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APPENDICES

Appendix A Calculation of percent weight polystyrene in admicellar modified natural rubber

$$\text{Weight of PS} = \frac{\text{conc. of styrene monomer} \times 104.5 \times \text{total volume}}{1000 \text{ ml}}$$

Ex. Conc. of styrene monomer = 50 mM and total volume = 20 ml.

$$\text{Total volume 1000 ml weight of PS} = 50 \text{ mM} \times 104.5 \text{ g/mole}$$

$$\therefore 50 \text{ ml weight of PS} = \frac{50 \text{ mM} \times 104.5 \text{ g/mole} \times 20 \text{ ml}}{1000 \text{ ml}}$$

$$= 104.5 \text{ mg}$$

$$\text{Total weight of admicellar modified NR} = 2 + 0.1045 = 2.1045 \text{ g}$$

$$\% \text{wt of PS} = \frac{0.1045 \times 100}{2.1045} = 4.97 \% \text{wt}$$

Appendix B Data of Gel Permeation Chromatography

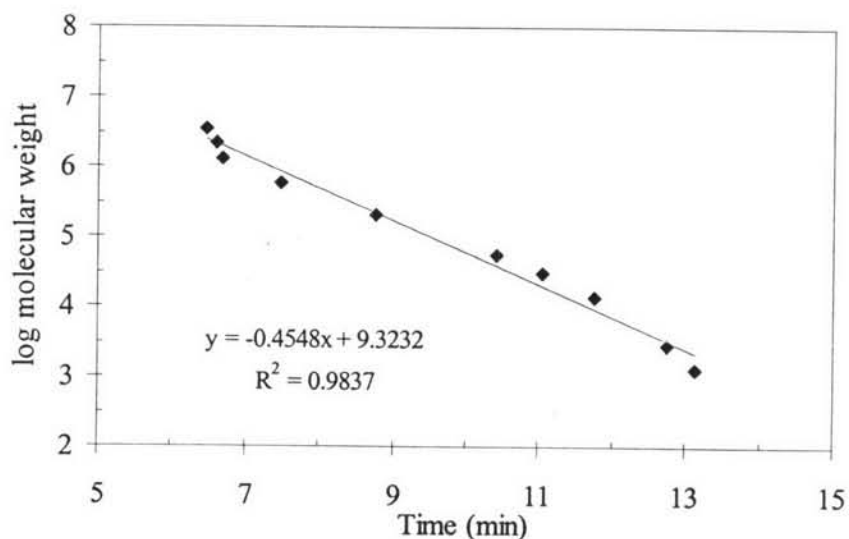


Figure B1 Calibration curve of styrene standard solution by Gel Permeation Chromatography.

Table B1 Data of calibration curve

	Retention time (min)	Molecular weight
1	6.444	3440000
2	6.604	2170000
3	6.686	1340000
4	7.485	575000
5	8.763	202000
6	10.411	54100
7	11.034	30500
8	11.753	13800
9	12.736	2960
10	13.123	1300

Appendix C Data of Dynamic Mechanical Thermal Analysis

Table C1 Storage modulus, loss modulus and $\tan \delta$ of aged and unaged modified natural rubber at 30°C

Sample	Results		
	E' (MPa)	E'' (MPa)	Tan δ
NR	0.5499	0.05715	0.1039
NR,A	0.1829	0.02578	0.1409
SR100mM, CTAB	0.1812	0.02795	0.1543
SR100mM, CTAB,A	0.3548	0.1109	0.3126
SR200mM, CTAB	0.3473	0.05450	0.1569
SR200mM, CTAB,A	0.3885	0.09315	0.2398
SR300mM, CTAB	0.2305	0.03511	0.1523
SR300mM, CTAB,A	0.4453	0.1062	0.2385
SR100mM, SDS	0.6518	0.2209	0.3388
SR100mM, SDS,A	0.5193	0.2239	0.4312
SR200mM, SDS	0.2792	0.06500	0.2328
SR200mM, SDS.A	0.3597	0.09721	0.2702
SR300mM, SDS	0.4150	0.1020	0.2459
SR300mM, SDS,A	0.2600	0.1027	0.3949

Table C2 The dynamic loss modulus (E'') and max $\tan \delta$ of aged and unaged modified natural rubber in CTAB and SDS surfactant

Sample	Result	
	Max. tan delta	T_g ($^{\circ}\text{C}$)
1.NR	2.317	-47.40
2.NR,A	1.795	-44.50
3.SR100mM, CTAB	1.799	-51.40
4.SR100mM, CTAB,A	1.692	-43.90
5.SR200mM, CTAB	1.697	-51.10
6.SR200mM, CTAB,A	1.721	-51.10
7.SR300mM, CTAB	1.545	-50.50
8.SR300mM, CTAB,A	1.490	-49.90
9.SR100mM, SDS	2.200	-46.50
10.SR100mM, SDS,A	1.884	-47.00
11.SR200mM, SDS	1.012	-50.80
12.SR200mM, SDS,A	1.554	-50.00
13.SR300mM, SDS	1.926	-47.30
14.SR300mM, SDS,A	1.647	-43.40

Appendix D Data of Tensile Testing

Table D1 Stiffness of pure polystyrene and blended sample with modified natural rubber in CTAB surfactant

Sample Information	Stiffness (N/m)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	210.63	159.44	186.16	159.73	301.56	178.96	204.97	237.37
II	238.03	201.16	204.67	192.44	261.79	179.86	107.49	216.26
III	220.87	185.73	166.77	175.90	255.88	187.89	203.86	195.67
IV	258.11	200.63	189.74	192.37	240.95	191.40	228.81	206.55
V	198.57	190.89	190.01	162.71	269.95	176.13	211.01	165.18
Average	225.24	187.57	187.47	177.43	266.02	182.85	203.83	204.21
S.D.	23.38	19.04	13.58	16.71	22.59	6.48	21.14	26.68

