APPENDIX A

Calculation for Na^+ ion-exchange percentage

The 1000-ppm NaCl stock solution was used to prepare standard solution having concentration of 0.2-, 0.5- and 1.0-ppm by dilution method. Firstly 100-ppm Na^+ solution was prepared by dilution 1000-ppm NaCl solution for 10 times. Then, the 2-, 5- and 10-ppm Na^- solutions were further prepared from the 100-ppm Na^- solution. Finally, the 0.2-, 0.5- and 1.0-ppm Na^+ solutions were prepared by dilution from previous concentration. The 0.2, -0.5- and 1.0-ppm were used as standard Na^+ solutions to create a calibration curve, as shown in Figure A1.
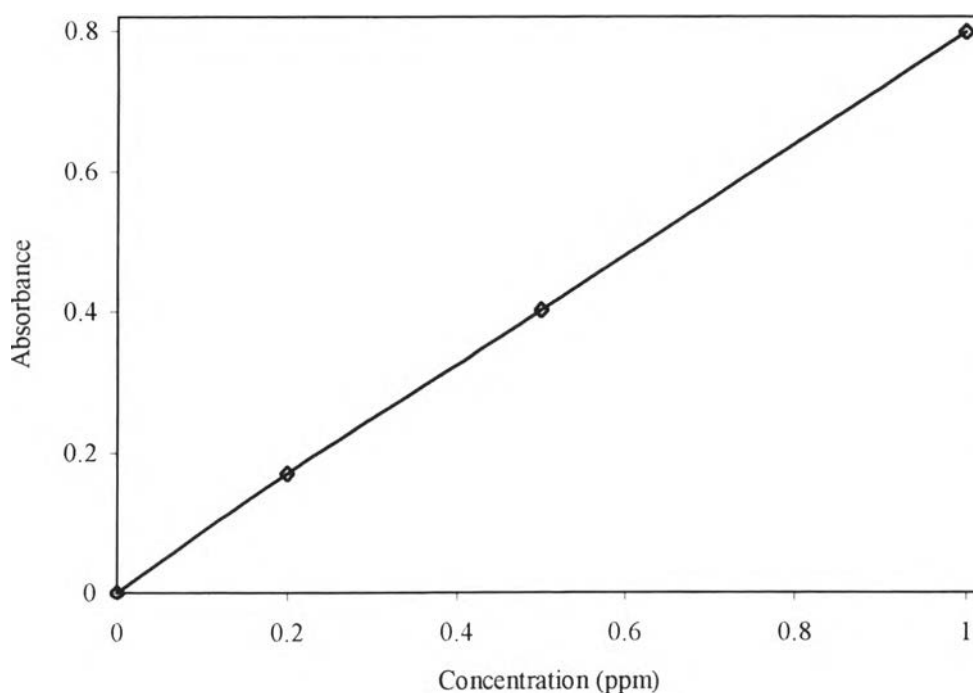

Figure A1 The calibration curve of the standard Na^+ solutions.

The sample solution was collected from the preparation of the organically modified MMT. This solution was diluted into 1000 times and used as the sample solution for AAS analysis. The Na^+-exchanged percentage was calculated from the following equation.

$$\% \ Na \cdot ion - exchanged \ = \ \frac{Amount \ of \ Na^+ \ in \ solution \ obtained \ fron \ AAS}{Weight \ of \ MMT \ * \ 119e^{-5}} * 100$$

APPENDIX B

Flammability data of Nylon 12 and PVC/organoclay nanocomposites and Nylon12/metalatrane composites.

Table B1 LOI data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	LOI value						
	1	2	3	4	5	Average	SD
0	20.3	20.4	20.4	20.3	20.4	20.4	0.1
1	22.9	22.8	22.9	22.8	22.9	22.9	0.1
3	25.0	25.1	25.1	25.0	25.1	25.1	0.1
5	26.7	26.8	26.6	26.9	26.8	26.8	0.1
7	27.6	27.6	27.5	27.8	27.8	27.7	0.1
9	28.1	28.3	28.1	28.2	28.2	28.2	0.1

Table B2 LOI data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	LOI value						
	1	2	3	4	5	Average	SD
0	35.5	35.6	35.6	35.6	35.5	35.6	0.1
1	45.3	45.2	45.2	45.2	45.1	45.2	0.1
3	46.6	46.5	46.6	46.6	46.5	46.6	0.1
5	47.6	47.7	47.7	47.6	47.7	47.7	0.1
7	48.1	48.2	48.2	48.2	48.1	48.2	0.1
9	49.0	48.9	49.1	49.0	49.0	49.0	0.1

Table B3 LOI data of Nylon12/silatrane composites

Silatrane loading (wt%)	LOI value						
	1	2	3	4	5	Average	SD
0	20.3	20.4	20.4	20.3	20.4	20.4	0.1
5	26.5	26.6	26.4	26.5	26.5	26.5	0.1
10	27.3	27.4	27.4	27.3	27.4	27.4	0.1
15	28.2	28.3	28.4	28.2	28.3	28.3	0.1
20	29.0	29.1	29.2	29.1	29.1	29.1	0.1

