.3155	
0.02	1	84.91	68.62	71.95	20.4420	20.4310
	2	85.12	68.75	72.08	20.3462	
	3	85.19	68.41	71.85	20.5047	
0.05	1	85.18	69.35	76.02	42.1352	42.5085
	2	85.12	69.28	76.15	43.3803	
	3	85.08	69.23	75.89	42.0101	
0.1	1	84.87	68.95	77.58	54.1972	53.0566
	2	85.13	69.07	77.48	52.3553	
	3	85.10	69.12	77.53	52.6173	
0.2	1	85.26	69.36	78.51	57.5472	57.3853
	2	85.33	69.24	78.48	57.4389	
	3	85.24	69.34	78.43	57.1698	
0.3	1	85.32	69.31	79.06	60.8994	61.6802
	2	85.25	69.17	79.18	62.2512	
	3	85.23	69.25	79.14	61.8899	
0.4	1	85.27	68.82	79.12	62.6140	62.7489
	2	85.03	69.17	79.23	63.4300	
	3	85.22	69.24	79.18	62.2028	

Table B-7 %Detergency from polyester fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 at the optimum salinity (2.83 %wt/v) at different active surfactant concentration

%Active surfactant	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	86.31	69.69	69.70	0.0602	0.0799
	2	86.28	69.64	69.65	0.0601	
	3	86.36	69.62	69.64	0.1195	
0.02	1	86.40	69.72	71.63	11.4508	11.6648
	2	86.34	69.68	71.63	11.7047	
	3	86.34	69.70	71.67	11.8389	
0.05	1	86.30	69.65	74.78	30.8108	30.8252
	2	86.35	69.54	74.69	30.6365	
	3	86.32	69.69	74.85	31.0283	
0.1	1	86.34	69.71	78.11	50.5111	50.5005
	2	86.36	69.67	78.08	50.3895	
	3	86.32	69.68	78.1	50.6010	
0.2	1	86.41	69.58	79.21	57.2193	57.2394
	2	86.35	69.64	79.19	57.1514	
	3	86.36	69.62	79.22	57.3477	
0.3	1	86.38	69.65	79.59	59.4142	59.5729
	2	86.35	69.68	79.61	59.5681	
	3	86.40	69.71	79.68	59.7364	
0.4	1	86.34	69.61	79.88	61.3867	61.4987
	2	86.36	69.57	79.90	61.5247	
	3	86.32	69.66	79.92	61.5846	

Table B-8 Motor oil removal from pure cotton fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8068	95.9250	0.4585	52.3875	43.5375	43.5000
	2	0.8068	95.9250	0.4598	52.5500	43.3750	
	3	0.8068	95.9250	0.4581	52.3375	43.5875	
0.1	1	0.8092	96.2250	0.2422	25.3500	70.8750	70.9125
	2	0.8092	96.2250	0.2408	25.1750	71.0500	
	3	0.8092	96.2250	0.2427	25.4125	70.8125	
0.5	1	0.8051	95.7125	0.2084	21.1250	74.5875	74.5833
	2	0.8051	95.7125	0.2072	20.9750	74.7375	
	3	0.8051	95.7125	0.2097	21.2875	74.4250	
0.8	1	0.8073	95.9875	0.1894	18.7500	77.2375	77.1375
	2	0.8073	95.9875	0.1912	18.9750	77.0125	
	3	0.8073	95.9875	0.1900	18.8250	77.1625	
1	1	0.8085	96.1375	0.1720	16.5750	79.5625	79.4292
	2	0.8085	96.1375	0.1732	16.7250	79.4125	
	3	0.8085	96.1375	0.1740	16.8250	79.3125	
2	1	0.8088	96.175	0.1464	13.3750	82.8000	82.7542
	2	0.8088	96.175	0.1479	13.5625	82.6125	
	3	0.8088	96.175	0.1460	13.3250	82.8500	
2.8	1	0.8097	96.2875	0.1337	11.7875	84.1287	84.1047
	2	0.8097	96.2875	0.1385	12.3875	83.9011	
	3	0.8097	96.2875	0.1354	12.0000	84.2843	

Table B-9 Motor oil removal from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8097	96.2875	0.5027	57.9125	38.3750	38.3375
	2	0.8097	96.2875	0.5030	57.9500	38.3375	
	3	0.8097	96.2875	0.5033	57.9875	38.3000	
0.1	1	0.8095	96.2625	0.2635	28.0125	68.2500	68.3333
	2	0.8095	96.2625	0.2617	27.7875	68.4750	
	3	0.8095	96.2625	0.2633	27.9875	68.2750	
0.5	1	0.8111	96.4625	0.2376	24.7750	71.6875	71.7792
	2	0.8111	96.4625	0.2362	24.6000	71.8625	
	3	0.8111	96.4625	0.2368	24.6750	71.7875	
0.8	1	0.8114	96.5000	0.2063	20.8625	75.6375	75.7208
	2	0.8114	96.5000	0.2041	20.5875	75.9125	
	3	0.8114	96.5000	0.2065	20.8875	75.6125	
1	1	0.8120	96.5750	0.1933	19.2375	77.3375	77.3875
	2	0.8120	96.5750	0.1922	19.1000	77.4750	
	3	0.8120	96.5750	0.1932	19.2250	77.3500	
2	1	0.8107	96.4125	0.1648	15.6750	80.7375	80.6417
	2	0.8107	96.4125	0.1653	15.7375	80.6750	
	3	0.8107	96.4125	0.1666	15.9000	80.5125	
2.8	1	0.8094	96.2500	0.1523	14.1125	82.1375	82.2833
	2	0.8094	96.2500	0.1506	13.9000	82.3500	
	3	0.8094	96.2500	0.1505	13.8875	82.3625	

