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APPENDICES

Appendix A Experimental Data of Microemulsion Formation

1. Interfacial tension (IFT)

The dynamic interfacial tension (IFT) between aqueous phase and the oil phase which were in equilibrium at different conditions was measured using a spinning drop tensiometer (Operating manual Dataphysics SVT 20). The IFT measurements were made using 1-2 μL of oil injected into 300 μL of aqueous phase in capillary tube. Reported IFT values were recorded at twenty minutes after oil injection.

2. Experimental data of interfacial tension

Table A-1 Interfacial tension of distilled water

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
-	-	0.2480	0.987	7.080	7.0797	0.0006
		0.2464		7.080		
		0.2456		7.079		

Table A-2 Interfacial tension as a function of FE-1020E concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
FE-1020E	0.0481	0.2499	0.999	2.797	2.7970	0.0000
		0.2501		2.797		
		0.2491		2.797		
	0.1123	0.2494	0.999	2.894	2.8947	0.0006
		0.2499		2.895		
		0.2501		2.895		
	0.2075	0.2500	0.999	2.725	2.7250	0.0000
		0.2496		2.725		
		0.2497		2.725		
	0.3253	0.2500	0.999	2.891	2.8907	0.0006
		0.2496		2.890		
		0.2497		2.891		
	0.5132	0.2494	0.998	2.621	2.6210	0.0000
		0.2501		2.621		
		0.2492		2.621		
	0.8165	0.2499	0.999	2.704	2.7040	0.0000
		0.2497		2.704		
		0.2497		2.704		
	1.2202	0.2503	1.001	2.686	2.6860	0.0000
		0.2500		2.686		
		0.2501		2.686		

Table A-3 Interfacial tension as a function of FE-1030E concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
FE-1030E	0.0653	0.2494	1.000	3.053	3.0533	0.0006
		0.2502		3.053		
		0.2501		3.054		
	0.1245	0.2503	1.001	3.365	3.3650	0.0000
		0.2503		3.365		
		0.2501		3.365		
	0.2097	0.2490	0.999	3.251	3.2843	0.0586
		0.2499		3.352		
		0.2504		3.250		
	0.3129	0.2502	0.999	3.297	3.2970	0.0000
		0.2498		3.297		
		0.2493		3.297		
	0.5355	0.2501	1.000	3.311	3.3107	0.0006
		0.2498		3.311		
		0.2498		3.310		
	0.7427	0.2500	0.999	3.375	3.3747	0.0006
		0.2494		3.374		
		0.2497		3.375		
1.276	0.2498	1.000	3.312	3.3107	0.0012	
	0.2499		3.310			
	0.2500		3.310			

Table A-4 Interfacial tension as a function of MEE-8EO concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
MEE-8EO	0.0687805	0.2493	0.998	2.481	2.4810	0.0000
		0.2492		2.481		
		0.2500		2.481		
	0.11843	0.2496	0.998	1.728	1.7280	0.0000
		0.2492		1.728		
		0.2500		1.728		
	0.2270212	0.2479	0.995	1.664	1.6647	0.0006
		0.2491		1.665		
		0.2491		1.665		
	0.3283244	0.2490	0.998	1.493	1.4927	0.0006
		0.2497		1.493		
		0.2495		1.492		
	0.5107066	0.2492	0.997	1.296	1.2960	0.0000
		0.2488		1.296		
		0.2494		1.296		
	0.71058	0.2489	0.996	1.329	1.3297	0.0006
		0.2491		1.330		
		0.2487		1.330		
	1.2169138	0.2497	0.997	1.299	1.2990	0.0000
		0.2490		1.299		
		0.2488		1.299		

Table A-5 Interfacial tension as a function of MEE-14EO concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
MEE-14EO	0.0539784	0.2499	1.000	2.303	2.3020	0.0010
		0.2497		2.302		
		0.2501		2.301		
	0.100062	0.2496	0.999	2.192	2.1923	0.0006
		0.2498		2.192		
		0.2498		2.193		
	0.2104056	0.2501	1.000	2.146	2.1460	0.0000
		0.2497		2.146		
		0.2501		2.146		
	0.3156084	0.2497	0.999	2.329	2.3293	0.0006
		0.2496		2.330		
		0.2497		2.329		
	0.5132538	0.2497	0.999	2.061	2.0617	0.0006
		0.2500		2.062		
		0.2498		2.062		
	0.7162236	0.2497	1.000	2.213	2.2130	0.0000
		0.2501		2.213		
		0.2501		2.213		
	1.2040488	0.2498	1.000	2.295	2.2947	0.0006
		0.2499		2.295		
		0.2505		2.294		

Table A-6 Interfacial tension as a function of MEE-18EO concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
MEE-18EO	0.065846	0.2495	0.998	2.729	2.7290	0.0000
		0.2496		2.729		
		0.2495		2.729		
	0.1147344	0.2499	0.998	2.829	2.8290	0.0000
		0.2493		2.829		
		0.2496		2.829		
	0.222794	0.2496	0.999	2.839	2.8383	0.0012
		0.2497		2.839		
		0.2497		2.837		
	0.3132646	0.2492	0.998	2.994	2.9940	0.0000
		0.2494		2.994		
		0.2499		2.994		
	0.5255954	0.2493	0.998	3.076	3.0753	0.0006
		0.2500		3.075		
		0.2495		3.075		
	0.73964	0.2496	0.998	3.074	3.0740	0.0000
		0.2495		3.074		
		0.2493		3.074		
1.2502622	0.2498	0.998	3.213	3.2130	0.0000	
	0.2494		3.213			
	0.2491		3.213			

