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APPENDIX A

Calculation of Na^+-Exchanged Percentage by Atomic Adsorption Spectroscopy

Conditions of instrument

Instrument Mode	Absorbance
Calibration Mode	Concentration
Measurement Mode	Integration
Slit Width (nm)	0.5
Slit Height	Normal
Wavelength (nm)	589.0
Flame	Air-Acetylene
Sample Introduction	Manual
Delay Time	2
Time Constant	0.05
Measurement Time (sec)	1.0
Replicates	3
Background Correction	Off
Air Flow (L/min)	13.5
Acetylene Flow (L/min)	2.00

Condition of sodium lamp

Table A1 Light wavelengths of sodium lamp and their intensities

Wavelength (nm)	Slit width (nm)	Conc. for 0.2 ABS (mg/L)	Relative lamp intensity
589.0	0.5	0.15	100
589.6	0.5	0.30	60
330.3	0.5	80.0	2

The 1000 ppm Na^+ solution was used as the stock solution. The 100 ppm Na^+ solution was first prepared by dilution from the 1000 ppm Na^+ solution. Then, the 10, 1, 0.5, 0.2 ppm Na^+ solution were further prepared from the 100 ppm Na^+ solution. The 1, 0.5, 0.2 ppm Na^+ solution with KCl and 1:1 HCl solution were subsequently used as standard Na^+ solutions to create a calibration curve.

Table A2 Relationship between concentration and absorbance of standard sodium solution for OC-MMT

Sample	Conc. (ppm)	% RSD	Mean ABS	Readings		
Blank	0.00		0.000	0.002	-0.001	0.000
Blank	0.00		0.000	0.000	0.000	0.000
Blank	0.00		0.000	0.000	0.000	0.000
Standard 1	0.20	0.2	0.107	0.107	0.107	0.107
Standard 2	0.50	0.4	0.258	0.259	0.257	0.258
Standard 3	1.00	1.0	0.540	0.538	0.546	0.535

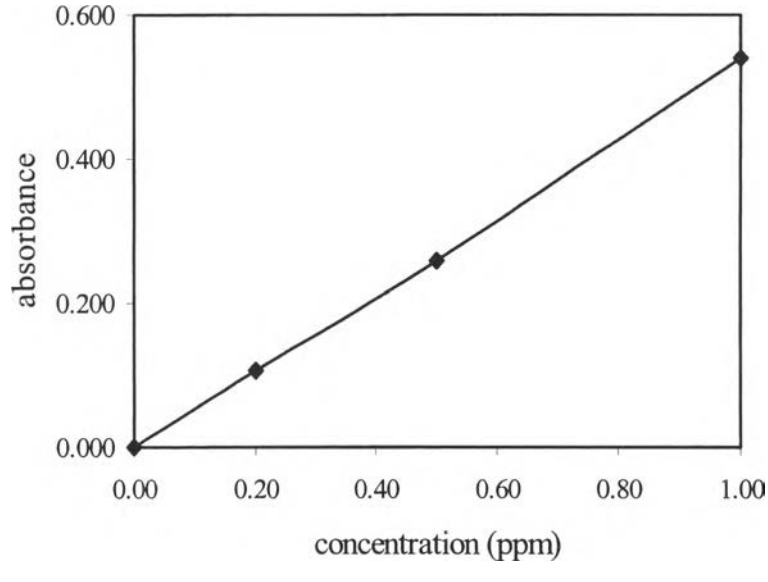

Figure A1 Calibration curve obtained from standard Na^+ solutions for OC-MMT.

The sample solution was collected from the supernatant part in the preparation of organically modified MMT. This solution was diluted to 200 times and used as the sample solution for AAS test. The Na^+ exchange percentage was calculated from the following data.