Table B-10 Motor oil removal from pure polyester fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Average soil removal (%)
0	1	0.8067	95.9125	0.5023	57.8625	38.0500	37.9833
	2	0.8067	95.9125	0.5037	58.0375	37.8750	
	3	0.8067	95.9125	0.5025	57.8875	38.0250	
0.1	1	0.8059	95.8125	0.2929	31.6875	64.1250	64.0083
	2	0.8059	95.8125	0.2949	31.9375	63.8750	
	3	0.8059	95.8125	0.2937	31.7875	64.0250	
0.5	1	0.8108	96.4250	0.2726	29.1500	67.2750	67.2000
	2	0.8108	96.4250	0.2723	29.1125	67.3125	
	3	0.8108	96.4250	0.2747	29.4125	67.0125	
0.8	1	0.8088	96.1750	0.2579	27.3125	68.8625	68.9417
	2	0.8088	96.1750	0.2567	27.1625	69.0125	
	3	0.8088	96.1750	0.2572	27.2250	68.9500	
1	1	0.8074	96.0000	0.2374	24.7500	71.2500	71.2375
	2	0.8074	96.0000	0.2361	24.5875	71.4125	
	3	0.8074	96.0000	0.2390	24.9500	71.0500	
2	1	0.8063	95.8625	0.2155	22.0125	73.8500	73.9250
	2	0.8063	95.8625	0.2142	21.8500	74.0125	
	3	0.8063	95.8625	0.2150	21.9500	73.9125	
2.8	1	0.8099	96.3125	0.1980	19.8250	76.4875	77.4250
	2	0.8099	96.3125	0.1866	18.4000	77.9125	
	3	0.8099	96.3125	0.1869	18.4375	77.8750	

Table B-11 %Detergency from pure cotton fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	87.19	68.92	71.91	16.3656	16.3846
	2	87.23	68.88	71.86	16.2398	
	3	87.21	68.90	71.93	16.5483	
0.1	1	87.28	68.94	76.62	41.8757	41.9760
	2	87.22	68.96	76.63	42.0044	
	3	87.27	68.91	76.63	42.0479	
0.5	1	87.18	68.89	77.07	44.7239	44.6264
	2	87.19	68.93	77.05	44.4688	
	3	87.23	68.88	77.08	44.6866	
0.8	1	87.26	68.91	77.45	46.5395	46.5342
	2	87.22	68.96	77.43	46.3855	
	3	87.23	68.87	77.44	46.6776	
1	1	87.19	68.95	77.72	48.0811	48.3052
	2	87.24	68.89	77.76	48.3379	
	3	87.21	68.92	77.79	48.4964	
2	1	87.23	68.92	78.67	53.2496	53.3211
	2	87.20	68.92	78.66	53.2823	
	3	87.25	68.89	78.70	53.4314	
2.8	1	87.27	68.91	78.95	54.6841	54.6878
	2	87.22	68.96	78.95	54.7097	
	3	87.25	68.94	78.95	54.6696	

Table B-12 %Detergency from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	85.36	69.24	71.05	11.2283	11.3962
	2	85.11	69.12	70.93	11.3196	
	3	85.28	69.13	71.01	11.6409	
0.1	1	85.14	69.31	75.60	39.7347	39.6294
	2	85.06	69.26	75.51	39.5570	
	3	85.19	69.33	75.61	39.5965	
0.5	1	85.25	69.24	76.02	42.3485	42.3093
	2	85.31	69.18	76.03	42.4675	
	3	85.27	69.17	75.95	42.1118	
0.8	1	85.37	68.92	76.32	44.9848	44.9849
	2	85.26	69.28	76.49	45.1189	
	3	85.28	69.16	76.39	44.8511	
1	1	85.19	69.24	76.58	46.0188	45.9240
	2	85.21	69.18	76.53	45.8515	
	3	85.15	69.29	76.57	45.9016	
2	1	85.25	69.27	77.05	48.6859	48.6651
	2	85.25	69.05	76.91	48.5185	
	3	85.23	69.10	76.97	48.7911	
2.8	1	85.17	69.17	77.27	50.6250	50.7110
	2	85.03	69.28	77.29	50.8571	
	3	85.20	69.07	77.24	50.6510	

Table B-13 %Detergency from pure polyester fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the different salinity

NaCl concentration	Sample No.	Reflectance of the unsoiled swatches before washing (Co)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	86.02	69.49	70.95	8.8324	8.8045
	2	86.18	69.55	70.99	8.6590	
	3	86.22	69.52	71.01	8.9222	
0.1	1	86.15	69.51	75.21	34.2548	34.2975
	2	86.28	69.46	75.20	34.1260	
	3	86.18	69.49	75.25	34.5117	
0.5	1	86.29	69.51	75.68	36.7700	36.6263
	2	86.14	69.55	75.61	36.5280	
	3	86.17	69.44	75.56	36.5810	
0.8	1	86.24	69.52	76.05	39.0550	38.9354
	2	86.16	69.41	75.92	38.8657	
	3	86.12	69.43	75.92	38.8856	
1	1	86.28	69.48	76.42	41.3095	41.2209
	2	86.07	69.54	76.35	41.1978	
	3	86.30	69.51	76.42	41.1554	
2	1	86.24	69.56	76.88	43.8849	44.1206
	2	86.11	69.47	76.84	44.2909	
	3	86.25	69.48	76.89	44.1860	
2.8	1	86.15	69.56	77.12	45.5696	45.4642
	2	86.26	69.45	77.07	45.3302	
	3	86.12	69.48	77.05	45.4928	

Table B-14 Motor oil removal from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the optimum salinity by using 2 rinses

Sample number	Cleaning step	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Different soil removal (%)
1	W	0.8083	96.1125	0.5228	60.4250	35.6875	35.6875
	R1	0.8083	96.1125	0.1986	19.9000	76.2125	40.5250
	R2	0.8083	96.1125	0.1424	12.8750	83.2375	7.0250
2	W	0.8085	96.1375	0.5349	61.9375	34.2000	34.2000
	R1	0.8085	96.1375	0.1995	20.0125	76.1250	41.9250
	R2	0.8085	96.1375	0.1601	15.0875	81.0500	4.9250
3	W	0.8081	96.0875	0.5394	62.5000	33.5875	33.5875
	R1	0.8081	96.0875	0.1981	19.8375	76.2500	42.6625
	R2	0.8081	96.0875	0.1503	13.8625	82.2250	5.9750
4	W	0.8087	96.1625	0.5203	60.1125	36.0500	36.05
	R1	0.8087	96.1625	0.1907	18.9125	77.2500	41.2000
	R2	0.8087	96.1625	0.1557	14.5375	81.6250	4.3750