Table A-7 Interfacial tension as a function of MES-14C concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
MES-14C	0.0544908	0.2499	0.999	3.231	3.2313	0.0006
		0.2498		3.231		
		0.2494		3.232		
	0.110279	0.2496	0.999	1.657	1.6567	0.0006
		0.2498		1.657		
		0.2499		1.656		
	0.2033924	0.2493	0.999	1.715	1.7150	0.0000
		0.2496		1.715		
		0.2502		1.715		
	0.3171644	0.2495	1.000	1.515	1.5150	0.0000
		0.2504		1.515		
		0.2504		1.515		
	0.5107764	0.2500	1.001	1.310	1.3100	0.0000
		0.2503		1.310		
		0.2501		1.310		
	0.8299368	0.2494	1.000	1.031	1.0313	0.0006
		0.2500		1.031		
		0.2508		1.032		
	1.239017	0.2503	1.002	0.746	0.7460	0.0000
		0.2507		0.746		
		0.2503		0.746		

Table A-8 Interfacial tension as a function of commercial grade liquid detergent concentration

Type of Surfactant	Actual Concentration(%w/v)	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
Comercial grade liquid detergent	0.05287644	0.2506	1.001	2.029	2.0293	0.0006
		0.2500		2.029		
		0.2503		2.030		
	0.10508385	0.2502	1.001	1.306	1.3387	0.0283
		0.2497		1.355		
		0.2508		1.355		
	0.2009397	0.2498	1.000	0.800	0.8000	0.0000
		0.2500		0.800		
		0.2499		0.800		
	0.30457014	0.2493	0.997	0.541	0.5407	0.0006
		0.2489		0.540		
		0.2497		0.541		
	0.50209548	0.2498	0.999	0.592	0.5920	0.0000
		0.2497		0.592		
		0.2496		0.592		
	0.71293221	0.2493	0.998	0.434	0.4340	0.0000
		0.2494		0.434		
		0.2496		0.434		
	1.20750687	0.2489	0.998	0.324	0.3283	0.0075
		0.2500		0.324		
		0.2498		0.337		

Table A-9 Interfacial tension as a function of fraction of MES-14C of mixture between MES-14C and FE-1020E

Fraction of MES-14C	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
0	0.2499	1.000	2.849	2.85	0.00
	0.2499		2.849		
	0.2499		2.850		
0.1	0.2491	0.998	4.712	4.76	0.08
	0.2496		4.710		
	0.2498		4.849		
0.2	0.2499	0.999	4.715	4.71	0.00
	0.2500		4.714		
	0.2491		4.715		
0.3	0.2497	0.998	4.245	4.24	0.00
	0.2493		4.245		
	0.2494		4.244		
0.4	0.2501	1.000	3.655	3.66	0.00
	0.2498		3.655		
	0.2501		3.656		
0.5	0.2499	0.999	3.350	3.35	0.00
	0.2498		3.350		
	0.2498		3.350		
0.6	0.2492	0.998	2.411	2.41	0.00
	0.2498		2.411		
	0.2497		2.411		

Table A-9 Interfacial tension as a function of fraction of MES-14C of mixture between MES-14C and FE-1020E (Cont.)

Fraction of MES-14C	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
0.7	0.2488	0.998	2.104	2.10	0.00
	0.2494		2.104		
	0.2500		2.103		
0.8	0.2498	1.000	1.825	1.82	0.00
	0.2498		1.825		
	0.2502		1.824		
0.9	0.2497	1.000	1.458	1.46	0.00
	0.2499		1.458		
	0.2501		1.458		
1	0.2480	0.996	1.285	1.28	0.00
	0.2495		1.284		
	0.2495		1.285		

Table A-10 Interfacial tension as a function of fraction of MES-14C of mixture between MES-14C and MEE-8EO

Fraction of MES-14C	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
0	0.2493	0.998	1.400	1.40	0.00
	0.2497		1.400		
	0.2492		1.400		
0.1	0.2487	0.998	2.809	2.81	0.00
	0.2496		2.810		
	0.2501		2.810		
0.2	0.2499	0.999	3.350	3.35	0.00
	0.2493		3.350		
	0.2497		3.351		
0.3	0.2492	0.998	3.838	3.84	0.00
	0.2500		3.838		
	0.2494		3.837		
0.4	0.2501	0.998	3.391	3.39	0.00
	0.2492		3.391		
	0.2491		3.392		
0.5	0.2499	0.999	3.238	3.24	0.00
	0.2497		3.238		
	0.2498		3.237		
0.6	0.2505	1.000	2.876	2.88	0.00
	0.2500		2.876		
	0.2496		2.875		

Table A-10 Interfacial tension as a function of fraction of MES-14C of mixture between MES-14C and MEE-8EO (Cont.)

Fraction of MES-14C	Density of Solution (g/250 μ l)	Average Density of Solution (g/cm ³)	IFT (mN/m)	Average IFT (mN/m)	SD of IFT (mN/m)
0.7	0.2499	0.999	2.525	2.52	0.00
	0.2499		2.524		
	0.2496		2.524		
0.8	0.2501	0.999	1.824	1.82	0.00
	0.2493		1.824		
	0.2500		1.824		
0.9	0.2497	0.998	1.629	1.63	0.00
	0.2495		1.628		
	0.2493		1.629		
1	0.2495	0.999	1.351	1.35	0.00
	0.2496		1.351		
	0.2501		1.352		

Appendix B Experimental Data of Detergency Experiment

1. %Detergency

The detergency performance can be determined by the following equation:

$$\text{Detergency (\%)} = [(A-B)/(C_0-B)] \times 100$$

where A = average reflectance of the soiled swatches after washing

B = average reflectance of the soiled swatches before washing

C₀ = average reflectance of the unsoiled swatches before washing

2. %Oil Removal

This measurement was followed Goel (1998)'s method. Oil removal was characterized by portion of residual oil on the swatches that is washed out during the detergency process. The attached oil was extracted from the pre-wash soiled swatches by submerging the fabric in propan-2-ol overnight at room temperature. After washing, submerge the post-wash soiled swatches in propan-2-ol overnight at room temperature. Then, measure the amount of extracted oil in the solution via UV/VIS Spectrophotometer (Hewlett Packard, 8452A). Finally, calculate extracted oil concentration from the calibration curve.

