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APPENDICES

APPENDIX A Experimental Data of Detergency Experiment

1. Detergency (%)

The detergency performance can be calculated from the following equation.

$$\text{Detergency (\%)} = [(A-B)/(C_0-B)] \times 100 \qquad (A.1)$$

Where A = The average reflectance of the soiled swatches after washing

B = The average reflectance of the soiled swatches before washing

C_0= The average reflectance of the unsoiled swatches before washing

2. Monoglyceride Removal (%)

The monoglyceride removal is determined by the following equation.

$$\text{Monoglyceride removal (\%)} = [(C_0-C_1)/C_0] \times 100 \qquad (A.2)$$

Where C_0 = The average Monoglyceride concentration of the soiled swatches before washing

C_1 = The average Monoglyceride concentration of the soiled swatch after washing

To calculate the oil removal, the calibration curve of colored methyl palmitate was required.

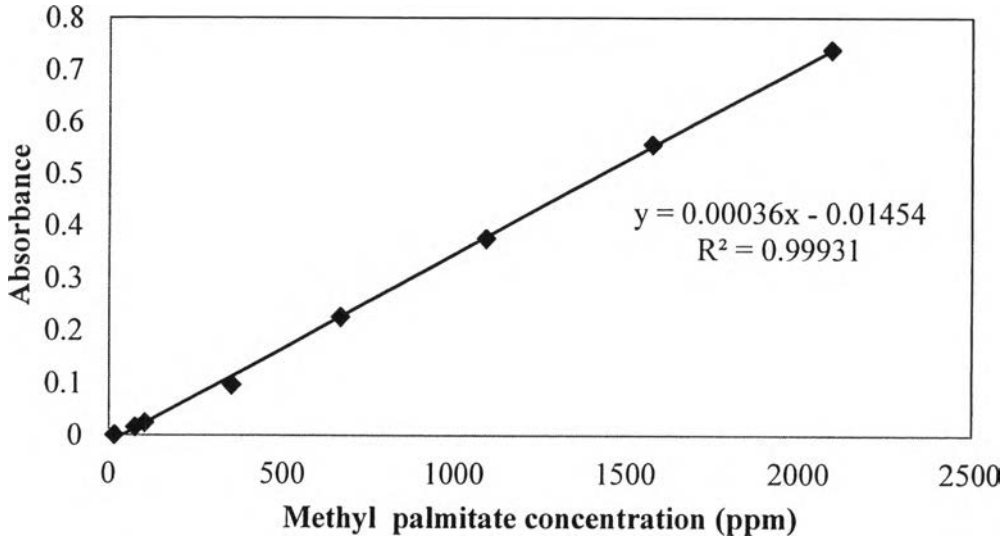

Figure A1 Relationship between colored methyl palmitate concentration and the absorbance measured at 205 nm.

Table A1 Relationship between colored methyl palmitate concentration and the absorbance measured at 205 nm

Methyl palmitate conc. (ppm)	Absorbance
16	0.0008
76	0.0157
104	0.0242
352	0.0965
668	0.2255
1092	0.3755
1576	0.5566
2092	0.7391

3. Experimental Data of Detergency Performance

Table A2 % Detergency of monoglyceride at different total surfactant concentrations with 3 %w/v NaCl

Total surfactant concentration (%w/v)	Sample No.	Reflectance of the unsoiled swatches before washing (C_o)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	84.2633	69.7600	69.0733	-4.7346	-6.0708
	2	84.2633	69.7667	68.7967	-6.6912	
	3	84.2633	70.5600	69.6300	-6.7867	
0.05	1	84.2633	70.9133	71.0333	0.8989	3.0104
	2	84.2633	71.2400	72.2433	7.7041	
	3	84.2633	71.8100	71.8633	0.4283	
0.10	1	84.2633	71.1167	72.2033	8.2657	8.5519
	2	84.2633	71.2833	72.9333	12.7119	
	3	84.2633	71.2233	71.8333	4.6779	
0.20	1	84.2633	71.0433	72.5900	11.6995	16.7820
	2	84.2633	70.7300	72.9433	16.3547	
	3	84.2633	69.3400	72.6667	22.2918	
0.30	1	84.2633	71.0200	74.0767	23.0809	26.7466
	2	84.2633	71.3033	75.3933	31.5587	
	3	84.2633	70.2400	73.8300	25.6003	
0.50	1	84.2633	70.5600	72.7367	15.8843	20.5900
	2	84.2633	70.7000	73.8300	23.0770	
	3	84.2633	70.6867	73.7833	22.8088	