Table A3 Na^+ concentration of the supernatant of OC-MMT

Sample	Conc. (ppm)	% RSD	Mean ABS	Readings		
OC 1	0.73	1.2	0.384	0.378	0.386	0.389
OC 2	0.72	0.9	0.378	0.376	0.376	0.383
OC 3	0.72	0.9	0.378	0.376	0.383	0.376

Calculation for Na^+ content

Na^+ concentration from AAS	=	0.72 ppm (or μg/ml)
Dilution factor	=	200
Total concentration	=	0.72 × 200 μg/ml
Amount of supernatant	=	1.8 L
Amount of Na^+ in the supernatant	=	0.72 × 200 μg/ml × 1800 ml
	=	259,200 μg
	=	259.2 mg

Calculation for Na^+ exchange percentage

CEC of Na-MMT	=	119 meq
Na-MMT 100 g contains Na^+	=	119 mmol
	=	0.119 mol
Na^+ in 10 g Na-MMT	=	0.0119 mol
	=	0.0119 × 23 g
	=	273.7 mg
So, Na^+ exchange percentage	=	(259.2 mg / 273.7 mg) × 100
	=	94.70 %

Table A4 Relationship between concentration and absorbance of standard sodium solution for OH-MMT

Sample	Conc. (ppm)	% RSD	Mean ABS	Readings		
Blank	0.00		0.001	0.001	0.000	0.001
Blank	0.00		0.000	0.000	0.000	0.000
Blank	0.00		0.000	0.000	0.000	0.000
Standard 1	0.20	1	0.086	0.087	0.085	0.086
Standard 2	0.50	0.5	0.238	0.237	0.239	0.237
Standard 3	1.00	0.5	0.534	0.536	0.535	0.531

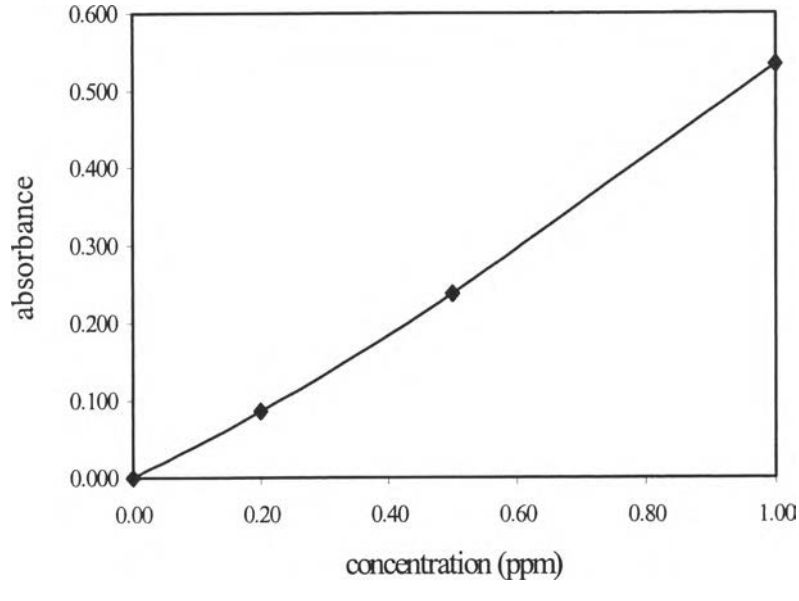

Figure A2 Calibration curve obtained from standard Na^+ solutions for OH-MMT.

Table A5 Na^+ concentration of the supernatant of OH-MMT

Sample	Conc. (ppm)	% RSD	Mean ABS	Readings		
OH 1	0.94	0.8	0.497	0.501	0.494	0.495
OH 2	0.94	0.9	0.503	0.501	0.509	0.500
OH 3	0.94	0.9	0.503	0.498	0.503	0.507

Calculation for Na^+ content

Na^+ concentration from AAS = 0.94 ppm (or μg/ml)