3. Experimental data of detergency performance

Table B-1 %Detergency of distilled water

Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
	1	82.5460	-	81.9860	-	
	2					
	3					
	4					
	5					
	1	82.7360	68.2833	68.5200	1.6375	1.7772
	2					
	3					
	4					
	5					
	1	82.1100	67.0367	67.5467	3.3835	1.7772
	2					
	3					
	4					
	5					
	1	82.9660	68.4850	68.5300	0.3108	
	2					
	3,4,5					

Table B-2 %Detergency of FE-1020E at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
FE-1020E	0.05159	1	82.6080	-	81.9040	-	-
		2	83.2680	69.3900	69.7640	2.6949	3.5992
		3	82.7500	68.8460	69.3860	3.8838	
		4	82.7680	68.9260	69.5100	4.2190	
FE-1020E	0.10317	1	82.6820	-	81.6440	-	-
		2	83.1200	69.1900	69.4260	1.6942	3.2283
		3	82.4780	68.9440	69.5740	4.6549	
		4	82.5960	68.8060	69.2660	3.3358	
FE-1020E	0.20371	1	82.9780	-	81.8300	-	-
		2	81.9700	69.9980	70.3660	3.0738	4.7377
		3	81.1580	69.4600	70.2000	6.3259	
		4	83.1620	69.4920	70.1500	4.8135	
FE-1020E	0.3018	1	82.7980	-	82.0360	-	-
		2	83.1360	69.6500	70.6980	7.7710	8.0843
		3	82.3980	69.1880	70.4040	9.2051	
		4	82.1800	70.0040	70.8900	7.2766	

Table B-2 %Detergency of FE-1020E at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
FE-1020E	0.50342	1	83.6860	-	83.6640	-	18.3045
		2	81.9860	68.8220	71.5800	20.9511	
		3	82.3840	68.8280	71.2660	17.9847	
		4	82.9640	69.7080	71.8260	15.9777	
FE-1020E	0.70777	1	82.5420	-	82.8780	-	19.9288
		2	82.2780	68.6820	71.7940	22.8891	
		3	82.0980	69.2100	71.7020	19.3358	
		4	83.1080	69.8860	72.2080	17.5616	
FE-1020E	1.2077	1	81.6020	-	82.1240	-	26.3684
		2	82.3920	68.2200	72.3840	29.3819	
		3	84.0440	68.3120	72.1900	24.6504	
		4	84.1500	68.4120	72.3580	25.0731	

Table B-3 %Detergency of FE-1030E at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
FE-1030E	0.05014	1	81.2860	-	82.5580	-	-
		2	82.3640	69.1060	69.1680	0.4676	0.8080
		3	82.6740	69.0920	69.3360	1.7965	
		4	82.4280	68.6760	68.6980	0.1600	
FE-1030E	0.10158	1	82.2600	-	83.4180	-	-
		2	81.1260	69.2700	69.9660	5.8704	4.2631
		3	83.2060	69.8920	70.0320	1.0515	
		4	83.0160	69.0400	69.8600	5.8672	
FE-1030E	0.20047	1	81.6360	-	82.6060	-	-
		2	82.0680	69.9400	70.6660	5.9861	6.6351
		3	82.4440	69.1220	70.1660	7.8367	
		4	82.1680	68.8180	69.6300	6.0824	
FE-1030E	0.30117	1	83.1700	-	82.7540	-	-
		2	82.3480	69.5340	70.5780	8.1473	6.5224
		3	82.6600	69.4300	70.2020	5.8352	
		4	82.9920	69.9920	70.7180	5.5846	

Table B-3 %Detergency of FE-1030E at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
FE-1030E	0.50744	1	82.8220	-	83.0780	-	-
		2	82.1820	68.3240	69.6000	9.2077	6.7120
		3	82.8800	69.4300	70.2140	5.8290	
		4	82.9700	69.8700	70.5380	5.0992	
FE-1030E	0.71297	1	82.1140	-	82.3680	-	-
		2	82.9180	68.3800	69.9300	10.6617	8.3891
		3	82.5960	68.9780	70.2500	9.3406	
		4	83.0280	69.9400	70.6160	5.1650	
FE-1030E	1.20687	1	82.0560	-	82.5800	-	-
		2	82.4740	68.3260	69.5340	8.5383	6.4982
		3	83.3260	68.2240	69.2400	6.7276	
		4	84.1100	69.1640	69.7960	4.2286	

Table B-4 %Detergency of MEE-8EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-8EO	0.0503783	1	82.9260	-	82.3080	-	-
		2	83.6080	69.0500	70.9840	13.2848	14.6253
		3	83.4340	69.1500	71.2680	14.8278	
		4	83.5020	69.0380	71.3180	15.7633	
MEE-8EO	0.10117566	1	82.4100	-	81.7820	-	-
		2	81.7520	68.1800	72.3000	30.3566	26.6069
		3	82.6520	68.1900	71.6640	24.0216	
		4	83.4880	69.1420	72.7920	25.4426	
MEE-8EO	0.20072974	1	83.2320	-	82.4700	-	-
		2	83.4340	68.9880	72.1860	22.1376	22.8642
		3	83.4900	69.5820	72.5680	21.4697	
		4	82.4320	68.7680	72.1820	24.9854	
MEE-8EO	0.30246111	1	83.3720	-	82.5820	-	-
		2	82.7900	68.5360	73.1180	32.1454	30.1136
		3	82.9220	68.8960	72.6540	26.7931	
		4	82.6800	68.6620	73.0640	31.4025	

Table B-4 %Detergency of MEE-8EO at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-8EO	0.5060969	1	82.9560	-	82.8580	-	-
		2	82.5820	69.4560	73.9160	33.9784	34.0896
		3	82.5820	69.6680	74.1640	34.8149	
		4	82.2280	69.5800	73.8140	33.4756	
MEE-8EO	0.7014153	1	83.1080	-	83.5740	-	-
		2	82.2180	69.0760	73.3500	32.5217	33.6260
		3	82.8360	70.0780	74.3880	33.7827	
		4	82.1360	69.4500	73.8360	34.5735	
MEE-8EO	1.2072754	1	83.4960	-	81.9700	-	-
		2	83.8260	68.0120	72.4020	27.7602	28.3072
		3	83.2180	67.8720	72.0680	27.3426	
		4	83.3860	67.3760	72.1500	29.8189	