Table A3 % Detergency of monoglyceride at different salinity concentrations with 0.3 %w/v total surfactant concentration

NaCl concentration (%w/v)	Sample No.	Reflectance of the unsoiled swatches before washing (C_o)	Reflectance of the soiled swatches before washing (B)	Reflectance of the soiled swatches after washing (A)	%Detergency	Average %Detergency
0	1	84.2633	69.9100	68.0200	-13.1677	-15.9329
	2	84.2633	70.6600	68.6200	14.9964	
	3	84.2633	70.7667	68.1167	-19.6345	
1	1	84.2633	69.5167	71.2133	11.5055	7.0415
	2	84.2633	70.7667	71.4267	4.8901	
	3	84.2633	70.8000	71.4367	4.7289	
2	1	84.2633	70.9667	72.7133	13.1362	13.4743
	2	84.2633	71.4633	72.6633	9.3750	
	3	84.2633	70.9200	73.3100	17.9116	
3	1	84.2633	71.1433	74.7733	27.6678	30.2399
	2	84.2633	71.1467	75.2133	31.0039	
	3	84.2633	70.0867	74.6300	32.0480	
5	1	84.2633	70.6467	73.7267	22.6194	23.3551
	2	84.2633	70.4267	73.3833	21.3684	
	3	84.2633	70.4967	74.0867	26.0775	
7	1	84.2633	69.8033	74.1967	30.3827	27.4447
	2	84.2633	70.2467	73.7133	24.7325	
	3	84.2633	69.6900	73.6567	27.2187	

Table A4 % Monoglyceride removal at different total surfactant concentrations with 3 %w/v NaCl

Total surfactant concentration (%w/v)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
0	1	3549.667	2509.5201	29.3027
	2	3549.667	2478.6566	
	3	3549.667	2540.3836	
0.05	1	3549.667	1665.5299	53.0793
	2	3549.667	1789.6453	
	3	3549.667	1541.4145	
0.1	1	3549.667	1622.0570	54.3040
	2	3549.667	1703.6548	
	3	3549.667	1540.4591	
0.2	1	3549.667	1502.0109	57.6859
	2	3549.667	1546.1129	
	3	3549.667	1457.9088	
0.3	1	3549.667	1107.1724	68.8091
	2	3549.667	1018.6567	
	3	3549.667	1195.6882	
0.5	1	3549.667	1462.5947	58.7963
	2	3549.667	1367.4649	
	3	3549.667	1557.7245	

Table A5 % Monoglyceride re-deposition at different total surfactant concentrations with 3 %w/v NaCl

Total surfactant concentration (%w/v)	% Re-deposition
0	10.4709
0.05	7.6846
0.10	7.5105
0.20	6.7682
0.30	4.7208
0.50	9.9261

Table A6 % Monoglyceride removal at different salinity concentrations with 0.3 %w/v total surfactant concentration

NaCl concentration (%w/v)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
0	1	3549.667	2879.2138	18.8878
	2	3549.667	2912.3567	
	3	3549.667	2846.0708	
1	1	3549.667	1911.7838	46.1419
	2	3549.667	1864.9028	
	3	3549.667	1958.6647	
2	1	3549.667	1492.5122	57.9535
	2	3549.667	1478.4672	
	3	3549.667	1506.5571	
3	1	3549.667	1105.0896	68.8678
	2	3549.667	1130.9835	
	3	3549.667	1079.1957	
5	1	3549.667	1224.8195	65.4948
	2	3549.667	1258.0657	
	3	3549.667	1191.5733	
7	1	3549.667	1402.3761	60.4927
	2	3549.667	1367.4649	
	3	3549.667	1437.2874	

Table A7 % Monoglyceride re-deposition at different salinity concentrations with 0.3 %w/v total surfactant concentration