Dilution factor = 200

Total concentration = 0.94 × 200 μg/ml

Amount of supernatant = 1.4 L

Amount of Na^+ in the supernatant = 0.94 × 200 μg/ml × 1400 ml

= 263,200 μg

= 263.2 mg

Calculation for Na^+ exchange percentage

Na^+ exchange percentage = (263.2 mg / 273.7 mg) × 100

= 96.16 %

APPENDIX B

Viscosity and Particle Size Measurement Data of PEO/MMT Nanocomposites

Table B1 Specific viscosity data of PEO/Na-MMT nanocomposites in aqueous solution as a function of Na-MMT loading

Na-MMT (%)	Conc. (g/100ml)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
0	0.010	184.19	184.16	184.25	184.20	0.05	0.011
	0.050	192.03	191.99	192.07	192.03	0.04	0.054
	0.100	201.67	201.56	201.65	201.63	0.06	0.107
1	0.010	182.80	182.90	182.87	182.86	0.05	0.004
	0.050	189.97	190.02	190.08	190.02	0.06	0.043
	0.100	199.27	199.27	199.35	199.30	0.05	0.094
3	0.010	182.77	182.69	182.74	182.73	0.04	0.003
	0.050	191.07	190.89	190.99	190.98	0.09	0.048
	0.100	199.92	199.81	199.75	199.83	0.09	0.097
5	0.010	183.63	183.62	183.64	183.63	0.01	0.008
	0.050	190.39	190.33	190.27	190.33	0.06	0.045
	0.100	198.43	198.30	198.27	198.33	0.09	0.088
10	0.010	183.54	183.56	183.59	183.56	0.03	0.007
	0.050	189.50	189.55	189.50	189.52	0.03	0.040
	0.100	197.75	197.69	197.71	197.72	0.03	0.085
20	0.010	182.94	183.00	182.97	182.97	0.03	0.004
	0.050	187.22	187.28	187.21	187.24	0.04	0.028
	0.100	193.18	193.13	193.30	193.20	0.09	0.060
60	0.010	182.54	182.57	182.54	182.55	0.02	0.002
	0.050	186.33	186.40	186.52	186.42	0.10	0.023
	0.100	191.36	191.42	191.43	191.40	0.04	0.050

Table B2 Specific viscosity data of 0.1g/100ml PEO/Na-MMT nanocomposites in aqueous solution in the presence of NaCl as a function of Na-MMT loading

Na-MMT (%)	NaCl (M)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
1	0.001	199.57	199.54	199.56	199.56	0.02	0.095
	0.010	199.32	199.19	199.20	199.24	0.07	0.093
	0.100	199.87	199.67	199.76	199.77	0.10	0.096
3	0.001	199.53	199.47	199.49	199.50	0.03	0.095
	0.010	199.53	199.35	199.35	199.41	0.10	0.094
	0.100	200.79	200.83	200.89	200.84	0.05	0.102
5	0.001	198.64	198.56	198.76	198.65	0.10	0.090
	0.010	199.27	199.18	199.22	199.22	0.05	0.093
	0.100	198.62	198.52	198.48	198.54	0.07	0.090
10	0.001	196.29	196.21	196.14	196.21	0.08	0.077
	0.010	198.33	198.34	198.36	198.34	0.02	0.089
	0.100	197.78	197.67	197.77	197.74	0.06	0.085
20	0.001	194.13	194.17	194.03	194.11	0.07	0.065
	0.010	193.53	193.50	193.64	193.56	0.07	0.062
	0.100	192.30	192.31	192.19	192.27	0.07	0.055
60	0.001	191.39	191.23	191.33	191.32	0.08	0.050
	0.010	188.05	187.83	187.87	187.92	0.12	0.031
	0.100	185.15	185.19	185.23	185.19	0.04	0.016

Table B3 Particle size data obtained from dynamic light scattering of PEO/Na-MMT nanocomposites in aqueous solution as a function of Na-MMT loading