Table B-5 %Detergency of MEE-14EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-14EO	0.05109588	1	82.8880	-	82.4600	-	-
		2	82.4180	68.0900	71.3300	22.6131	22.9592
		3	83.3500	68.9320	71.8700	20.3773	
		4	83.0020	68.4080	72.1860	25.8874	
MEE-14EO	0.10089738	1	82.3780	-	81.9120	-	-
		2	82.6300	68.6900	72.0560	24.1463	21.5290
		3	83.5960	69.7280	72.1680	17.5945	
		4	83.0080	68.9400	72.1540	22.8462	
MEE-14EO	0.20073906	1	83.1460	-	82.4080	-	-
		2	83.1880	68.9540	72.0600	21.8210	24.1802
		3	82.7280	68.4340	72.1240	25.8150	
		4	83.0880	68.9220	72.4500	24.9047	
MEE-14EO	0.30044304	1	83.3220	-	82.9260	-	-
		2	83.1420	68.9540	72.2920	23.5269	24.7632
		3	82.1560	68.2220	72.1140	27.9317	
		4	82.6980	68.6820	71.8820	22.8311	

Table B-5 %Detergency of MEE-14EO at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-14EO	0.5205427	1	82.9820	-	83.4740	-	24.0653
		2	82.5640	68.7860	72.0040	23.3561	
		3	82.7860	69.1380	72.5840	25.2491	
		4	83.2200	69.4180	72.6740	23.5908	
MEE-14EO	0.7182524	1	82.7380	-	83.2100	-	18.8833
		2	83.0520	69.9800	72.1880	16.8911	
		3	81.6820	69.1280	71.8480	21.6664	
		4	82.2300	69.3960	71.7180	18.0926	
MEE-14EO	1.2194712	1	84.3740	-	82.5040	-	26.7921
		2	83.7520	67.8940	72.1400	26.7751	
		3	83.8960	67.8940	72.1060	26.3217	
		4	83.7000	67.7760	72.1200	27.2796	

Table B-6 %Detergency of MEE-18EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-18EO	0.0521807	1	82.4520	-	82.2060	-	-
		2	83.0820	68.5160	70.2600	11.9731	10.4836
		3	82.2960	68.5120	69.8780	9.9100	
		4	82.7260	68.5740	69.9280	9.5676	
MEE-18EO	0.10117734	1	82.8140	-	82.2740	-	-
		2	82.7560	68.6400	71.2060	18.1780	16.5548
		3	83.7720	69.6700	71.7280	14.5937	
		4	82.5920	69.0360	71.3260	16.8929	
MEE-18EO	0.2044383	1	82.2460	-	81.9720	-	-
		2	82.6340	68.8940	72.2240	24.2358	20.7835
		3	83.6120	69.8060	72.3120	18.1515	
		4	82.3560	69.3420	71.9400	19.9631	
MEE-18EO	0.30278336	1	82.5800	-	82.1080	-	-
		2	82.6960	69.4560	72.0300	19.4411	20.8938
		3	82.7000	69.4100	72.0140	19.5937	
		4	82.3900	68.9420	72.1220	23.6466	

Table B-6 %Detergency of MEE-18EO at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MEE-18EO	0.5070052	1	82.1660	-	82.2520	-	-
		2	82.8000	68.8800	71.7080	20.3161	18.1206
		3	84.2620	69.1500	71.4740	15.3785	
		4	83.7180	68.9220	71.6840	18.6672	
MEE-18EO	0.7005293	1	83.2620	-	83.4820	-	-
		2	82.6500	68.7320	71.1880	17.6462	19.2544
		3	82.5080	68.3680	71.2680	20.5092	
		4	83.9880	68.6880	71.6880	19.6078	
MEE-18EO	1.2066325	1	82.8480	-	82.6500	-	-
		2	83.1040	69.1340	72.2900	22.5913	21.5385
		3	84.1960	69.2420	72.2960	20.4226	
		4	83.9500	69.3400	72.4960	21.6016	

Table B-7 %Detergency of MES-14C at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MES-14C	0.05026926	1	83.0660	-	82.6980	-	-2.2008
		2	82.1500	67.8500	67.8740	0.1678	
		3	82.3420	68.3720	68.1260	-1.7609	
		4	82.9000	68.8860	68.1840	-5.0093	
MES-14C	0.10090778	1	82.2040	-	81.9360	-	2.8124
		2	83.4200	69.5420	69.8420	2.1617	
		3	82.6640	68.8800	69.2840	2.9309	
		4	83.3840	69.6300	70.0900	3.3445	
MES-14C	0.20715486	1	81.8420	-	81.8720	-	2.5965
		2	82.5620	69.3580	69.5300	1.3026	
		3	82.3680	69.1040	69.7880	5.1568	
		4	82.5460	69.4640	69.6380	1.3301	
MES-14C	0.30135608	1	83.3000	-	83.1880	-	3.8982
		2	83.2440	69.7600	70.1900	3.1890	
		3	82.5540	69.8140	70.0460	1.8210	
		4	82.4540	69.0800	69.9740	6.6846	

Table B-7 %Detergency of MES-14C at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
MES-14C	0.5005369	1	82.8480	-	82.6080	-	-
		2	84.2980	68.5800	69.7580	7.4946	6.3133
		3	84.3980	68.9980	69.9760	6.3506	
		4	84.2660	68.7600	69.5500	5.0948	
MES-14C	0.7008355	1	82.3620	-	82.5840	-	-
		2	84.6040	69.2280	70.2900	6.9069	7.0088
		3	84.3000	68.8700	69.9360	6.9086	
		4	84.3360	69.0260	70.1300	7.2110	
MES-14C	1.2131189	1	83.7480	-	81.9200	-	-
		2	83.6700	68.4780	69.8740	9.1890	9.3912
		3	84.7500	69.2800	70.6560	8.8946	
		4	84.6840	69.1240	70.6940	10.0900	

