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APPENDICES

Appendix A Milk Deterioration Analysis

Titratable Acidity (TA) can be calculated by following equation:

$$\text{TA (g/l)} = \frac{\text{ml NaOH} \times \text{normality of NaOH} \times \text{Eq. weight of lactic acid} \times 1000}{\text{sample volume (ml)}}$$

Table A1 Change in TA values of fresh milk during storage at ambient temperature

Days	ml NaOH					TA	
	1	2	3	Av	SD	Av	SD
0	5.80	6.00	5.80	5.87	0.12	0.221	0.004
1	5.90	5.80	6.00	5.90	0.10	0.223	0.004
2	6.00	6.00	5.90	5.97	0.06	0.225	0.002
3	9.90	10.00	10.00	9.97	0.06	0.376	0.002
4	18.80	18.60	19.10	18.83	0.25	0.707	0.009
5	20.20	20.00	20.10	20.10	0.10	0.755	0.004
6	20.50	20.20	20.10	20.27	0.21	0.761	0.008
7	20.10	20.40	20.30	20.27	0.15	0.761	0.006

Table A2 Change in Hunter color values of BMB type-film during storage at ambient temperature

Day (s)	Hunter	1	2	3	Av.	SD
0	*L*	21.15	21.18	20.97	**21.10**	0.11
	a	-1.37	-1.34	-1.41	**-1.37**	0.04
	b	8.24	8.2	7.96	**8.13**	0.15
1	*L*	21.23	21.11	21.15	**21.16**	0.06
	a	-1.45	-1.54	-1.48	**-1.49**	0.05
	b	8.23	8.25	7.9	**8.13**	0.20
2	*L*	21.17	21.25	21.14	**21.19**	0.06
	a	-1.54	-1.58	-1.41	**-1.51**	0.09
	b	8.8	8.6	8.57	**8.66**	0.13
3	*L*	22.78	22.83	23.07	**22.89**	0.16
	a	-2.49	-2.5	-2.61	**-2.53**	0.07
	b	11.38	11.35	11.66	**11.46**	0.17
4	*L*	23.98	23.92	23.89	**23.93**	0.05
	a	-3.98	-4	-4.08	**-4.02**	0.05
	b	15.73	15.66	15.95	**15.78**	0.15
5	*L*	24.21	24.13	24.1	**24.15**	0.06
	a	-4.01	-3.98	-4.12	**-4.04**	0.07
	b	15.88	15.91	15.9	**15.90**	0.02
6	*L*	24.26	24.24	24.27	**24.26**	0.02
	a	-4.15	-4.13	-4.2	**-4.16**	0.04
	b	16.27	16.12	16.18	**16.19**	0.08
7	*L*	24.34	24.21	24.25	**24.27**	0.07
	a	-4.19	-4.13	-4.21	**-4.18**	0.04
	b	16.26	16.12	16.23	**16.20**	0.07

Table A3 Change in Hunter color values of BP type-film during storage at ambient temperature

Day (s)	Hunter	1	2	3	Av.	SD
0	*L*	15.34	15.41	15.37	15.37	0.04
	a	3.18	3.06	3	3.08	0.09
	b	-8.86	-8.67	-8.69	-8.74	0.10
1	*L*	15.38	15.43	15.32	15.38	0.06
	a	2.41	2.39	2.36	2.39	0.03
	b	-9.47	-9.42	-9.4	-9.43	0.04
2	*L*	15.34	15.36	15.38	15.36	0.02
	a	2.48	2.31	2.26	2.35	0.12
	b	-9.48	-9.41	-9.44	-9.44	0.04
3	*L*	17.91	17.9	17.86	17.89	0.03
	a	0.75	0.72	0.8	0.76	0.04
	b	-0.11	-0.22	-0.38	-0.24	0.14
4	*L*	21.12	21.09	21.22	21.14	0.07
	a	-1.84	-1.82	-1.99	-1.88	0.09
	b	5.36	5.19	5.18	5.24	0.10
5	*L*	20.82	20.83	20.91	20.85	0.05
	a	-1.6	-1.86	-1.96	-1.81	0.19
	b	5.41	5.26	5.47	5.38	0.11
6	*L*	20.41	20.36	20.37	20.38	0.03
	a	-1.91	-1.9	-1.81	-1.87	0.06
	b	5.49	5.38	5.33	5.40	0.08
7	*L*	21.24	21.21	21.16	21.20	0.04
	a	-1.67	-1.6	-1.54	-1.60	0.07
	b	5.42	5.64	5.5	5.52	0.11