Table B-15 Motor oil removal from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the optimum salinity by using 4 rinses

Sample number	Cleaning step	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Different soil removal (%)
1	W	0.8087	96.1625	0.5182	59.8500	36.3125	36.3125
	R1	0.8087	96.1625	0.1809	17.6875	78.4750	42.1625
	R2	0.8087	96.1625	0.1409	12.6875	83.4750	5.0000
	R3	0.8087	96.1625	0.1282	11.1000	85.0625	1.5875
	R4	0.8087	96.1625	0.1218	10.3000	85.8625	0.8000
2	W	0.8086	96.1500	0.5391	62.4625	33.6875	33.6875
	R1	0.8086	96.1500	0.1899	18.8125	77.3375	43.6500
	R2	0.8086	96.1500	0.1587	14.9125	81.2375	3.9000
	R3	0.8086	96.1500	0.1462	13.3500	82.8000	1.5625
	R4	0.8086	96.1500	0.1411	12.7125	83.4375	0.6375
3	W	0.8082	96.1000	0.5237	60.5375	35.5625	35.5625
	R1	0.8082	96.1000	0.2043	20.6125	75.4875	39.9250
	R2	0.8082	96.1000	0.1577	14.7875	81.3125	5.8250
	R3	0.8082	96.1000	0.1461	13.3375	82.7625	1.4500
	R4	0.8082	96.1000	0.1436	13.0250	83.0750	0.3125
4	W	0.8080	96.0750	0.5303	61.3625	34.7125	34.7125
	R1	0.8080	96.0750	0.1913	18.9875	77.0875	42.3750
	R2	0.8080	96.0750	0.1469	13.4375	82.6375	5.5500
	R3	0.8080	96.0750	0.13745	12.2563	83.8187	1.1812
	R4	0.8080	96.0750	0.1335	11.7625	84.3125	0.4938

Table B-16 Motor oil removal from polyester/cotton (65/35) blend fabrics using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 %active surfactant concentration at the optimum salinity by using 6 rinses

Sample number	Cleaning step	Reflectance of extracted soil before washing	Amount of applied soiled (%)	Reflectance of extracted soil after washing	Amount of residual soil (%)	Soil removal (%)	Different soil removal (%)
1	W	0.8023	95.3625	0.5129	59.1875	36.1750	36.1750
	W,R1	0.8023	95.3625	0.2595	27.5125	67.8500	31.6750
	R2	0.8023	95.3625	0.1316	11.5250	83.8375	15.9875
	R3	0.8023	95.3625	0.1250	10.7000	84.6625	0.8250
	R4	0.8023	95.3625	0.1245	10.6375	84.7250	0.0625
	R5	0.8023	95.3625	0.1244	10.6250	84.7375	0.0125
	R6	0.8023	95.3625	0.1244	10.6250	84.7375	0.0000
2	W	0.8041	95.5875	0.5383	62.3625	33.2250	33.2250
	R1	0.8041	95.5875	0.3097	33.7875	61.8000	28.5750
	R2	0.8041	95.5875	0.1473	13.4875	82.1000	20.3000
	R3	0.8041	95.5875	0.1378	12.3000	83.2875	1.1875
	R4	0.8041	95.5875	0.1320	11.5750	84.0125	0.7250
	R5	0.8041	95.5875	0.1319	11.5625	84.0250	0.0125
	,R6	0.8041	95.5875	0.1318	11.5500	84.0375	0.0125
3	W	0.8038	95.5500	0.5377	62.2875	33.2625	33.2625
	R1	0.8038	95.5500	0.2999	32.5625	62.9875	29.7250
	R2	0.8038	95.5500	0.1632	15.4750	80.0750	17.0875
	R3	0.8038	95.5500	0.1463	13.3625	82.1875	2.1125
	R4	0.8038	95.5500	0.1431	12.9625	82.5875	0.4000
	R5	0.8038	95.5500	0.1430	12.9500	82.6000	0.0125
	R6	0.8038	95.5500	0.1430	12.9500	82.6000	0.0000
4	W	0.8046	95.6500	0.5537	64.2875	31.3625	31.3625
	R1	0.8046	95.6500	0.3102	33.8500	61.8000	30.4375
	R2	0.8046	95.6500	0.1593	14.9925	80.6575	18.8575
	R3	0.8046	95.6500	0.1273	10.9875	84.6625	4.0050
	R4	0.8046	95.6500	0.1272	10.9750	84.6750	0.0125
	R5	0.8046	95.6500	0.1271	10.9625	84.6875	0.0125
	R6	0.8046	95.6500	0.1271	10.9625	84.6875	0.0000

Table B-17 Dynamic interfacial tension of washing or rinsing solution and dyed oil using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the optimum salinity by using 2 rinses