Table B4 Gross Heat Calorific data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Gross Heat Calorific value (cal/g)				
	1	2	3	Average	SD
0	9617.96	9767.33	9845.55	9743.61	115.63
1	9379.08	9183.14	9207.07	9256.43	106.89
3	8714.14	8799.09	8911.43	8808.22	98.96
5	8541.62	8555.92	8382.99	8493.51	95.98
7	8392.82	8264.84	8442.86	8366.84	91.81
9	8188.94	8313.85	8360.97	8287.92	88.90

Table B5 Gross Heat Calorific data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Gross Heat Calorific value (cal/g)				
	1	2	3	Average	SD
0	4891.99	4998.18	4954.65	4948.27	53.38
1	4774.52	4677.01	4692.17	4714.57	52.47
3	4582.84	4618.61	4682.48	4627.98	50.48
5	4382.18	4453.41	4368.09	4401.23	45.74
7	4252.04	4344.14	4307.32	4301.17	46.36
9	4232.75	4326.47	4293.27	4284.16	47.52

Table B6 Gross Heat Calorific data of Nylon12/silatrane composites

Silatrane loading (wt%)	Gross Heat Calorific value (cal/g)				
	1	2	3	Average	SD
0	9617.96	9767.33	9845.55	9743.61	115.63
5	7285.45	7367.12	7204.35	7285.64	81.39
10	6744.64	6891.17	6801.53	6812.45	73.87
15	6478.32	6615.10	6569.54	6554.32	69.65
20	6418.58	6652.24	6533.49	6501.44	72.37

APPENDIX C

Mechanical property data of Nylon 12 and PVC/organoclay nanocomposites and Nylon12/metalatrane composites.

Table C1 Tensile strength data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Tensile strength (MPa)						
	1	2	3	4	5	Average	SD
0	34.0	33.3	35.9	33.3	35.6	34.4	1.3
1	35.6	37.9	37.3	35.3	35.3	36.3	1.2
3	39.8	38.1	38.2	41.3	39.3	39.3	1.3
5	41.9	39.9	38.4	39.9	41.3	40.3	1.4
7	37.7	38.7	36.9	37.7	40.6	38.3	1.4
9	34.4	34.7	35.3	35.0	37.4	35.4	1.2

Table C2 Tensile strength data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Tensile strength (MPa)						
	1	2	3	4	5	Average	SD
0	7.0	6.7	7.0	6.7	6.6	6.8	0.2
1	16.8	16.0	16.6	16.3	15.6	16.3	0.5
3	13.3	13.0	12.9	13.9	13.5	13.3	0.4
5	12.1	12.0	12.3	11.2	11.7	11.9	0.4
7	11.2	10.8	11.0	10.5	11.4	11.0	0.3
9	9.9	10.7	10.3	10.0	9.7	10.1	0.4

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Table C3 Tensile strength data of Nylon12/silatrane composites

Silatrane loading (wt%)	Tensile strength (MPa)						
	1	2	3	4	5	Average	SD
0	34.0	33.3	35.9	33.3	35.6	34.4	1.3
5	32.9	33.9	36.2	35.4	34.6	34.6	1.3
10	34.1	36.3	33.9	35.5	36.3	35.2	1.1
15	34.6	37.1	35.0	36.9	36.9	36.1	1.2
20	35.9	38.1	39.0	36.6	37.9	37.5	1.2

Table C4 Modulus data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Modulus (MPa)						
	1	2	3	4	5	Average	SD
0	432.9	443.6	454.0	426.3	419.1	435.2	13.9
1	587.6	577.5	627.3	597.8	591.3	596.3	18.9
3	646.0	619.6	678.5	656.8	625.2	645.2	24.0
5	677.2	664.4	695.5	724.0	665.3	685.3	25.0
7	671.8	647.9	624.1	657.5	625.3	645.3	20.7
9	647.7	624.5	670.8	612.0	636.3	638.3	22.5

Table C5 Modulus data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Modulus (MPa)						
	1	2	3	4	5	Average	SD
0	659.3	651.3	622.5	674.9	668.5	655.3	20.4
1	1140.3	1156.2	1062.2	1083.4	1115.3	1111.5	38.9
3	1186.6	1099.0	1172.7	1126.3	1136.2	1144.2	35.5
5	1229.3	1143.8	1194.7	1149.1	1201.7	1183.7	36.4
7	1127.2	1216.8	1149.3	1157.4	1196.2	1169.4	36.4
9	1103.2	1185.7	1190.2	1137.2	1153.6	1154.0	36.0

Table C6 Modulus data of Nylon12/silatrane composites

Silatrane loading (wt%)	Modulus (MPa)						
	1	2	3	4	5	Average	SD
0	432.9	443.6	454.0	426.3	419.1	435.2	13.9
5	446.3	438.4	479.1	460.9	468.7	458.7	16.5
10	468.2	470.4	457.7	494.4	454.3	469.0	15.7
15	452.7	481.8	465.1	483.5	498.6	476.3	17.8
20	461.1	498.1	500.3	485.1	466.2	482.2	18.0