NaCl concentration (%w/v)	% Re-deposition
0	20.9163
1	15.8589
2	12.1043
3	9.5296
5	14.9839
7	17.4769

Table A8 Monoglyceride removal (%) of selected formulation at different washing temperatures on polyester/cotton blend fabric

Washing temperature (°C)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
20	1	3549.667	2062.4144	41.8984
	2	3549.667	1984.4599	
	3	3549.667	2140.3688	
25	1	3549.667	1787.1124	49.6541
	2	3549.667	1855.7548	
	3	3549.667	1718.4701	
30	1	3549.667	1599.7738	54.9317
	2	3549.667	1678.4654	
	3	3549.667	1521.0823	
35	1	3549.667	1408.6245	60.3167
	2	3549.667	1338.7540	
	3	3549.667	1478.4950	
40	1	3549.667	1371.8560	61.3525
	2	3549.667	1299.6889	
	3	3549.667	1444.0231	
45	1	3549.667	1115.4666	68.5755
	2	3549.667	1209.5460	
	3	3549.667	1021.3872	
50	1	3549.667	1078.0387	69.6299
	2	3549.667	1143.6483	
	3	3549.667	1012.4291	

Table A9 Monoglyceride removal (%) of selected formulation at different washing temperatures on pure polyester fabric

Washing temperature (°C)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
20	1	3056.8913	2149.2109	29.6929
	2	3056.8913	2153.6435	
	3	3056.8913	2144.7784	

Table A9 Monoglyceride removal (%) of selected formulation at different washing temperatures on pure polyester fabric **(Cont.)**

Washing temperature (°C)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
25	1	3056.8913	1847.6437	39.5581
	2	3056.8913	1864.9028	
	3	3056.8913	1830.3846	
30	1	3056.8913	1786.8076	41.5482
	2	3056.8913	1854.6433	
	3	3056.8913	1718.9720	
35	1	3056.8913	1499.6655	50.9415
	2	3056.8913	1387.3480	
	3	3056.8913	1611.9830	
40	1	3056.8913	1337.0349	56.2616
	2	3056.8913	1258.0657	
	3	3056.8913	1416.0040	
45	1	3056.8913	1021.8257	66.5730
	2	3056.8913	1005.7854	
	3	3056.8913	1037.8660	
50	1	3056.8913	904.8159	70.4008
	2	3056.8913	853.4683	
	3	3056.8913	956.1634	

Table A10 % Monoglyceride re-deposition at different washing temperatures for selected formulation for both types of fabric

Washing temperature (°C)	% Re-deposition	
	Polyester/cotton blend	Pure polyester
20	17.1987	19.0058
25	13.5362	16.3980
30	13.0856	15.7842
35	11.3935	14.3227
40	11.1894	13.1328
45	9.6869	12.7718
50	9.4510	11.2396

Table A11 Monoglyceride removal (%) of commercial detergent product as a function of a concentration

Total surfactant concentration (%w/v)	Sample No.	Extracted soil before washing (ppm)	Residual soil after washing (ppm)	Average monoglyceride removal (%)
0	1	3549.6671	2825.1400	20.4111
	2	3549.6671	2912.3567	
	3	3549.6671	2737.9232	
0.05	1	3549.6671	2906.7014	18.1134
	2	3549.6671	2901.7570	
	3	3549.6671	2911.6459	
0.1	1	3549.6671	2900.1768	18.2972
	2	3549.6671	2812.4573	
	3	3549.6671	2987.8964	
0.2	1	3549.6671	2899.3061	18.3217
	2	3549.6671	2954.8458	
	3	3549.6671	2843.7663	
0.3	1	3549.6671	2851.8203	19.6595
	2	3549.6671	2876.9780	
	3	3549.6671	2826.6625	
0.5	1	3549.6671	2845.4385	19.8393
	2	3549.6671	2789.7690	
	3	3549.6671	2901.1080	

Table A12 Monoglyceride re-deposition (%) of commercial detergent product as a function of a concentration

Total surfactant concentration (%w/v)	% Re-deposition
0	16.0511
0.05	19.0047
0.10	22.0951
0.20	23.3115
0.30	24.3354
0.50	26.4281

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