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
1	W	0	0.044	50	0.88	0.0509	50	1.018	1.23	2487	0.0162
		200	0.044	50	0.88	0.0509	50	1.018	1.24	2445	0.0161
		400	0.044	50	0.88	0.0509	50	1.018	1.19	2445	0.0142
		600	0.044	50	0.88	0.0509	50	1.018	1.12	2387	0.0113
		800	0.044	50	0.88	0.0509	50	1.018	1.11	2218	0.0095
		1000	0.044	50	0.88	0.0509	50	1.018	1.08	2221	0.0088
		1200	0.044	50	0.88	0.0509	50	1.018	1.02	2356	0.0083
	R1	0	0.0435	50	0.87	0.0512	50	1.024	2.25	3828	0.2624
		20	0.0435	50	0.87	0.0512	50	1.024	2.2	3814	0.2435
		40	0.0435	50	0.87	0.0512	50	1.024	2.07	3805	0.2019
		60	0.0435	50	0.87	0.0512	50	1.024	1.65	3800	0.102
		80	0.0435	50	0.87	0.0512	50	1.024	1.6	3708	0.0885
		100	0.0435	50	0.87	0.0512	50	1.024	1.54	3629	0.0756
		120	0.0435	50	0.87	0.0512	50	1.024	1.55	3625	0.0769
		140	0.0435	50	0.87	0.0512	50	1.024	1.54	3628	0.0756
		160	0.0435	50	0.87	0.0512	50	1.024	1.56	3626	0.0785
		180	0.0435	50	0.87	0.0512	50	1.024	1.55	3620	0.0767
	R2	0	0.044	50	0.888	0.0515	50	1.03	-	-	23.5
		20	0.044	50	0.888	0.0515	50	1.03	-	-	23.45
		40	0.044	50	0.888	0.0515	50	1.03	-	-	23.34
		60	0.044	50	0.888	0.0515	50	1.03	-	-	23.19
		80	0.044	50	0.888	0.0515	50	1.03	-	-	23.14
		100	0.044	50	0.888	0.0515	50	1.03	-	-	22.92
		120	0.044	50	0.888	0.0515	50	1.03	-	-	22.86

Table B-17 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
2	W	0	0.0437	50	0.874	0.0502	50	1.004	1.71	3957	0.1039
		200	0.0437	50	0.874	0.0502	50	1.004	1.68	3624	0.0827
		400	0.0437	50	0.874	0.0502	50	1.004	1.51	3802	0.0661
		600	0.0437	50	0.874	0.0502	50	1.004	1.3	3871	0.0437
		800	0.0437	50	0.874	0.0502	50	1.004	1.18	3220	0.0226
		1000	0.0437	50	0.874	0.0502	50	1.004	1.08	2897	0.014
		1200	0.0437	50	0.874	0.0502	50	1.004	1.01	2405	0.0079
		R1	0	0.0441	50	0.882	0.0506	50	1.012	2.12	3892
	20		0.0441	50	0.882	0.0506	50	1.012	2.02	3868	0.1637
	40		0.0441	50	0.882	0.0506	50	1.012	1.96	3868	0.1495
	60		0.0441	50	0.882	0.0506	50	1.012	1.58	3859	0.078
	80		0.0441	50	0.882	0.0506	50	1.012	1.56	3858	0.075
	100		0.0441	50	0.882	0.0506	50	1.012	1.52	3861	0.0695
	120		0.0441	50	0.882	0.0506	50	1.012	1.52	3861	0.0695
	140		0.0441	50	0.882	0.0506	50	1.012	1.51	3859	0.068
	160		0.0441	50	0.882	0.0506	50	1.012	1.51	3860	0.0681
	180		0.0441	50	0.882	0.0506	50	1.012	1.52	3861	0.0695
	R2	0	0.0444	50	0.888	0.0511	50	1.022	-	-	23.29
		20	0.0444	50	0.888	0.0511	50	1.022	-	-	23.2
		40	0.0444	50	0.888	0.0511	50	1.022	-	-	23.15
		60	0.0444	50	0.888	0.0511	50	1.022	-	-	23.08
		80	0.0444	50	0.888	0.0511	50	1.022	-	-	23.04
		100	0.0444	50	0.888	0.0511	50	1.022	-	-	22.89
		120	0.0444	50	0.888	0.0511	50	1.022	-	-	22.83

Table B-17 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
3	W	0	0.0441	50	0.882	0.0513	50	1.026	1.75	3864	0.1095
		200	0.0441	50	0.882	0.0513	50	1.026	1.68	3725	0.09
		400	0.0441	50	0.882	0.0513	50	1.026	1.62	3856	0.0865
		600	0.0441	50	0.882	0.0513	50	1.026	1.56	3641	0.0689
		800	0.0441	50	0.882	0.0513	50	1.026	1.15	3205	0.0214
		1000	0.0441	50	0.882	0.0513	50	1.026	1.05	3347	0.0177
		1200	0.0441	50	0.882	0.0513	50	1.026	0.91	2812	0.0088
		R1	0	0.044	50	0.88	0.0511	50	1.022	2.12	3621
	20		0.044	50	0.88	0.0511	50	1.022	2.1	3622	0.1786
	40		0.044	50	0.88	0.0511	50	1.022	1.88	3621	0.1281
	60		0.044	50	0.88	0.0511	50	1.022	1.62	3622	0.082
	80		0.044	50	0.88	0.0511	50	1.022	1.61	3622	0.0805
	100		0.044	50	0.88	0.0511	50	1.022	1.51	3623	0.0664
	120		0.044	50	0.88	0.0511	50	1.022	1.51	3611	0.0651
	140		0.044	50	0.88	0.0511	50	1.022	1.5	3616	0.064
	160		0.044	50	0.88	0.0511	50	1.022	1.51	3611	0.0651
	180		0.044	50	0.88	0.0511	50	1.022	1.51	3609	0.065
	R2	0	0.0444	50	0.888	0.0508	50	1.016	-	-	23.28
		20	0.0444	50	0.888	0.0508	50	1.016	-	-	23.25
		40	0.0444	50	0.888	0.0508	50	1.016	-	-	23.18
		60	0.0444	50	0.888	0.0508	50	1.016	-	-	23.13
		80	0.0444	50	0.888	0.0508	50	1.016	-	-	23.11
		100	0.0444	50	0.888	0.0508	50	1.016	-	-	23.02
		120	0.0444	50	0.888	0.0508	50	1.016	-	-	22.92

Table B-18 Dynamic interfacial tension of washing or rinsing solution and dyed oil using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the optimum salinity by using 4 rinses