Na-MMT (%)	Conc. (g/100ml)	Diameter (nm)				P	% in range
		Z_1	Z_2	Z_3	Z_{ave}		
1	0.010	250.5	236.0	234.4	240.3	0.783	82.10
	0.050	285.4	241.8	232.8	253.3	0.791	85.47
	0.100	97.7	113.1	116.5	109.1	0.888	76.40
3	0.010	305.3	329.6	324.8	319.9	0.882	71.03
	0.050	336.1	302.3	295.2	311.2	0.900	79.57
	0.100	256.8	229.5	233.4	239.9	1.000	78.37
5	0.010	404.5	394.0	382.0	393.5	0.943	74.00
	0.050	348.8	339.4	360.2	349.5	0.870	79.77
	0.100	256.9	259.7	218.1	244.9	1.000	78.67
10	0.010	492.8	434.9	415.3	447.7	0.718	80.37
	0.050	505.4	478.7	500.7	494.9	0.708	85.03
	0.100	511.8	545.5	508.6	522.0	0.774	83.83
20	0.010	483.5	491.2	471.1	481.9	0.635	86.90
	0.050	508.7	510.3	513.1	510.7	0.560	92.90
	0.100	504.9	502.8	504.1	503.9	0.526	96.63
60	0.010	498.2	491.2	502.3	497.2	0.545	92.20
	0.050	498.7	472.4	485.7	485.6	0.577	93.10
	0.100	501.2	509.4	497.5	502.7	0.516	97.13

Table B4 Particle size data obtained from dynamic light scattering of 0.1g/100ml PEO/Na-MMT nanocomposites in aqueous solution in the presence of NaCl as a function of Na-MMT loading

Na-MMT (%)	NaCl (M)	Diameter (nm)				P	% in range
		Z_1	Z_2	Z_3	Z_{ave}		
1	0.001	309.3	282.9	287.5	293.23	0.958	79.67
	0.010	230.4	230.9	219.9	227.07	0.960	86.10
	0.100	307.2	267.0	278.0	284.07	1.000	82.13
3	0.001	228.4	231.9	241.8	234.03	1.000	75.60
	0.010	359.7	351.5	366.1	359.10	0.798	91.90
	0.100	196.0	200.7	181.5	192.73	1.000	83.73
5	0.001	290.7	260.8	246.4	265.97	0.946	86.47
	0.010	352.8	380.1	356.6	363.17	0.739	90.37
	0.100	339.2	344.9	339.1	341.07	0.732	95.80
10	0.001	766.7	702.9	617.0	695.53	0.764	88.27
	0.010	369.4	380.0	374.0	374.47	1.000	86.67
	0.100	158.4	150.1	171.9	160.13	1.000	79.63
20	0.001	444.7	447.8	446.8	446.43	1.000	84.87
	0.010	448.8	449.9	497.6	465.43	1.000	84.67
	0.100	350.2	430.5	412.1	397.60	1.000	74.77
60	0.001	506.4	516.0	499.2	507.20	0.901	85.67
	0.010	780.0	785.2	756.8	774.00	0.520	95.20
	0.100	3525.7	4056.6	4531.9	4038.07	0.262	92.60

Table B5 Specific viscosity data of PEO/OC-MMT nanocomposites in aqueous solution as a function of OC-MMT loading

MMTs	Conc. (g/100ml)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
OC-MMT1%	0.010	183.91	183.83	183.77	183.84	0.07	0.009
	0.050	190.38	190.32	190.35	190.35	0.03	0.045
	0.100	198.39	198.36	198.33	198.36	0.03	0.089
OC-MMT10%	0.010	183.33	183.28	183.23	183.28	0.05	0.006
	0.050	189.56	189.48	189.53	189.52	0.04	0.040
	0.100	197.71	197.72	197.63	197.69	0.05	0.085
OC-MMT60%	0.010	182.75	182.81	182.66	182.74	0.08	0.003
	0.050	188.62	188.53	188.55	188.57	0.05	0.035
	0.100	196.79	196.75	196.77	196.77	0.02	0.080