Table B-8 %Detergency of commercial grade liquid detergent at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
Commercial grade liquid detergent	0.100013064	1	82.9160	-	83.0020	-	-
		2	82.0680	69.1140	71.0560	14.9915	14.0695
		3	82.1100	69.0740	71.0240	14.9586	
		4	82.5560	69.5200	71.1180	12.2584	
Commercial grade liquid detergent	0.20038602	1	81.9620	-	81.9540	-	-
		2	82.6880	68.3580	71.0680	18.9114	20.2615
		3	82.8260	68.2900	71.0340	18.8773	
		4	82.0800	68.0340	71.2640	22.9959	
Commercial grade liquid detergent	0.300272199	1	82.5600	-	83.3760	-	-
		2	81.8140	69.0360	72.0020	23.2118	21.5857
		3	82.2940	69.3280	71.9400	20.1450	
		4	82.4020	69.1780	72.0080	21.4005	
Commercial grade liquid detergent	0.400485972	1	82.5100	-	82.7700	-	-
		2	81.0780	68.8080	72.2000	27.6447	24.1868
		3	82.5800	69.4320	72.3960	22.5434	
		4	82.9540	69.4820	72.4960	22.3723	

Table B-8 %Detergency of commercial grade liquid detergent at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
Commercial grade liquid detergent	0.5001138	1	82.5720	-	82.5880	-	-
		2	82.5280	67.6380	71.7260	27.4547	25.1299
		3	82.5860	67.3660	71.2980	25.8344	
		4	82.8300	68.2240	71.4520	22.1005	
Commercial grade liquid detergent	0.600519	1	82.7400	-	83.5360	-	-
		2	82.5080	69.5660	72.4120	21.9904	24.9757
		3	82.5120	68.3460	71.8680	24.8623	
		4	82.5660	67.9120	72.0260	28.0742	
Commercial grade liquid detergent	0.7978413	1	82.8960	-	84.5620	-	-
		2	82.5260	69.3580	72.2300	21.8104	22.5550
		3	82.5660	69.3360	72.1420	21.2094	
		4	82.0960	68.4220	71.7920	24.6453	
Commercial grade liquid detergent	0.9981881	1	82.3620	-	83.6420	-	-
		2	82.1280	68.8200	71.9240	23.3243	24.1322
		3	82.0440	68.2660	71.7120	25.0109	
		4	82.3720	68.5740	71.8940	24.0615	

Table B-8 %Detergency of commercial grade liquid detergent at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
Commercial grade liquid detergent	1.2012088	1	81.0100	-	82.9340	-	-
		2	82.7120	69.1540	72.2120	22.5549	25.4659
		3	82.1540	68.3960	71.9960	26.1666	
		4	82.4040	68.0740	72.0400	27.6762	

Table B-9 %Detergency as a function of fraction of MES-14C of mixture between MES-14C and FE-1020E

Fraction of MES-14C	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0.1018	1	84.0660	-	82.8100	-	-
	2	84.3140	69.9480	70.1340	1.2947	1.2849
	3	83.5460	68.7160	68.5800	-0.9171	
	4	84.3500	69.2800	69.8040	3.4771	
0.4006	1	83.6560	-	82.7640	-	-
	2	84.2940	69.5760	69.7700	1.3181	1.4758
	3	83.9240	69.8620	70.3320	3.3423	
	4	84.5040	69.9140	69.8800	-0.2330	
0.7989	1	83.9000	-	82.2080	-	-
	2	84.2820	69.9300	70.2800	2.4387	2.2372
	3	84.5260	70.2820	70.7140	3.0329	
	4	84.2580	70.3880	70.5600	1.2401	

Table B-10 %Detergency as a function of fraction of MES-14C of mixture between MES-14C and MEE-8EO

Fraction of MES-14C	Sample No.	Average reflectance of the unsoiled swatches before washing (Co)	Average reflectance of the soiled swatches before washing (B)	Average reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0.1012	1	84.7220	-	83.2280	-	-
	2	84.4320	70.1380	70.3580	1.5391	3.0541
	3	84.5040	70.1780	70.4200	1.6892	
	4	84.2460	70.1240	70.9620	5.9340	
0.3052	1	84.8020	-	83.0160	-	-
	2	84.3920	69.7800	69.4500	-2.2584	0.0983
	3	84.0300	69.3440	69.6000	1.7432	
	4	84.1600	69.3500	69.4700	0.8103	
0.8004	1	83.8380	-	82.7720	-	-
	2	83.8900	69.6760	70.2140	3.7850	4.0173
	3	83.2580	69.0740	69.5460	3.3277	
	4	84.1440	70.0120	70.7100	4.9391	

Table B-11 % Oil Removal of distilled water

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
-	-	1	-	42.0750	-	-	-	-	5.3804
		2	4411.9750	4141.7250	270.2500	6.1254	5.9082	3.0685	-
		3	4411.9750	4291.2250	120.7500	2.7369			
		4	4411.9750	4020.9750	391.0000	8.8622			

Table B-12 % Oil Removal of FE-1020E at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
FE-1020E	0.0516	1	-	97.6400	-	-	-	-	3.0921
		2	4483.7273	3483.3960	1000.3313	22.3103	23.4752	1.8258	-
		3	4483.7273	3336.8170	1146.9103	25.5794			
		4	4483.7273	3473.2760	1010.4513	22.5360			
FE-1020E	0.1032	1	-	83.8080	-	-	-	-	2.0675
		2	4483.7273	3260.7560	1222.9713	27.2758	30.1352	2.6913	-
		3	4483.7273	3021.1880	1462.5393	32.6188			
		4	4483.7273	3115.6950	1368.0323	30.5111			
FE-1020E	0.2037	1	-	105.5180	-	-	-	-	2.2618
		2	4483.7273	3006.7900	1476.9373	32.9399	34.6821	2.1993	-
		3	4483.7273	2817.8680	1665.8593	37.1534			
		4	4483.7273	2961.3650	1522.3623	33.9531			
FE-1020E	0.3018	1	-	70.9200	-	-	-	-	1.5146
		2	4483.7273	2871.7340	1611.9933	35.9521	34.8116	1.7580	-
		3	4483.7273	3013.6440	1470.0833	32.7871			
		4	4483.7273	2883.2340	1600.4933	35.6956			
FE-1020E	0.5034	1	-	48.4870	-	-	-	-	1.1071
		2	4345.6047	2902.9910	1442.6137	33.1971	33.5953	1.4492	-
		3	4345.6047	2938.2040	1407.4007	32.3868			
		4	4345.6047	2815.8670	1529.7377	35.2020			