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
1	W	0	0.0448	50	0.896	0.0508	50	1.016	1.08	3274	0.0165
		200	0.0448	50	0.896	0.0508	50	1.016	1.06	3205	0.015
		400	0.0448	50	0.896	0.0508	50	1.016	1.01	3215	0.013
		600	0.0448	50	0.896	0.0508	50	1.016	0.95	3231	0.011
		800	0.0448	50	0.896	0.0508	50	1.016	0.9	3264	0.0095
		1000	0.0448	50	0.896	0.0508	50	1.016	0.87	3120	0.0079
		1200	0.0448	50	0.896	0.0508	50	1.016	0.82	3104	0.0065
		R1	0	0.0443	50	0.886	0.0511	50	1.022	2.35	4122
	20		0.0443	50	0.886	0.0511	50	1.022	2.32	4120	0.2943
	40		0.0443	50	0.886	0.0511	50	1.022	2.25	4120	0.2685
	60		0.0443	50	0.886	0.0511	50	1.022	1.85	4118	0.1491
	80		0.0443	50	0.886	0.0511	50	1.022	1.75	4117	0.1261
	100		0.0443	50	0.886	0.0511	50	1.022	1.74	4116	0.1239
	120		0.0443	50	0.886	0.0511	50	1.022	1.73	4114	0.1217
	140		0.0443	50	0.886	0.0511	50	1.022	1.71	4114	0.1175
	160		0.0443	50	0.886	0.0511	50	1.022	1.7	4113	0.1154
	180		0.0443	50	0.886	0.0511	50	1.022	1.71	4113	0.1174
	R2	0	0.0444	50	0.888	0.0501	50	1.002	-	-	4.16
		20	0.0444	50	0.888	0.0501	50	1.002	-	-	4.05
		40	0.0444	50	0.888	0.0501	50	1.002	-	-	3.96
		60	0.0444	50	0.888	0.0501	50	1.002	-	-	3.81
		80	0.0444	50	0.888	0.0501	50	1.002	-	-	3.76
		100	0.0444	50	0.888	0.0501	50	1.002	-	-	3.71
		120	0.0444	50	0.888	0.0501	50	1.002	-	-	3.65

Table B-18 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement			
			Upper phase			Lower phase			Upper phase/Lower phase			
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)	
1	R3	0	0.0444	50	0.888	0.0492	50	0.984	-	-	21.67	
		20	0.0444	50	0.888	0.0492	50	0.984	-	-	21.33	
		40	0.0444	50	0.888	0.0492	50	0.984	-	-	21.26	
		60	0.0444	50	0.888	0.0492	50	0.984	-	-	21.07	
		80	0.0444	50	0.888	0.0492	50	0.984	-	-	20.77	
		100	0.0444	50	0.888	0.0492	50	0.984	-	-	20.53	
	R4	120	0.0444	50	0.888	0.0492	50	0.984	-	-	20.32	
		0	0.0444	50	0.888	0.0504	50	1.008	-	-	23.43	
		20	0.0444	50	0.888	0.0504	50	1.008	-	-	23.35	
		40	0.0444	50	0.888	0.0504	50	1.008	-	-	23.2	
		60	0.0444	50	0.888	0.0504	50	1.008	-	-	23.17	
		80	0.0444	50	0.888	0.0504	50	1.008	-	-	22.9	
		100	0.0444	50	0.888	0.0504	50	1.008	-	-	22.72	
		120	0.0444	50	0.888	0.0504	50	1.008	-	-	22.66	
2	W	0	0.0449	50	0.898	0.0504	50	1.008	2.08	3020	0.1006	
		200	0.0449	50	0.898	0.0504	50	1.008	1.9	3159	0.0839	
		400	0.0449	50	0.898	0.0504	50	1.008	1.72	3128	0.061	
		600	0.0449	50	0.898	0.0504	50	1.008	1.63	2955	0.0463	
		800	0.0449	50	0.898	0.0504	50	1.008	1.39	2803	0.0259	
		1000	0.0449	50	0.898	0.0504	50	1.008	1.28	2685	0.0185	
		1200	0.0449	50	0.898	0.0504	50	1.008	1.03	2625	0.0085	
		RI	0	0.0442	50	0.884	0.0512	50	1.024	2.31	3380	0.2013
			20	0.0442	50	0.884	0.0512	50	1.024	2.28	3378	0.1933
			40	0.0442	50	0.884	0.0512	50	1.024	2.25	3378	0.1858
	60		0.0442	50	0.884	0.0512	50	1.024	2.12	3375	0.1551	
	80		0.0442	50	0.884	0.0512	50	1.024	2.02	3376	0.1343	
	100		0.0442	50	0.884	0.0512	50	1.024	1.99	3377	0.1285	
	120		0.0442	50	0.884	0.0512	50	1.024	1.98	3375	0.1264	
	140		0.0442	50	0.884	0.0512	50	1.024	1.97	3372	0.1243	
	160		0.0442	50	0.884	0.0512	50	1.024	1.97	3374	0.1244	
	180		0.0442	50	0.884	0.0512	50	1.024	1.96	3372	0.1224	