Table B6 Specific viscosity data of 0.1g/100ml PEO/OC-MMT nanocomposites in aqueous solution in the presence of NaCl as a function of OC-MMT loading

MMTs	NaCl (M)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
OC-MMT1%	0.001	199.10	199.12	199.02	199.08	0.05	0.093
	0.010	198.28	198.16	198.15	198.20	0.07	0.088
	0.100	199.87	199.76	199.74	199.79	0.07	0.097
OC-MMT10%	0.001	197.73	197.81	197.71	197.75	0.05	0.085
	0.010	196.67	196.51	196.52	196.57	0.09	0.079
	0.100	198.47	198.45	198.44	198.45	0.02	0.089
OC-MMT60%	0.001	196.75	196.79	196.76	196.77	0.02	0.080
	0.010	195.76	195.95	195.83	195.85	0.10	0.075
	0.100	197.61	197.69	197.73	197.68	0.06	0.085

Table B7 Specific viscosity data of PEO/OH-MMT nanocomposites in aqueous solution as a function of OH-MMT loading

MMTs	Conc. (g/100ml)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
OH-MMT1%	0.010	184.06	184.04	184.04	184.05	0.01	0.010
	0.050	190.53	190.53	190.60	190.55	0.04	0.046
	0.100	198.64	198.73	198.67	198.68	0.05	0.090
OH-MMT10%	0.010	183.30	183.30	183.45	183.35	0.09	0.006
	0.050	188.87	188.71	188.76	188.78	0.08	0.036
	0.100	196.06	196.13	196.06	196.08	0.04	0.076
OH-MMT60%	0.010	182.88	182.96	182.91	182.92	0.04	0.004
	0.050	187.34	187.30	187.24	187.29	0.05	0.028
	0.100	193.82	193.85	193.88	193.85	0.03	0.064

Table B8 Specific viscosity data of 0.1g/100ml PEO/OH-MMT nanocomposites in aqueous solution in the presence of NaCl as a function of OH-MMT loading

MMTs	NaCl (M)	Time (s)				SD	Specific viscosity
		t_1	t_2	t_3	t_{ave}		
OH-MMT1%	0.001	199.08	198.99	199.19	199.09	0.10	0.093
	0.010	199.36	199.26	199.27	199.30	0.06	0.094
	0.100	200.27	200.11	200.10	200.16	0.10	0.099
OH-MMT10%	0.001	197.43	197.36	197.44	197.41	0.04	0.083
	0.010	197.06	196.91	196.86	196.94	0.10	0.081
	0.100	198.12	197.97	198.05	198.05	0.08	0.087
OH-MMT60%	0.001	196.21	196.20	196.25	196.22	0.03	0.077
	0.010	196.57	196.55	196.62	196.58	0.04	0.079
	0.100	196.97	196.93	196.95	196.95	0.02	0.081

APPENDIX C

UV Standard Calibration Curve for Adsorption Test

Standard solutions were prepared by dilution of the 8670 ppm toluene in n-hexane and the 8600 ppm xylene in cyclohexane to 86.7 and 86 ppm, respectively. These prepared solutions were further diluted to 8.67, 6.07, 4.34, 3.47 and 1.73 ppm for toluene and 8.60, 6.88, 5.16, 3.44 and 1.72 ppm for xylene, and they were used as standard solutions to create a calibration curve as shown in Figure C1 and C2.

Table C1 Relationship between concentration and absorbance of standard toluene in n-hexane solution

Concentration (ppm)	Readings			Mean ABS
	abs_1	abs_2	abs_3	
1.73	0.15921	0.15932	0.15936	0.15930
3.47	0.34144	0.34138	0.34146	0.34143
4.34	0.44695	0.44701	0.44711	0.44702
6.07	0.59241	0.59238	0.59252	0.59244
8.67	0.83711	0.83701	0.83696	0.83703

