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ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



**APPENDICES**

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## APPENDIX A

**Table A-1 Effect of Initiator Concentration, Reaction Temperature, Monomer Concentration, and Reaction Time on the Conversion, Percentage Grafted Natural**

Rubber and Grafting Efficiency

Exp.	NR (g)	product	%DRC	NR content (g)	% conv.	Sample	wt.A	wt.B	% free NR	%free St/GMA	% grafted NR	total St/GMA	free St/GMA	grafted St/GMA	% GE
50I0.5	51.88	35.41	59.81	31.03	14.60	1.1967	0.3195	0.1085	26.70	9.07	64.23	4.38	3.21	1.17	26.71
50I0.5	50.61	34.40	59.81	30.27	13.77	1.0107	0.3211	0.0934	31.77	9.24	58.99	4.13	3.18	0.95	23.03
50I1.5	50.11	40.26	59.81	29.97	34.30	1.0926	0.1703	0.0904	15.59	8.27	76.14	10.29	3.33	6.96	67.63
50I1.5	50.32	41.26	59.81	30.10	37.21	1.0103	0.1461	0.0997	14.46	9.87	75.67	11.16	4.07	7.09	63.53
50I2.5	50.94	44.86	59.81	30.47	47.98	1.0604	0.1394	0.0876	13.15	8.26	78.59	14.39	3.71	10.69	74.25
50I2.5	51.00	44.20	59.81	30.50	45.66	1.0834	0.1629	0.0929	15.04	8.57	76.39	13.70	3.79	9.91	72.33
50I5	50.20	42.61	59.81	30.02	41.95	1.0080	0.1544	0.1147	15.32	11.38	73.30	12.59	4.85	7.74	61.47
50I5	51.04	43.37	59.81	30.53	42.81	1.0824	0.2192	0.0849	20.25	7.84	71.91	12.84	3.40	9.44	73.51
60I0.5	50.73	36.97	59.81	30.34	22.09	1.0862	0.3512	0.1627	32.33	14.98	52.69	6.63	5.54	1.09	16.46
60I0.5	50.42	36.22	59.81	30.16	20.21	1.1099	0.2909	0.1634	26.21	14.72	59.07	6.06	5.33	0.73	12.06
60I1.5	50.11	47.16	59.81	29.97	57.30	1.0234	0.1965	0.1320	19.20	12.90	67.90	17.19	6.08	11.11	64.61
60I1.5	50.30	46.96	59.81	30.08	56.25	1.0693	0.1880	0.1350	17.58	12.63	69.79	16.88	5.93	10.95	64.87
60I2.5	50.91	51.04	59.81	30.45	68.64	1.0722	0.1645	0.1512	15.34	14.10	70.56	20.59	7.20	13.39	65.04
60I2.5	50.31	51.11	59.81	30.09	70.07	1.0351	0.1208	0.1583	11.67	15.29	73.04	21.02	7.82	13.20	62.81
60I5	50.26	52.41	59.81	30.06	74.50	1.0587	0.0782	0.1771	7.39	16.73	75.89	22.35	8.77	13.58	60.77
60I5	50.26	55.19	59.81	30.06	83.76	1.0521	0.0228	0.2323	2.17	22.08	75.75	25.13	12.19	12.94	51.51

wt. A = Grafted product was extracted by light petroleum ether for 24 hours.

wt. B = Grafted product was extracted by light petroleum ether for 24 hours and then extracted by acetone for 24 hours.