Table B-12 % Oil Removal of FE-1020E at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
FE-1020E	0.7078	1	-	39.6370	-	-	-	-	0.8311
		2	4345.6047	2793.7870	1551.8177	35.7101	36.5807	0.7674	-
		3	4345.6047	2730.8360	1614.7687	37.1587			
		4	4345.6047	2743.2330	1602.3717	36.8734			
FE-1020E	1.2077	1	-	44.8330	-	-	-	-	0.8045
		2	4537.1257	2618.4580	1918.6677	42.2882	40.9438	1.4780	-
		3	4537.1257	2751.2600	1785.8657	39.3612			
		4	4537.1257	2668.6440	1868.4817	41.1821			

Table B-13 % Oil Removal of FE-1030E at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
FE-1030E	0.0501	1	-	59.8630	-	-	-	-	6.0830
		2	4483.7273	4050.4610	433.2663	9.6631	7.3161	2.7113	-
		3	4483.7273	4127.8560	355.8713	7.9370			
		4	4483.7273	4288.7640	194.9633	4.3482			
FE-1030E	0.1016	1	-	68.1770	-	-	-	-	2.2989
		2	4483.7273	3447.2400	1036.4873	23.1166	22.0469	0.9611	-
		3	4483.7273	3507.7070	976.0203	21.7681			
		4	4483.7273	3530.6610	953.0663	21.2561			
FE-1030E	0.2005	1	-	74.7480	-	-	-	-	2.1034
		2	4483.7273	3252.8670	1230.8603	27.4517	26.4195	1.1263	-
		3	4483.7273	3353.0090	1130.7183	25.2183			
		4	4483.7273	3291.5760	1192.1513	26.5884			
FE-1030E	0.3012	1	-	67.3100	-	-	-	-	1.5864
		2	4483.7273	2944.5980	1539.1293	34.3270	31.5431	3.4860	-
		3	4483.7273	3018.9340	1464.7933	32.6691			
		4	4483.7273	3244.7250	1239.0023	27.6333			
FE-1030E	0.5074	1	-	52.3830	-	-	-	-	1.3678
		2	4345.6047	3078.8490	1266.7557	29.1503	29.3768	2.6557	-
		3	4345.6047	2948.9910	1396.6137	32.1385			
		4	4345.6047	3179.1750	1166.4297	26.8416			

Table B-13 % Oil Removal of FE-1030E at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
FE-1030E	0.7130	1	-	53.5610	-	-	-	-	1.6078
		2	4345.6047	3191.1120	1154.4927	26.5669	25.5526	2.0475	-
		3	4345.6047	3337.5990	1008.0057	23.1960			
		4	4345.6047	3176.8520	1168.7527	26.8951			
FE-1030E	1.2069	1	-	41.8950	-	-	-	-	1.0849
		2	4537.1257	3386.2670	1150.8587	25.3654	28.3718	2.9457	-
		3	4537.1257	3119.1450	1417.9807	31.2528			
		4	4537.1257	3244.1730	1292.9527	28.4972			

Table B-14 % Oil Removal of MEE-8EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-8EO	0.0504	1	-	85.0690	-	-	-	-	2.5864
		2	4529.9343	3439.8110	1090.1233	24.0649	24.2023	3.6312	-
		3	4529.9343	3266.0690	1263.8653	27.9003			
		4	4529.9343	3594.8770	935.0573	20.6417			
MEE-8EO	0.1012	1	-	76.6440	-	-	-	-	1.4862
		2	4529.9343	2601.2080	1928.7263	42.5774	37.9487	4.5069	-
		3	4529.9343	3009.0440	1520.8903	33.5742			
		4	4529.9343	2822.3990	1707.5353	37.6945			
MEE-8EO	0.2007	1	-	61.7210	-	-	-	-	1.1290
		2	4529.9343	2891.6750	1638.2593	36.1652	40.2269	3.5279	-
		3	4529.9343	2627.9110	1902.0233	41.9879			
		4	4529.9343	2603.4620	1926.4723	42.5276			
MEE-8EO	0.3025	1	-	61.8420	-	-	-	-	0.9962
		2	4529.9343	2418.5190	2111.4153	46.6103	45.6776	0.8079	-
		3	4529.9343	2482.6890	2047.2453	45.1937			
		4	4529.9343	2481.1020	2048.8323	45.2287			
MEE-8EO	0.5061	1	-	29.6050	-	-	-	-	0.4146
		2	4345.6047	1967.6960	2377.9087	54.7199	54.7664	0.4564	-
		3	4345.6047	1944.9030	2400.7017	55.2444			
		4	4345.6047	1984.4170	2361.1877	54.3351			

Table B-14 % Oil Removal of MEE-8EO at different concentration **(Cont.)**

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-8EO	0.7014	1	-	26.1500	-	-	-	-	0.3675
		2	4345.6047	1972.1120	2373.4927	54.6182	54.5747	2.9480	-
		3	4345.6047	2103.0510	2242.5537	51.6051			
		4	4345.6047	1846.8540	2498.7507	57.5006			
MEE-8EO	1.2073	1	-	27.9830	-	-	-	-	0.4211
		2	4476.2523	2308.6020	2167.6503	48.4256	49.4847	0.9224	-
		3	4476.2523	2233.1390	2243.1133	50.1114			
		4	4476.2523	2241.8330	2234.4193	49.9172			