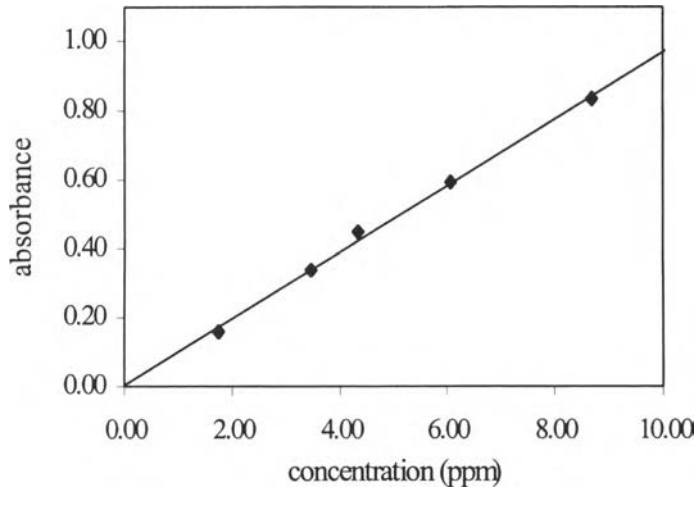

Figure C1 Calibration curve of standard toluene in n-hexane solution.

Table C2 Relationship between concentration and absorbance of standard xylene in cyclohexane solution

Concentration (ppm)	Readings			Mean ABS
	abs_1	abs_2	abs_3	
1.72	0.05509	0.05493	0.05502	0.05501
3.44	0.11701	0.11707	0.11714	0.11707
5.16	0.16989	0.16991	0.16995	0.16992
6.88	0.23675	0.23664	0.23672	0.23670
8.60	0.28780	0.28775	0.28768	0.28774

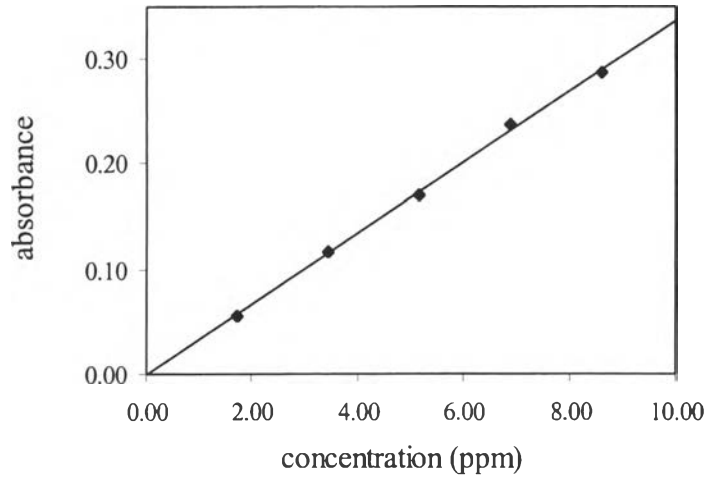

Figure C2 Calibration curve of standard xylene in cyclohexane solution.

The sample solutions were diluted into 5,000 times and the amounts of left over adsorbate were determined by using UV/VIS spectrometer.

APPENDIX D

Mass Balance Equation for Calculation of Adsorption Test

The concentration of adsorbed species on the adsorbent nanocomposites could be calculated from a simple mass balance equation by the assumption that the decrease from the initial concentration was due to the sorption by sorbent (Wibulswas, 2000).

$$ym = V(x_o - x)$$

where:

y = the quantity of adsorbate on nanocomposites (mg/g)

m = dry weight of adsorbent used (g)

V = volume of adsorbate solution (ml)

x_o = the initial concentration of adsorbate in solution (mg/ml)

x = the final concentration of adsorbate in solution (mg/ml)

APPENDIX E

Adsorption Data of Pure Na-MMT, OC-MMT and OH-MMT

Table E1 Toluene adsorption data of pure Na-MMT, OC-MMT and OH-MMT

MMTs	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
Na-MMT	0.19320	0.20130	0.20580	0.20010	5000	10067.08
OC-MMT	0.29210	0.29160	0.29260	0.29210	1000	2962.00
OH-MMT	2.59560	2.61710	2.62280	2.61183	100	2690.23