Table A4 Change in TCD values of BMB type- and BP type-film during storage at ambient temperature

Day (s)	BMB type-		BP type-	
	TCD value	SD	**TCD value**	SD
0	0.00	0.00	0.00	0.00
1	0.13	0.07	0.69	0.10
2	0.55	0.08	1.01	0.07
3	3.96	0.06	9.83	0.06
4	8.57	0.07	16.21	0.03
5	8.75	0.15	16.55	0.10
6	9.09	0.12	16.68	0.04
7	9.11	0.09	16.81	0.03

Appendix B Mechanical Measurement of PP/organoclay nanocomposites

Table B1 Young's modulus (MPa) of PP/organoclay nanocomposites

Composition	1	2	3	4	5	Av.	SD
PP2	3050	3081	3064	3272	3320	3157	128
PP2S6	2251	2667	2478	2656	2515	2514	169
PP2S6D1	3183	2969	3258	2892	3040	3069	151
PP2S6D3	3455	3321	3391	3067	2875	3222	244
PP2S6D5	3194	3399	2923	3141	3038	3139	178
PP2S6D7	2501	2830	2470	3048	2723	2714	240

Table B2 Tensile strength (MPa) of PP/organoclay nanocomposites

Composition	1	2	3	4	5	Av.	SD
PP2	31.16	31.10	31.20	31.50	31.89	31.37	0.33
PP2S6	28.72	28.82	28.34	27.88	28.46	28.45	0.37
PP2S6D1	30.29	30.47	31.15	30.56	31.06	30.70	0.38
PP2S6D3	31.79	31.58	31.03	31.14	31.45	31.40	0.31
PP2S6D5	31.49	31.28	31.41	31.57	31.48	31.44	0.11
PP2S6D7	31.36	31.22	31.08	31.10	31.03	31.16	0.13

Table B3 Strain at break (%) of PP/organoclay nanocomposites

Composition	1	2	3	4	5	Av.	SD
PP2	74	80	64	75	64	71	7
PP2S6	384	366	384	376	376	377	7
PP2S6D1	178	166	176	189	164	175	10
PP2S6D3	135	100	96	119	95	109	17
PP2S6D5	103	105	103	113	107	106	4
PP2S6D7	92	77	100	86	98	91	9

Table B4 Toughness (MPa) of PP/organoclay nanocomposites

Composition	1	2	3	4	5	Av.	SD
PP2	16.66	18.19	15.97	14.62	17.29	16.55	1.35
PP2S6	72.66	73.98	73.47	71.92	72.45	72.89	0.82
PP2S6D1	36.86	32.10	34.39	38.99	35.64	35.60	2.59
PP2S6D3	21.12	25.94	21.31	28.21	33.26	25.97	5.09
PP2S6D5	24.01	21.37	23.54	21.84	26.56	23.47	2.06
PP2S6D7	15.79	19.23	16.07	19.33	17.47	17.58	1.68