Table D2 Young's modulus of pure polystyrene and blended sample with modified natural rubber in CTAB surfactant

Sample Information	Young's Modulus (MPa)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	1560.20	1315.98	1476.72	1207.64	1727.99	1240.36	1362.35	1286.75
II	1531.18	1185.28	1382.62	1493.34	1545.99	1480.05	1456.04	1594.85
III	1567.81	1052.39	1469.15	1204.08	1425.84	1453.35	1224.50	1545.24
IV	1567.74	1217.42	1218.67	1185.34	1590.22	1134.95	1374.33	1662.81
V	1726.70	1130.58	1220.43	1367.68	1407.47	1232.34	1070.92	1404.80
Average	1590.73	1180.33	1353.52	1291.62	1539.50	1308.21	1297.63	1498.89
S.D.	77.49	98.29	127.76	134.62	130.86	150.81	151.58	151.72

Table D3 Stress at break of pure polystyrene and blended sample with modified natural rubber in CTAB surfactant

Sample Information	Stress at Break (MPa)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	36.77	36.41	34.23	30.16	42.56	33.83	30.19	24.73
II	38.54	30.19	27.89	35.36	44.99	28.33	31.44	33.16
III	31.31	27.59	34.42	28.27	31.77	15.88	20.98	1.79
IV	43.29	35.75	25.18	27.06	45.45	28.63	22.37	31.89
V	42.34	30.96	28.13	33.47	35.94	24.19	27.11	1.32
Average	38.45	32.18	29.97	30.86	40.14	26.17	26.42	18.58
S.D.	4.80	3.78	4.14	3.49	6.03	6.69	4.63	15.87

Table D4 Strain at break of pure polystyrene and blended sample with modified natural rubber in CTAB surfactant

Sample Information	Strain at Break (mm)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	1.29	1.20	1.30	1.49	1.34	1.13	1.19	1.26
II	1.36	1.19	1.22	1.29	1.57	0.99	1.16	1.17
III	1.21	1.24	1.14	1.24	1.35	0.32	1.08	0.04
IV	1.44	1.26	1.24	1.22	1.56	1.04	1.06	0.85
V	1.38	1.89	1.01	1.49	1.49	0.94	1.20	0.03
Average	1.34	1.19	1.18	1.34	1.46	0.89	1.14	0.67
S.D.	0.09	0.05	0.11	0.13	0.11	0.32	0.06	0.59

Table D5 Stiffness of pure polystyrene and blended sample with modified natural rubber in SDS surfactant

Sample Information	Stiffness (N/m)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	210.63	185.99	163.53	208.64	301.56	163.38	163.07	182.09
II	238.03	166.78	175.29	167.43	261.79	178.76	175.58	189.81
III	220.87	154.61	159.26	187.96	255.87	150.95	192.71	200.13
IV	258.10	167.41	182.02	200.61	240.94	170.26	149.16	211.59
V	198.57	139.05	170.28	161.99	269.95	139.29	196.39	231.22
Average	225.24	162.77	170.07	185.33	266.02	160.53	175.39	202.97
S.D.	23.38	17.37	9.08	20.30	22.52	15.64	19.88	19.30

Table D6 Young's modulus of pure polystyrene and blended sample with modified natural rubber in SDS surfactant

Sample Information	Young's Modulus (MPa)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	1560.20	1154.69	1071.90	1199.35	1727.10	1011.51	1131.18	1254.45
II	1531.18	1109.80	1105.20	1120.68	1545.10	1163.78	1145.18	1277.99
III	1567.81	1092.48	1067.70	1198.45	1425.84	1103.45	1333.84	1339.58
IV	1567.74	1063.03	1167.70	966.32	1590.22	1053.58	1087.84	1128.63
V	1726.70	1087.34	1176.93	1077.92	1407.47	1111.45	1316.70	1338.07
Average	1590.72	1101.47	1117.89	1112.54	1539.50	1088.75	1202.95	1267.75
S.D.	77.49	34.13	51.87	96.90	130.86	58.23	113.81	86.23

Table D7 Stress at break of pure polystyrene and blended sample with modified natural rubber in SDS surfactant

Sample Information	Stress at Break (MPa)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	36.77	35.13	36.32	35.91	42.56	30.10	31.57	30.56
II	38.54	34.35	35.93	34.96	44.99	37.35	26.64	26.51
III	31.31	36.97	24.63	34.45	31.77	35.74	32.11	36.55
IV	43.30	36.10	35.40	27.47	45.45	34.62	34.65	32.48
V	42.34	38.01	30.73	32.47	35.94	30.94	27.01	36.31
Average	38.45	36.11	32.60	33.05	40.14	33.75	30.39	32.48
S.D.	4.80	1.45	4.99	3.36	6.03	3.12	3.47	4.20

Table D8 Strain at break of pure polystyrene and blended sample with modified natural rubber in SDS surfactant

Sample Information	Strain at Break (mm)							
	Unaged				Aged			
	PS	SR100	SR200	SR300	PS	SR100	SR200	SR300
I	1.29	1.35	1.37	1.28	1.34	1.27	1.20	1.07
II	1.37	1.28	1.34	1.25	1.57	1.31	1.07	0.99
III	1.21	1.37	1.07	1.19	1.35	1.30	0.78	1.21
IV	1.44	1.37	1.28	1.17	1.56	1.32	1.29	1.21
V	1.38	1.40	1.16	1.19	1.49	1.20	0.58	1.25
Average	1.34	1.35	1.24	1.22	1.46	1.27	0.98	1.14
S.D.	0.09	0.05	0.13	0.05	0.11	0.05	0.30	0.11

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