Table B-15 % Oil Removal of MEE-14EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-14EO	0.0511	1	-	64.9800	-	-	-	-	1.3588
		2	4529.9343	2977.9250	1552.0093	34.2612	35.1890	3.8715	-
		3	4529.9343	3086.4390	1443.4953	31.8657			
		4	4529.9343	2743.3250	1786.6093	39.4401			
MEE-14EO	0.1009	1	-	58.9660	-	-	-	-	1.1290
		2	4529.9343	2670.1390	1859.7953	41.0557	38.4317	3.3467	-
		3	4529.9343	2959.7320	1570.2023	34.6628			
		4	4529.9343	2737.1380	1792.7963	39.5767			
MEE-14EO	0.2007	1	-	64.0690	-	-	-	-	1.2168
		2	4529.9343	2841.3970	1688.5373	37.2751	38.7452	3.8255	-
		3	4529.9343	2578.0930	1951.8413	43.0876			
		4	4529.9343	2904.9230	1625.0113	35.8727			
MEE-14EO	0.3004	1	-	60.9720	-	-	-	-	1.0852
		2	4529.9343	2752.7320	1777.2023	39.2324	41.3422	1.9110	-
		3	4529.9343	2584.0040	1945.9303	42.9571			
		4	4529.9343	2634.7420	1895.1923	41.8371			
MEE-14EO	0.5205	1	-	36.3890	-	-	-	-	0.7435
		2	4345.6047	2726.3970	1619.2077	37.2608	37.5419	1.3030	-
		3	4345.6047	2652.4520	1693.1527	38.9624			
		4	4345.6047	2763.7030	1581.9017	36.4023			

Table B-15 % Oil Removal of MEE-14EO at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample 'No.'	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-14EO	0.7183	1	-	42.6420	-	-	-	-	0.9403
		2	4345.6047	2718.1400	1627.4647	37.4508	34.7868	4.7371	-
		3	4345.6047	2711.9990	1633.6057	37.5921			
		4	4345.6047	3071.5810	1274.0237	29.3175			
MEE-14EO	1.2195	1	-	34.2610	-	-	-	-	0.6287
		2	4476.2523	2632.5800	1843.6723	41.1879	40.5776	0.5868	-
		3	4476.2523	2684.9740	1791.2783	40.0174			
		4	4476.2523	2662.1350	1814.1173	40.5276			

Table B-16 % Oil Removal of MEE-18EO at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-18EO	0.0522	1	-	97.1460	-	-	-	-	3.0968
		2	4572.1700	3290.5180	1281.6520	28.2929	23.0836	4.7125	-
		3	4572.1700	3582.8020	989.3680	21.8407			
		4	4572.1700	3706.1740	865.9960	19.1172			
MEE-18EO	0.1012	1	-	66.7890	-	-	-	-	1.4735
		2	4572.1700	2900.9900	1671.1800	36.8919	33.3544	4.3923	-
		3	4572.1700	3283.9400	1288.2300	28.4382			
		4	4572.1700	2998.7860	1573.3840	34.7330			
MEE-18EO	0.2044	1	-	63.3800	-	-	-	-	1.3412
		2	4572.1700	3121.5600	1450.6100	32.0228	34.7723	2.7772	-
		3	4572.1700	2869.9860	1702.1840	37.5764			
		4	4572.1700	2999.4760	1572.6940	34.7178			
MEE-18EO	0.3028	1	-	63.5590	-	-	-	-	1.2541
		2	4572.1700	2811.5660	1760.6040	38.8660	37.2944	1.3706	-
		3	4572.1700	2911.0410	1661.1290	36.6700			
		4	4572.1700	2925.6690	1646.5010	36.3471			
MEE-18EO	0.5070	1	-	59.4380	-	-	-	-	1.3572
		2	4537.1257	3153.4610	1383.6647	30.4965	32.1746	2.2570	-
		3	4537.1257	3117.6040	1419.5217	31.2868			
		4	4537.1257	2960.9050	1576.2207	34.7405			

Table B-16 % Oil Removal of MEE-18EO at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MEE-18EO	0.7005	1	-	56.5060	-	-	-	-	1.1695
		2	4537.1257	2932.7530	1604.3727	35.3610	35.4965	3.0965	-
		3	4537.1257	2783.1380	1753.9877	38.6586			
		4	4537.1257	3063.9220	1473.2037	32.4700			
MEE-18EO	1.2066	1	-	38.9580	-	-	-	-	0.7933
		2	4537.1257	2863.8450	1673.2807	36.8798	36.0808	0.8106	-
		3	4537.1257	2937.3760	1599.7497	35.2591			
		4	4537.1257	2899.0580	1638.0677	36.1036			

Table B-17 % Oil Removal of MES-14C at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MES-14C	0.0503	1	-	70.7090	-	-	-	-	13.1056
		2	4572.1700	4270.5710	301.5990	6.6579	3.9701	2.4169	-
		3	4572.1700	4423.7280	148.4420	3.2769			
		4	4572.1700	4482.6770	89.4930	1.9756			
MES-14C	0.1009	1	-	79.8100	-	-	-	-	3.5641
		2	4572.1700	3842.7710	729.3990	16.1018	16.4776	0.9337	-
		3	4572.1700	3856.8700	715.3000	15.7905			
		4	4572.1700	3777.5890	794.5810	17.5407			
MES-14C	0.2072	1	-	71.5200	-	-	-	-	3.1670
		2	4572.1700	3859.0320	713.1380	15.7428	16.6176	1.4455	-
		3	4572.1700	3743.8250	828.3450	18.2860			
		4	4572.1700	3855.3520	716.8180	15.8240			
MES-14C	0.3014	1	-	71.3570	-	-	-	-	2.7751
		2	4572.1700	3566.5410	1005.6290	22.1996	18.9207	2.8501	-
		3	4572.1700	3778.3020	793.8680	17.5249			
		4	4572.1700	3800.3820	771.7880	17.0375			
MES-14C	0.5005	1	-	44.0520	-	-	-	-	1.7464
		2	4537.1257	3706.3350	830.7907	18.3109	18.5315	2.3576	-
		3	4537.1257	3584.7110	952.4147	20.9916			
		4	4537.1257	3797.9440	739.1817	16.2918			