Appendix C Thermal Stability of PP/organoclay Nanocomposites

Table C1 Decomposition temperatures (°C) of PP/organoclay nanocomposites

Composition	Clay content (wt%)					T_d (°C)				
	1	2	3	Av.	SD	1	2	3	Av.	SD
PP2	-	-	-	-	-	456.3	453.2	452.6	454.0	2.0
PP2S6	-	-	-	-	-	457.6	456.2	455.7	456.5	1.0
PP2S6D1	1.1	0.9	1.2	1.1	0.2	458.1	457.9	459.1	458.4	0.6
PP2S6D3	3.0	2.2	2.5	2.6	0.4	458.3	458.9	459.1	458.8	0.4
PP2S6D5	3.1	4.0	3.5	3.5	0.5	459.8	459.3	458.7	459.3	0.6
PP2S6D7	5.3	5.4	5.4	5.4	0.1	459.1	460.6	460.8	460.2	0.9

Appendix D Melting and Crystallization Behavior of PP/organoclay nanocomposites

Table D1 Melting temperature (°C) of PP/organoclay nanocomposites

Composition	1	2	3	Av.	SD
PP2	160.9	161.0	161.0	161.0	0.1
PP2S6	161.0	161.5	161.0	161.2	0.3
PP2S6D1	160.7	160.7	161.0	160.8	0.2
PP2S6D3	160.7	160.2	160.7	160.5	0.3
PP2S6D5	160.0	159.9	160.5	160.1	0.3
PP2S6D7	160.0	159.9	160.2	160.0	0.2

Table D2 Crystallization temperature (°C) of PP/organoclay nanocomposites

Composition	1	2	3	Av.	SD
PP2	113.6	113.8	114.0	113.8	0.2
PP2S6	115.8	114.0	115.6	115.1	1.0
PP2S6D1	111.1	115.5	115.6	114.1	2.6
PP2S6D3	111.5	112.1	111.6	111.7	0.3
PP2S6D5	111.6	111.8	112.1	111.9	0.3
PP2S6D7	110.8	111.1	113.6	111.9	1.5

Table D3 ΔH_f (J/g) of PP/organoclay nanocomposites

Composition	1	2	3	Av.	SD
PP2	53.0	66.8	68.8	62.9	8.6
PP2S6	62.8	58.5	66.3	62.5	3.9
PP2S6D1	62.2	62.0	62.3	62.1	0.1
PP2S6D3	57.8	67.4	60.5	61.9	4.9
PP2S6D5	61.0	57.1	57.9	58.7	2.0
PP2S6D7	59.6	58.0	57.1	58.3	1.3

Appendix E Melt Flow Index (MFI) of PP/organoclay Nanocomposites

Table E1 MFI of PP/organoclay nanocomposites

Load cell 2.16 kg, temperature 200°C

Composition	1	2	3	Av.	SD
PP2	2.00	1.94	1.96	1.97	0.03
PP2S6	2.18	2.2	2.18	2.19	0.01
PP2S6D1	2.48	2.48	2.52	2.49	0.02
PP2S6D3	2.74	2.76	2.78	2.76	0.02
PP2S6D5	2.70	2.72	2.74	2.72	0.02
PP2S6D7	2.92	2.86	2.9	2.89	0.03

Appendix F Bentonite Clay, Max-Gel® GRADE SAC

Table F1 Typical chemical analysis of bentonite on dry basis at 105°C

Element	**Percentage**
SiO_2	65-70
Al_2O_3	13-17
Fe_2O_3	1.0-2.0
Na_2O	1.5-2.5
LOI	10-12
MgO	2.0-3.0
CaO	1.5-2.5
K_2O	0.4-0.8
TiO_2	0.2-0.3

Table F2 Physical properties of bentonite

Physical properties	
Moisture content, %	8-12
5% suspension, pH	9.5-11.0
Swelling index, ml per 2 g of clay	15
Viscosity dial reading at 600 rpm	12-20
Dry particle size (pass 200 meshes), %	80 min
Wet particle size (pass 325 meshes),	98 min
Specific gravity	2.3-2.4
CEC, meq/100g of clay	50