Table B-18 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement			
			Upper phase			Lower phase			Upper phase/Lower phase			
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)	
2	R2	0	0.0444	50	0.888	0.0511	50	1.022	-	-	3.88	
		20	0.0444	50	0.888	0.0511	50	1.022	-	-	3.79	
		40	0.0444	50	0.888	0.0511	50	1.022	-	-	3.66	
		60	0.0444	50	0.888	0.0511	50	1.022	-	-	3.47	
		80	0.0444	50	0.888	0.0511	50	1.022	-	-	3.31	
		100	0.0444	50	0.888	0.0511	50	1.022	-	-	3.25	
		120	0.0444	50	0.888	0.0511	50	1.022	-	-	2.96	
		R3	0	0.0444	50	0.888	0.0509	50	1.018	-	-	20.96
	20		0.0444	50	0.888	0.0509	50	1.018	-	-	20.73	
	40		0.0444	50	0.888	0.0509	50	1.018	-	-	20.58	
	60		0.0444	50	0.888	0.0509	50	1.018	-	-	20.49	
	80		0.0444	50	0.888	0.0509	50	1.018	-	-	20.38	
	100		0.0444	50	0.888	0.0509	50	1.018	-	-	20.31	
	120		0.0444	50	0.888	0.0509	50	1.018	-	-	20.26	
	R4		0	0.0444	50	0.888	0.0504	50	1.008	-	-	23.41
		20	0.0444	50	0.888	0.0504	50	1.008	-	-	23.33	
		40	0.0444	50	0.888	0.0504	50	1.008	-	-	23.17	
		60	0.0444	50	0.888	0.0504	50	1.008	-	-	23.06	
		80	0.0444	50	0.888	0.0504	50	1.008	-	-	22.81	
		100	0.0444	50	0.888	0.0504	50	1.008	-	-	22.75	
		120	0.0444	50	0.888	0.0504	50	1.008	-	-	22.82	
		3	W	0	0.044	50	0.88	0.0503	50	1.006	1.88	3573
	200			0.044	50	0.88	0.0503	50	1.006	1.81	3608	0.0946
	400			0.044	50	0.88	0.0503	50	1.006	1.73	3334	0.0705
600	0.044			50	0.88	0.0503	50	1.006	1.52	3309	0.0471	
800	0.044			50	0.88	0.0503	50	1.006	1.33	3183	0.0292	
1000	0.044			50	0.88	0.0503	50	1.006	1.06	3082	0.0139	
1200	0.044			50	0.88	0.0503	50	1.006	0.98	2521	0.0077	

Table B-18 (continue)

Run number	Process	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
3	R1	0	0.0438	50	0.876	0.0509	50	1.018	2.21	3806	0.2267
		20	0.0438	50	0.876	0.0509	50	1.018	2.2	3804	0.2234
		40	0.0438	50	0.876	0.0509	50	1.018	2.16	3804	0.2114
		60	0.0438	50	0.876	0.0509	50	1.018	2	3802	0.1676
		80	0.0438	50	0.876	0.0509	50	1.018	1.89	3800	0.1413
		100	0.0438	50	0.876	0.0509	50	1.018	1.86	3800	0.1347
		120	0.0438	50	0.876	0.0509	50	1.018	1.84	3796	0.1301
		140	0.0438	50	0.876	0.0509	50	1.018	1.83	3799	0.1282
		160	0.0438	50	0.876	0.0509	50	1.018	1.83	3795	0.128
	180	0.0438	50	0.876	0.0509	50	1.018	1.83	3799	0.1282	
	R2	0	0.0444	50	0.888	0.0513	50	1.026	-	-	3.89
		20	0.0444	50	0.888	0.0513	50	1.026	-	-	3.75
		40	0.0444	50	0.888	0.0513	50	1.026	-	-	3.69
		60	0.0444	50	0.888	0.0513	50	1.026	-	-	3.62
		80	0.0444	50	0.888	0.0513	50	1.026	-	-	3.48
		100	0.0444	50	0.888	0.0513	50	1.026	-	-	3.35
	R3	0	0.0444	50	0.888	0.0502	50	1.004	-	-	21.11
		20	0.0444	50	0.888	0.0502	50	1.004	-	-	20.84
		40	0.0444	50	0.888	0.0502	50	1.004	-	-	20.77
		60	0.0444	50	0.888	0.0502	50	1.004	-	-	20.61
		80	0.0444	50	0.888	0.0502	50	1.004	-	-	20.55
		100	0.0444	50	0.888	0.0502	50	1.004	-	-	20.5
		120	0.0444	50	0.888	0.0502	50	1.004	-	-	20.43

Table B-18 (continue)

Run number	Process	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
3	R4	0	0.0444	50	0.888	0.0511	50	1.022	-	-	23.98
		20	0.0444	50	0.888	0.0511	50	1.022	-	-	23.9
		40	0.0444	50	0.888	0.0511	50	1.022	-	-	23.75
		60	0.0444	50	0.888	0.0511	50	1.022	-	-	23.68
		80	0.0444	50	0.888	0.0511	50	1.022	-	-	23.63
		100	0.0444	50	0.888	0.0511	50	1.022	-	-	23.52
		120	0.0444	50	0.888	0.0511	50	1.022	-	-	23.48

Table B-19 Dynamic interfacial tension of washing or rinsing solution and dyed oil using optimum formulation: 1.5wt% Dowfax 8390, 5wt% AOT and 5wt% Span 80 of 0.115 active surfactant concentration at the optimum salinity by using 6 rinses

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
1	W	0	0.0449	50	0.898	0.0504	50	1.008	1.16	3214	0.0181
		200	0.0449	50	0.898	0.0504	50	1.008	1.12	3226	0.0164
		400	0.0449	50	0.898	0.0504	50	1.008	1.08	3157	0.0141
		600	0.0449	50	0.898	0.0504	50	1.008	1.05	3126	0.0127
		800	0.0449	50	0.898	0.0504	50	1.008	1.02	3088	0.0114
		1000	0.0449	50	0.898	0.0504	50	1.008	1.01	3073	0.0109
		1200	0.0449	50	0.898	0.0504	50	1.008	0.97	3076	0.0097