Table C7 Elongation at break data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Elongation at break (%)						
	1	2	3	4	5	Average	SD
0	294.6	304.1	307.2	291.1	309.8	301.4	8.1
1	33.9	32.2	33.9	32.5	34.4	33.4	1.0
3	24.4	22.5	24.1	23.7	23.9	23.7	0.7
5	17.1	15.8	16.4	16.1	16.8	16.4	0.5
7	11.7	11.8	12.6	11.6	12.3	12.0	0.4
9	5.5	5.6	5.8	5.3	5.8	5.6	0.2

Table C8 Elongation at break data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Elongation at break (%)						
	1	2	3	4	5	Average	SD
0	4.7	4.4	4.6	4.6	4.4	4.6	0.1
1	2.8	2.6	2.5	2.8	2.8	2.7	0.1
3	1.8	2.0	2.1	1.8	1.9	1.9	0.1
5	1.2	1.4	1.1	1.2	1.2	1.2	0.1
7	1.2	1.0	1.2	1.1	1.2	1.1	0.1
9	0.9	0.8	1.1	0.9	0.9	0.9	0.1

Table C9 Elongation at break data of Nylon12/silatrane composites

Silatrane loading (wt%)	Elongation at break (%)						
	1	2	3	4	5	Average	SD
0	294.6	304.1	307.2	291.1	309.8	301.4	8.1
5	46.5	43.3	45.3	43.4	44.6	44.6	1.4
10	42.8	42.8	44.8	42.9	45.7	43.8	1.4
15	42.4	40.7	42.0	44.7	42.5	42.5	1.4
20	40.4	43.2	41.6	40.7	43.1	41.8	1.3

Table C10 Impact strength data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Impact strength (kJ/m^2)						
	1	2	3	4	5	Average	SD
0	13.1	12.9	13.7	13.2	13.8	13.3	0.4
1	12.5	11.8	12.3	12.1	11.6	12.1	0.4
3	10.9	11.9	11.8	11.4	12.0	11.6	0.5
5	10.5	10.2	9.7	9.9	10.3	10.1	0.3
7	9.9	9.5	10.1	10.1	9.4	9.8	0.3
9	8.9	8.8	9.5	9.2	9.3	9.1	0.3

Table C11 Impact strength data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Impact strength (kJ/m^2)						
	1	2	3	4	5	Average	SD
0	8.4	8.5	8.3	8.2	8.8	8.4	0.2
1	8.1	8.4	8.6	8.1	8.2	8.3	0.2
3	8.2	8.2	8.5	8.6	8.0	8.3	0.2
5	8.0	8.1	8.4	8.2	8.5	8.2	0.2
7	8.2	8.2	7.9	8.4	8.5	8.2	0.2
9	7.9	8.0	7.9	8.1	8.4	8.1	0.2

Table C12 Impact strength data of Nylon12/silatrane composites

Silatrane loading (wt%)	Impact strength (kJ/m^2)						
	1	2	3	4	5	Average	SD
0	13.1	12.9	13.7	13.2	13.8	13.3	0.4
5	12.8	12.6	13.1	13.3	12.9	12.9	0.3
10	12.9	12.4	12.6	12.2	12.8	12.6	0.3
15	11.8	12.5	12.4	12.0	11.9	12.1	0.3
20	11.5	12.2	12.0	11.9	11.6	11.8	0.3

Table C13 Hardness (Shore D) data of Nylon12/OC-MMT nanocomposites

Clay loading (wt%)	Hardness (Shore D)						
	1	2	3	4	5	Average	SD
0	68	68	69	68	68	68	0.4
1	71	72	72	71	71	71	0.5
3	71	72	72	72	71	72	0.5
5	73	73	73	73	72	73	0.4
7	72	73	73	73	73	73	0.4
9	74	74	74	74	75	74	0.4

Table C14 Hardness (Shore D) data of PVC/OC-MMT nanocomposites

Clay loading (wt%)	Hardness (Shore D)						
	1	2	3	4	5	Average	SD
0	68	68	68	67	68	68	0.4
1	71	72	72	72	72	72	0.4
3	72	72	72	72	71	72	0.4
5	73	73	73	73	74	73	0.4
7	74	74	74	74	73	74	0.4
9	75	75	75	75	74	75	0.4

Table C15 Hardness (Shore D) data of Nylon12/silatrane composites

Silatrane loading (wt%)	Hardness (Shore D)						
	1	2	3	4	5	Average	SD
0	68	68	69	68	68	68	0.4
5	71	71	71	71	72	71	0.4
10	72	71	72	72	72	72	0.4
15	74	74	73	73	74	74	0.5
20	74	74	74	74	73	74	0.4

CURRICULUM VITAE

Name: Ms. Jirawadee Pipattanatornkul

Date of Birth: January 6, 1979

Nationality: Thai

University Education:

1997-2000   Bachelor Degree of Science in Industrial Chemistry, Faculty of Applied Science, King Mongkut's Institute of Technology North Bangkok (KMIT'NB), Bangkok, Thailand.

Presentation:

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