Table E2 Xylene adsorption data of pure Na-MMT, OC-MMT and OH-MMT

MMTs	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
Na-MMT	0.21583	0.21609	0.21613	0.21602	5000	32091.21
OC-MMT	0.28872	0.28864	0.28861	0.28866	5000	42773.11
OH-MMT	0.51807	0.51995	0.52136	0.51979	5000	76763.72

APPENDIX F

Adsorption Data of PEO/NA-MMT, PEO/OC-MMT and PEO/OH-MMT Nanocomposites

Table F1 Toluene adsorption data of PEO/Na-MMT, PEO/OC-MMT and PEO/OH-MMT nanocomposites

MMTs (%)	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
MMT 3%	0.41286	0.41426	0.41553	0.41422	5000	21114.55
MMT 10%	0.75938	0.75960	0.75933	0.75944	5000	38926.73
MMT 60%	1.03890	1.04020	1.03900	1.03937	5000	53374.61
OC-MMT 3%	1.25870	1.25860	1.26000	1.25910	5000	64711.04
OC-MMT 10%	1.20470	1.20370	1.20400	1.20413	5000	61867.90
OC-MMT 60%	0.52492	0.52588	0.52727	0.52602	100	537.69
OH-MMT 3%	0.92005	0.92028	0.92046	0.92026	5000	47227.21
OH-MMT 10%	0.90783	0.90830	0.90843	0.90819	5000	46604.06
OH-MMT 60%	2.39870	2.40350	2.40440	2.40220	100	2473.89

Table F2 Xylene adsorption data of PEO/Na-MMT, PEO/OC-MMT and PEO/OH-MMT nanocomposites

MMTs (%)	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
MMT 3%	0.54376	0.54229	0.54589	0.54398	5000	80320.59
MMT 10%	0.54080	0.55184	0.54895	0.54720	5000	80793.63
MMT 60%	0.45886	0.42241	0.48545	0.45557	5000	67319.61
OC-MMT 3%	0.54863	0.54856	0.54920	0.54880	5000	81028.92
OC-MMT 10%	0.35048	0.34981	0.34996	0.35008	5000	51806.37
OC-MMT 60%	0.00000	0.00000	0.00000	0.00000	5000	0.00
OH-MMT 3%	0.40889	0.40766	0.40816	0.40824	5000	60358.33
OH-MMT 10%	0.28849	0.28802	0.28885	0.28845	5000	42743.14
OH-MMT 60%	1.72790	1.73210	1.73220	1.73073	100	5096.86

APPENDIX G

Adsorption Data of PAMAM/Na-MMT, PAMAM/OC-MMT and PAMAM/OH-MMT Nanocomposites at 10wt% MMTs

Table G1 Toluene adsorption data of PAMAM/Na-MMT, PAMAM/OC-MMT and PAMAM/OH-MMT nanocomposites at 10wt% MMTs

MMTs	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
Na-MMT	0.14838	0.14843	0.14829	0.14837	5000	7398.00
OC-MMT	0.93598	0.93571	0.93472	0.93547	5000	48011.87
OH-MMT	0.67347	0.67377	0.67419	0.67381	5000	34510.32

Table G2 Xylene adsorption data of PAMAM/Na-MMT, PAMAM/OC-MMT and PAMAM/OH-MMT nanocomposites at 10wt% MMTs

MMTs	Absorbance				Dilution factor	Conc. (ppm)
	abs_1	abs_2	abs_3	abs_{ave}		
Na-MMT	0.49319	0.49800	0.54741	0.51287	5000	75745.59
OC-MMT	0.48795	0.49636	0.54501	0.50977	5000	75290.20
OH-MMT	0.35810	0.36480	0.38176	0.36822	100	54473.53

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