**Table A-1 (Continued)**

Exp.	NR (g)	product	%DRC	NR content (g)	% conv.	Sample	wLA	wLB	% free NR	%free SI/GMA	% grafted NR	total SI/GMA	free SI/GMA	grafted SI/GMA	% GE
6510.5	50.13	35.90	59.81	29.98	19.72	1.0216	0.3981	0.1208	38.97	11.82	49.21	5.92	4.25	1.67	28.26
6510.5	50.69	36.37	59.81	30.32	20.17	1.0194	0.3358	0.1369	32.94	13.43	53.63	6.05	4.88	1.17	19.30
6511.5	50.16	43.95	59.81	30.00	46.50	1.0157	0.1889	0.1937	18.60	19.07	62.33	13.95	8.38	5.57	39.91
6511.5	50.13	41.03	59.81	29.98	36.82	1.1127	0.1583	0.1737	14.23	15.61	70.16	11.05	6.41	4.64	42.02
6512.5	50.05	47.91	59.81	29.93	59.92	1.1784	0.1741	0.1656	14.77	14.05	71.17	17.98	6.73	11.24	62.54
6512.5	50.26	48.46	59.81	30.06	61.33	1.0084	0.0884	0.1582	8.77	15.69	75.55	18.40	7.60	10.80	58.68
6515	50.32	50.74	59.81	30.10	68.81	1.1791	0.1268	0.1377	10.75	11.68	77.57	20.64	5.93	14.72	71.30
6515	50.50	49.48	59.81	30.20	64.25	1.0967	0.1165	0.1391	10.62	12.68	76.69	19.28	6.28	13.00	67.44
7010.5	51.18	33.74	59.81	30.61	10.43	1.1313	0.2412	0.0961	21.32	8.49	70.18	3.13	2.87	0.26	8.41
7010.5	51.17	34.19	59.81	30.60	11.95	1.0928	0.2697	0.1083	24.68	9.91	65.41	3.59	3.39	0.20	5.49
7011.5	50.37	41.64	59.81	30.13	38.38	1.0639	0.1650	0.1812	15.51	17.03	67.46	11.51	7.09	4.42	38.40
7011.5	50.06	40.85	59.81	29.94	36.36	1.0096	0.1418	0.1562	14.05	15.47	70.48	10.91	6.32	4.59	42.07
7012.5	50.12	43.86	59.81	29.98	46.28	1.0612	0.1287	0.1368	12.13	12.89	74.98	13.88	5.65	8.23	59.27
7012.5	50.14	44.85	59.81	29.99	49.54	1.0575	0.1760	0.1468	16.64	13.88	69.48	14.86	6.23	8.64	58.11
7015	50.51	45.73	59.81	30.21	51.73	1.0565	0.0861	0.1709	8.15	16.18	75.67	15.52	7.40	8.12	52.34
7015	50.06	44.98	59.81	29.94	50.13	1.1455	0.0885	0.1883	7.73	16.44	75.84	15.04	7.39	7.65	50.84

wt. A = Grafted product was extracted by light petroleum ether for 24 hours.

wt. B = Grafted product was extracted by light petroleum ether for 24 hours and then extracted by acetone for 24 hours.

**Table A-1 (Continued)**

Exp.	NR (g)	product	%DRC	NR content (g)	% conv.	Sample	wt.A	wt.B	% free NR	%free St/GMA	% grafted NR	total St/GMA	free St/GMA	grafted St/GMA	% GE
M50	51.89	35.49	57.79	29.99	34.39	1.0864	0.1609	0.1211	14.81	11.15	74.04	5.50	3.96	1.55	28.11
M50	51.63	35.76	57.79	29.84	37.02	1.0605	0.1533	0.1323	14.46	12.48	73.07	5.92	4.46	1.46	24.68
M75	50.75	36.90	57.79	29.33	32.92	1.0588	0.1533	0.1579	14.48	14.91	70.61	7.57	5.50	2.07	27.32
M75	54.29	41.41	57.79	31.37	43.63	1.0419	0.2263	0.1139	21.72	10.93	67.35	10.04	4.53	5.51	54.89
M100	52.91	49.36	57.79	30.58	62.61	1.1189	0.1468	0.1348	13.12	12.05	74.83	18.78	5.95	12.84	68.34
M100	56.93	53.44	57.79	32.90	68.47	1.0572	0.1940	0.1373	18.35	12.99	68.66	20.54	6.94	13.60	66.21
M125	50.68	52.40	57.79	29.29	60.82	1.0190	0.1882	0.1571	18.47	15.42	66.11	23.11	8.08	15.03	65.05
M125	50.59	50.73	57.79	29.24	56.56	1.1356	0.1914	0.1796	16.85	15.82	67.33	21.49	8.02	13.47	62.67
M150	50.47	54.86	57.79	29.17	55.86	1.0763	0.3828	0.2060	35.57	19.14	45.29	25.69	10.50	15.19	59.13
M150	50.36	56.27	57.79	29.10	59.06	1.0595	0.3640	0.2006	34.36	18.93	46.71	27.17	10.65	16.51	60.78
T4	51.88	35.52	57.79	29.98	18.46	1.1666	0.2738	0.1755	23.47	15.04	61.49	5.54	5.34	0.20	3.52
T4	51.07	34.41	57.79	29.51	16.32	1.1042	0.3147	0.1529	28.50	13.85	57.65	4.90	4.76	0.13	2.69
T8	51.10	48.44	57.79	29.53	63.03	1.1316	0.1966	0.1838	17.37	16.24	66.38	18.91	7.87	11.04	58.39
T8	52.16	49.23	57.79	30.14	63.62	1.0142	0.1891	0.1438	18.65	14.18	67.18	19.09	6.98	12.11	63.43
T10	52.91	49.36	57.79	30.58	62.61	1.1189	0.1468	0.1348	13.12	12.05	74.83	18.78	5.95	12.84	68.34
T10	56.93	53.44	57.79	32.90	68.47	1.0572	0.1940	0.1373	18.35	12.99	68.66	20.54	6.94	13.60	66.21