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
1	R1	0	0.0432	50	0.864	0.0512	50	1.024	2.72	4372	0.6283
		20	0.0432	50	0.864	0.0512	50	1.024	2.7	4370	0.614
		40	0.0432	50	0.864	0.0512	50	1.024	2.67	4370	0.5938
		60	0.0432	50	0.864	0.0512	50	1.024	2.61	4370	0.5546
		80	0.0432	50	0.864	0.0512	50	1.024	2.15	4368	0.3097
		100	0.0432	50	0.864	0.0512	50	1.024	2.02	4368	0.2569
		120	0.0432	50	0.864	0.0512	50	1.024	1.98	4366	0.2417
		140	0.0432	50	0.864	0.0512	50	1.024	1.97	4365	0.238
		160	0.0432	50	0.864	0.0512	50	1.024	1.97	4362	0.2376
	180	0.0432	50	0.864	0.0512	50	1.024	1.96	4365	0.2343	
	R2	20	0.0421	50	0.842	0.0528	50	1.056	2.96	6223	1.6406
		40	0.0421	50	0.842	0.0528	50	1.056	2.76	6023	1.2459
		60	0.0421	50	0.842	0.0528	50	1.056	2.75	5890	1.1785
		80	0.0421	50	0.842	0.0528	50	1.056	2.79	5602	1.1133
		100	0.0421	50	0.842	0.0528	50	1.056	2.86	5481	1.148
		120	0.0421	50	0.842	0.0528	50	1.056	2.61	5211	1.0548
	R3	0	0.0444	50	0.888	0.0502	50	1.004	-	-	20.61
		20	0.0444	50	0.888	0.0502	50	1.004	-	-	20.49
		40	0.0444	50	0.888	0.0502	50	1.004	-	-	20.04
		60	0.0444	50	0.888	0.0502	50	1.004	-	-	19.86
		80	0.0444	50	0.888	0.0502	50	1.004	-	-	19.74
		100	0.0444	50	0.888	0.0502	50	1.004	-	-	19.55
		120	0.0444	50	0.888	0.0502	50	1.004	-	-	19.32
	R4	0	0.0444	50	0.888	0.0511	50	1.022	-	-	24.63
		20	0.0444	50	0.888	0.0511	50	1.022	-	-	24.57
		40	0.0444	50	0.888	0.0511	50	1.022	-	-	24.11
		60	0.0444	50	0.888	0.0511	50	1.022	-	-	23.9
		80	0.0444	50	0.888	0.0511	50	1.022	-	-	23.63
		100	0.0444	50	0.888	0.0511	50	1.022	-	-	23.47
		120	0.0444	50	0.888	0.0511	50	1.022	-	-	23.25

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
1	R5	0	0.0444	50	0.888	0.052	50	1.04	-	-	24.54
		20	0.0444	50	0.888	0.052	50	1.04	-	-	24.33
		40	0.0444	50	0.888	0.052	50	1.04	-	-	24.19
		60	0.0444	50	0.888	0.052	50	1.04	-	-	24.08
		80	0.0444	50	0.888	0.052	50	1.04	-	-	23.84
		100	0.0444	50	0.888	0.052	50	1.04	-	-	23.62
		120	0.0444	50	0.888	0.052	50	1.04	-	-	23.54
	R6	0	0.0444	50	0.888	0.0508	50	1.016	-	-	24.61
		20	0.0444	50	0.888	0.0508	50	1.016	-	-	24.56
		40	0.0444	50	0.888	0.0508	50	1.016	-	-	24.23
		60	0.0444	50	0.888	0.0508	50	1.016	-	-	23.99
		80	0.0444	50	0.888	0.0508	50	1.016	-	-	23.79
		100	0.0444	50	0.888	0.0508	50	1.016	-	-	23.68
		120	0.0444	50	0.888	0.0508	50	1.016	-	-	23.57
2	W	0	0.0426	50	0.852	0.0512	50	1.024	1.85	3867	0.1237
		200	0.0426	50	0.852	0.0512	50	1.024	1.82	3502	0.0966
		400	0.0426	50	0.852	0.0512	50	1.024	1.66	3485	0.0726
		600	0.0426	50	0.852	0.0512	50	1.024	1.54	3260	0.0507
		800	0.0426	50	0.852	0.0512	50	1.024	1.38	3155	0.0342
		1000	0.0426	50	0.852	0.0512	50	1.024	1.12	3085	0.0175
		1200	0.0426	50	0.852	0.0512	50	1.024	1.02	2324	0.0101

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
2	R1	0	0.0402	50	0.804	0.0524	50	1.048	2.33	4261	0.5721
		20	0.0402	50	0.804	0.0524	50	1.048	2.3	4260	0.55
		40	0.0402	50	0.804	0.0524	50	1.048	2.26	4258	0.5213
		60	0.0402	50	0.804	0.0524	50	1.048	2.23	4256	0.5004
		80	0.0402	50	0.804	0.0524	50	1.048	1.79	4255	0.2587
		100	0.0402	50	0.804	0.0524	50	1.048	1.76	4258	0.2462
		120	0.0402	50	0.804	0.0524	50	1.048	1.75	4255	0.2417
		140	0.0402	50	0.804	0.0524	50	1.048	1.74	4252	0.2373
		160	0.0402	50	0.804	0.0524	50	1.048	1.74	4251	0.2371
	180	0.0402	50	0.804	0.0524	50	1.048	1.73	4255	0.2335	
	R2	0	0.0401	50	0.802	0.0537	50	1.074	3.26	5209	2.3418
		20	0.0401	50	0.802	0.0537	50	1.074	3.21	5210	2.2366
		40	0.0401	50	0.802	0.0537	50	1.074	2.76	5096	1.3601
		60	0.0401	50	0.802	0.0537	50	1.074	2.61	5082	1.1439
		80	0.0401	50	0.802	0.0537	50	1.074	2.63	4832	1.0581
		100	0.0401	50	0.802	0.0537	50	1.074	2.64	4733	1.0268
		120	0.0401	50	0.802	0.0537	50	1.074	2.55	4682	1.0094
	R3	0	0.0444	50	0.888	0.0511	50	1.022	-	-	19.92
		20	0.0444	50	0.888	0.0511	50	1.022	-	-	19.67
		40	0.0444	50	0.888	0.0511	50	1.022	-	-	19.52
		60	0.0444	50	0.888	0.0511	50	1.022	-	-	19.48
		80	0.0444	50	0.888	0.0511	50	1.022	-	-	19.23
		100	0.0444	50	0.888	0.0511	50	1.022	-	-	19.11
	R4	0	0.0444	50	0.888	0.0508	50	1.016	-	-	23.65
		20	0.0444	50	0.888	0.0508	50	1.016	-	-	23.22
		40	0.0444	50	0.888	0.0508	50	1.016	-	-	23.06
		60	0.0444	50	0.888	0.0508	50	1.016	-	-	22.91
		80	0.0444	50	0.888	0.0508	50	1.016	-	-	22.8
		100	0.0444	50	0.888	0.0508	50	1.016	-	-	22.64
		120	0.0444	50	0.888	0.0508	50	1.016	-	-	22.51