Table B-17 % Oil Removal of MES-14C at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
MES-14C	0.7008	1	-	43.9120	-	-	-	-	1.6639
		2	4537.1257	3616.2210	920.9047	20.2971	19.3888	0.8127	-
		3	4537.1257	3668.7530	868.3727	19.1393			
		4	4537.1257	3687.3140	849.8117	18.7302			
MES-14C	1.2131	1	-	43.2770	-	-	-	-	1.3721
		2	4537.1257	3395.7660	1141.3597	25.1560	23.1717	1.9153	-
		3	4537.1257	3492.4350	1044.6907	23.0254			
		4	4537.1257	3569.1860	967.9397	21.3338			

Table B-18 % Oil Removal of commercial grade liquid detergent at different concentration

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
commercial	0.1000	1	-	77.5750	-	-	-	-	2.7932
		2	4411.9750	3537.9750	874.0000	19.8097	20.9827	1.5030	-
		3	4411.9750	3509.2250	902.7500	20.4614			
		4	4411.9750	3411.4750	1000.5000	22.6769			
commercial	0.3003	1	-	44.3250	-	-	-	-	1.4302
		2	4411.9750	3376.9750	1035.0000	23.4589	23.4154	1.1084	-
		3	4411.9750	3330.9750	1081.0000	24.5015			
		4	4411.9750	3428.7250	983.2500	22.2859			
commercial	0.4005	1	-	49.0750	-	-	-	-	1.1113
		2	4411.9750	2830.7250	1581.2500	35.8400	33.3637	2.7739	-
		3	4411.9750	3072.2250	1339.7500	30.3662			
		4	4411.9750	2916.9750	1495.0000	33.8851			
commercial	0.5003	1	-	44.0750	-	-	-	-	0.8770
		2	4411.9750	2698.4750	1713.5000	38.8375	37.9686	0.7963	-
		3	4411.9750	2744.4750	1667.5000	37.7949			
		4	4411.9750	2767.4750	1644.5000	37.2736			
commercial	0.6005	1	-	54.0750	-	-	-	-	1.0663
		2	4411.9750	2732.9750	1679.0000	38.0555	38.3162	1.1945	-
		3	4411.9750	2767.4750	1644.5000	37.2736			
		4	4411.9750	2663.9750	1748.0000	39.6194			

Table B-18 % Oil Removal of commercial grade liquid detergent at different concentration (Cont.)

Type of Surfactant	Actual Concentration (%w/v)	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
commercial	0.7978	1	-	49.0750	-	-	-	-	0.9821
		2	4411.9750	2755.9750	1656.0000	37.5342	37.7514	0.7411	-
		3	4411.9750	2709.9750	1702.0000	38.5768			
		4	4411.9750	2773.2250	1638.7500	37.1432			
commercial	0.9982	1	-	39.8250	-	-	-	-	0.7765
		2	4411.9750	2773.2250	1638.7500	37.1432	38.7506	2.3471	-
		3	4411.9750	2583.4750	1828.5000	41.4440			
		4	4411.9750	2750.2250	1661.7500	37.6645			
commercial	1.2012	1	-	43.5750	-	-	-	-	0.8563
		2	4411.9750	2801.9750	1610.0000	36.4916	38.4465	1.7534	-
		3	4411.9750	2692.7250	1719.2500	38.9678			
		4	4411.9750	2652.4750	1759.5000	39.8801			

Table B-19 % Oil Removal as a function of fraction of MES-14C of mixture between MES-14C and FE-1020E

Fraction of MES-14C	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
0.1018	1	-	37.5880	-	-	-	-	7.1703
	2	3709.8540	3346.7300	363.1240	9.7881	4.7101	4.9689	-
	3	3709.8540	3715.1210	-5.2670	-0.1420			
	4	3709.8540	3543.4950	166.3590	4.4842			
0.4006	1	-	42.9100	-	-	-	-	4.2333
	2	3709.8540	3362.9910	346.8630	9.3498	9.1076	0.2385	-
	3	3709.8540	3380.6780	329.1760	8.8730			
	4	3709.8540	3372.2600	337.5940	9.0999			
0.7989	1	-	33.7850	-	-	-	-	2.4291
	2	3709.8540	3226.1410	483.7130	13.0386	12.4967	0.4978	-
	3	3709.8540	3262.4580	447.3960	12.0597			
	4	3709.8540	3250.1300	459.7240	12.3920			

Table B-20 % Oil Removal as a function of fraction of MES-14C of mixture between MES-14C and MEE-8EO

Fraction of MES-14C	Sample No.	Amount of applied soiled (ppm)	Amount of soil after washing (ppm)	Soil removal (ppm)	Soil removal (%)	Average soil removal (%)	SD soil removal (%)	%redeposition
0.1012	1	-	55.0020	-	-	-	-	2.5835
	2	3709.8540	2907.6140	802.2400	21.6246	19.1292	3.0600	-
	3	3709.8540	3126.8500	583.0040	15.7150			
	4	3709.8540	2966.1030	743.7510	20.0480			
0.3052	1	-	52.6180	-	-	-	-	4.4634
	2	3709.8540	3338.0820	371.7720	10.0212	10.5924	0.7151	-
	3	3709.8540	3325.4550	384.3990	10.3616			
	4	3709.8540	3287.1370	422.7170	11.3944			
0.8004	1	-	33.5290	-	-	-	-	1.7080
	2	3709.8540	3043.0150	666.8390	17.9748	17.6380	0.6099	-
	3	3709.8540	3081.6320	628.2220	16.9339			
	4	3709.8540	3041.8880	667.9660	18.0052			

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