Appendix G Interlayer Structure of Alkylammonium Layered Silicates

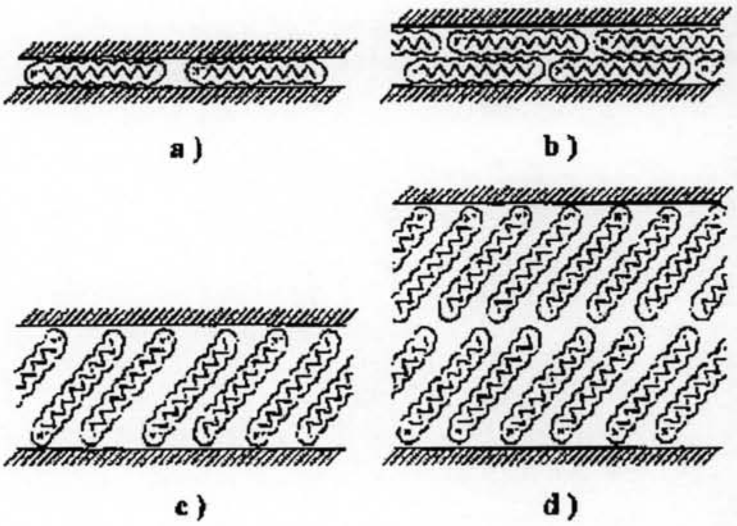

Figure G1 Alkyl chain aggregation in mica-type silicates: (a) lateral monolayer, (b) lateral bilayer, (c) paraffin-type monolayer, (d) paraffin-type bilayer (Richard *et al.*, 1994).

Appendix H Correlation between titratable acidity (TA) and pH

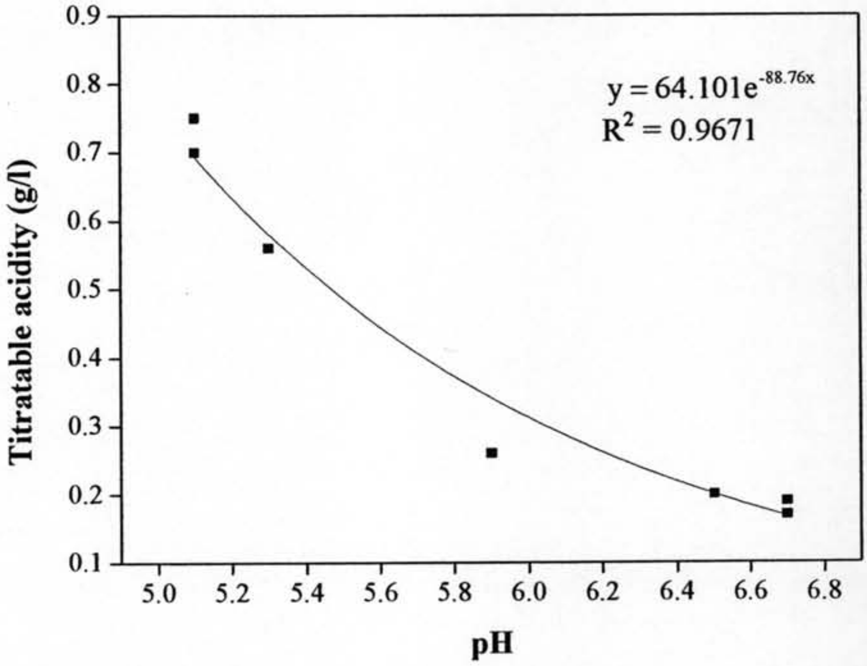

Figure H1 Correlation between titratable acidity (TA) and pH of fresh milk during storage at ambient temperature.

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2. Tassanawat, S., Magaraphan, R., Nithitanakul, M., and Manuspiya, H. (2007, April 9-13) Sensitive-Dye Incorporated PP/Clay Nanocomposites. Poster presented at 2007 MRS Spring Meeting, San Francisco, California, USA.
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