wt.A = Graft product was extracted by light petroleum ether for 24 hours.

wt.B = Graft product was extracted by light petroleum ether for 24 hours and then extracted by acetone for 24 hours.



**Table A-2** The Average of the Conversion, Percentage Grafted Natural Rubber, Percentage Free NR, Percentage Free St/GMA, and Grafting Efficiency

Exp.	Avg. Conversion (%)	Avg. Grafted NR (%)	Avg. Free NR (%)	Avg. Free St/GMA (%)	Avg. GE (%)
50I0.5	14.18	61.61	29.23	9.15	24.87
50I1.5	35.75	75.90	15.02	9.07	55.44
50I2.5	46.82	77.49	14.09	8.41	73.29
50I5	42.38	76.41	16.59	9.61	67.49
60I0.5	21.15	55.88	29.27	14.85	14.26
60I1.5	56.77	68.84	18.39	12.76	64.74
60I2.5	69.35	71.80	13.50	14.69	69.32
60I5	79.13	75.82	4.78	19.40	56.14
65I0.5	19.94	51.42	35.95	12.62	23.78
65I1.5	44.66	66.24	16.41	17.34	40.96
65I2.5	60.62	73.36	11.77	14.87	60.61
65I5	66.53	77.13	10.68	12.18	69.37
70I0.5	11.19	67.79	23.00	9.20	6.95
70I1.5	37.37	68.97	14.78	16.25	40.23
70I2.5	47.91	72.23	14.38	13.38	58.69
70I5	50.93	75.75	7.94	16.31	51.59

**Table A-2 (Continued)**

Exp.	Avg. Conversion (%)	Avg. Grafted NR (%)	Avg. Free NR (%)	Avg. Free St/GMA (%)	Avg. GE (%)
M50	35.70	73.55	14.63	11.81	26.39
M75	38.27	68.98	18.1	12.92	41.10
M100	65.54	71.74	15.73	12.52	67.27
M125	58.69	66.72	17.66	15.62	63.86
M150	57.46	46.00	34.96	19.03	59.95
T4	17.39	59.57	25.98	14.44	3.10
T8	63.32	66.78	18.01	15.21	60.91
T10	65.54	71.74	15.73	12.52	67.27

aI<sub>x</sub> : a = Reaction temperature (C)

I = Initiator

x = Initiator concentration (phr)

My : M = Monomer

y = Monomer concentration (phr)

Tz : T = Time

z = Reaction time (hr.)