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
2	R5	0	0.0444	50	0.888	0.0524	50	1.048	-	-	24.57
		20	0.0444	50	0.888	0.0524	50	1.048	-	-	24.39
		40	0.0444	50	0.888	0.0524	50	1.048	-	-	24.22
		60	0.0444	50	0.888	0.0524	50	1.048	-	-	24.08
		80	0.0444	50	0.888	0.0524	50	1.048	-	-	23.92
		100	0.0444	50	0.888	0.0524	50	1.048	-	-	23.75
		120	0.0444	50	0.888	0.0524	50	1.048	-	-	23.6
	R6	0	0.0444	50	0.888	0.0506	50	1.012	-	-	24.47
		20	0.0444	50	0.888	0.0506	50	1.012	-	-	24.36
		40	0.0444	50	0.888	0.0506	50	1.012	-	-	24.14
		60	0.0444	50	0.888	0.0506	50	1.012	-	-	23.91
		80	0.0444	50	0.888	0.0506	50	1.012	-	-	23.82
		100	0.0444	50	0.888	0.0506	50	1.012	-	-	23.69
		120	0.0444	50	0.888	0.0506	50	1.012	-	-	23.6
3	W	0	0.0435	50	0.87	0.0503	50	1.006	1.85	3641	0.1063
		200	0.0435	50	0.87	0.0503	50	1.006	1.77	3568	0.0894
		400	0.0435	50	0.87	0.0503	50	1.006	1.63	3460	0.0656
		600	0.0435	50	0.87	0.0503	50	1.006	1.48	3304	0.0448
		800	0.0435	50	0.87	0.0503	50	1.006	1.33	3087	0.0284
		1000	0.0435	50	0.87	0.0503	50	1.006	1.2	2863	0.0179
		1200	0.0435	50	0.87	0.0503	50	1.006	1.07	2554	0.0111

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
3	R1	0	0.0411	50	0.822	0.0521	50	1.042	2.42	4022	0.5149
		20	0.0411	50	0.822	0.0521	50	1.042	2.4	4021	0.502
		40	0.0411	50	0.822	0.0521	50	1.042	2.36	4019	0.4769
		60	0.0411	50	0.822	0.0521	50	1.042	2.33	4020	0.4591
		80	0.0411	50	0.822	0.0521	50	1.042	1.82	4018	0.2186
		100	0.0411	50	0.822	0.0521	50	1.042	1.81	4018	0.215
		120	0.0411	50	0.822	0.0521	50	1.042	1.8	4019	0.2116
		140	0.0411	50	0.822	0.0521	50	1.042	1.79	4020	0.2082
		160	0.0411	50	0.822	0.0521	50	1.042	1.79	4018	0.208
	180	0.0411	50	0.822	0.0521	50	1.042	1.78	4015	0.2042	
	R2	0	0.0405	50	0.81	0.0548	50	1.096	2.96	5736	1.9165
		20	0.0405	50	0.81	0.0548	50	1.096	2.94	5683	1.8434
		40	0.0405	50	0.81	0.0548	50	1.096	2.73	5611	1.4388
		60	0.0405	50	0.81	0.0548	50	1.096	2.62	5530	1.2353
		80	0.0405	50	0.81	0.0548	50	1.096	2.61	5482	1.2001
		100	0.0405	50	0.81	0.0548	50	1.096	2.6	5486	1.1881
	R3	0	0.0444	50	0.888	0.0522	50	1.044	-	-	19.56
		20	0.0444	50	0.888	0.0522	50	1.044	-	-	19.47
		40	0.0444	50	0.888	0.0522	50	1.044	-	-	19.21
		60	0.0444	50	0.888	0.0522	50	1.044	-	-	18.98
		80	0.0444	50	0.888	0.0522	50	1.044	-	-	18.84
		100	0.0444	50	0.888	0.0522	50	1.044	-	-	18.62
	R4	0	0.0444	50	0.888	0.0506	50	1.012	-	-	23.79
		20	0.0444	50	0.888	0.0506	50	1.012	-	-	23.63
		40	0.0444	50	0.888	0.0506	50	1.012	-	-	23.57
		60	0.0444	50	0.888	0.0506	50	1.012	-	-	23.44
		80	0.0444	50	0.888	0.0506	50	1.012	-	-	23.3
		100	0.0444	50	0.888	0.0506	50	1.012	-	-	23.18
	120	0.0444	50	0.888	0.0506	50	1.012	-	-	22.96	

Table B-19 (continue)

Sample number	Cleaning step	Time (s)	Density measurement						IFT measurement		
			Upper phase			Lower phase			Upper phase/Lower phase		
			wt (g)	Volume (mL)	ρ (g/ μ L)	wt (g)	Volume (mL)	ρ (g/ μ L)	d (mm)	speed (rpm)	IFT (mN/m)
3	R5	0	0.0444	50	0.888	0.0518	50	1.036	-	-	24.18
		20	0.0444	50	0.888	0.0518	50	1.036	-	-	24.03
		40	0.0444	50	0.888	0.0518	50	1.036	-	-	23.86
		60	0.0444	50	0.888	0.0518	50	1.036	-	-	23.74
		80	0.0444	50	0.888	0.0518	50	1.036	-	-	23.6
		100	0.0444	50	0.888	0.0518	50	1.036	-	-	23.51
		120	0.0444	50	0.888	0.0518	50	1.036	-	-	23.48
	R6	0	0.0444	50	0.888	0.0521	50	1.042	-	-	24.35
		20	0.0444	50	0.888	0.0521	50	1.042	-	-	24.26
		40	0.0444	50	0.888	0.0521	50	1.042	-	-	23.94
		60	0.0444	50	0.888	0.0521	50	1.042	-	-	23.89
		80	0.0444	50	0.888	0.0521	50	1.042	-	-	23.75
		100	0.0444	50	0.888	0.0521	50	1.042	-	-	23.62
		120	0.0444	50	0.888	0.0521	50	1.042	-	-	23.58

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