## APPENDIX B

### Dynamic Mechanical Properties of Grafted Natural Rubber

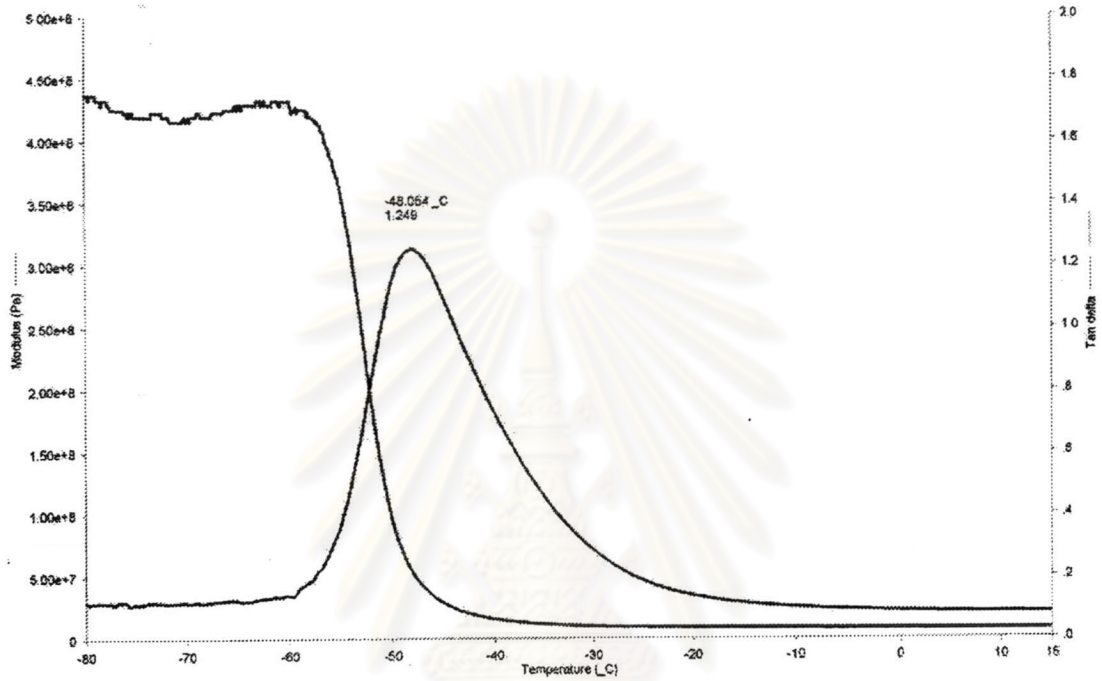


Figure B-1 Dynamic Mechanical Properties of Natural Rubber

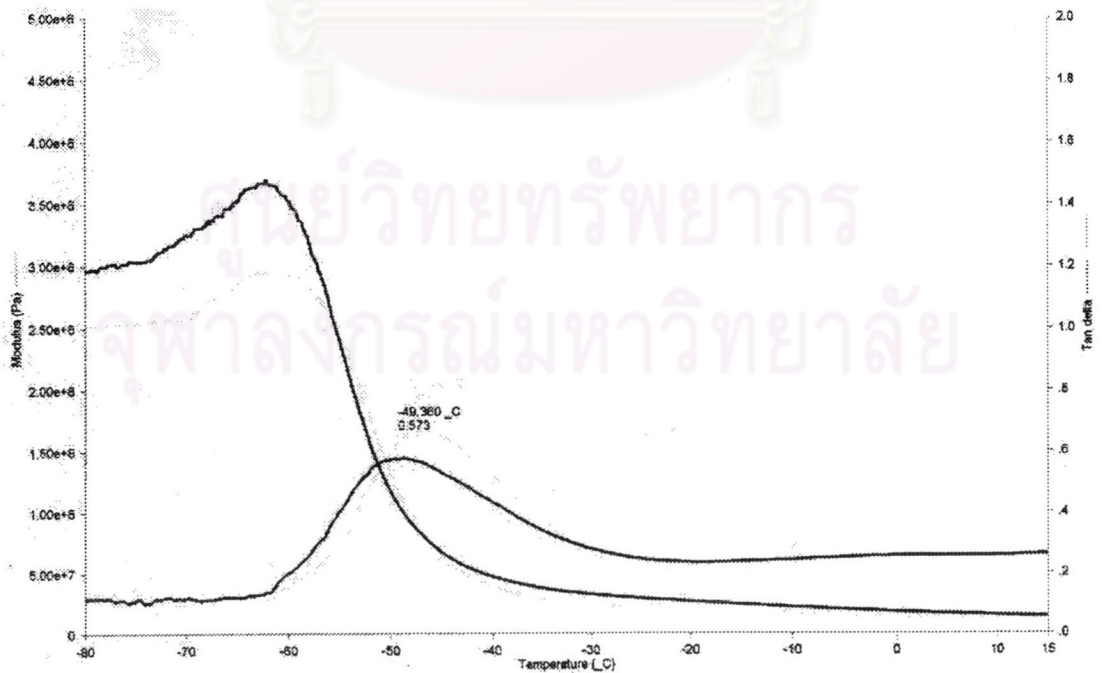
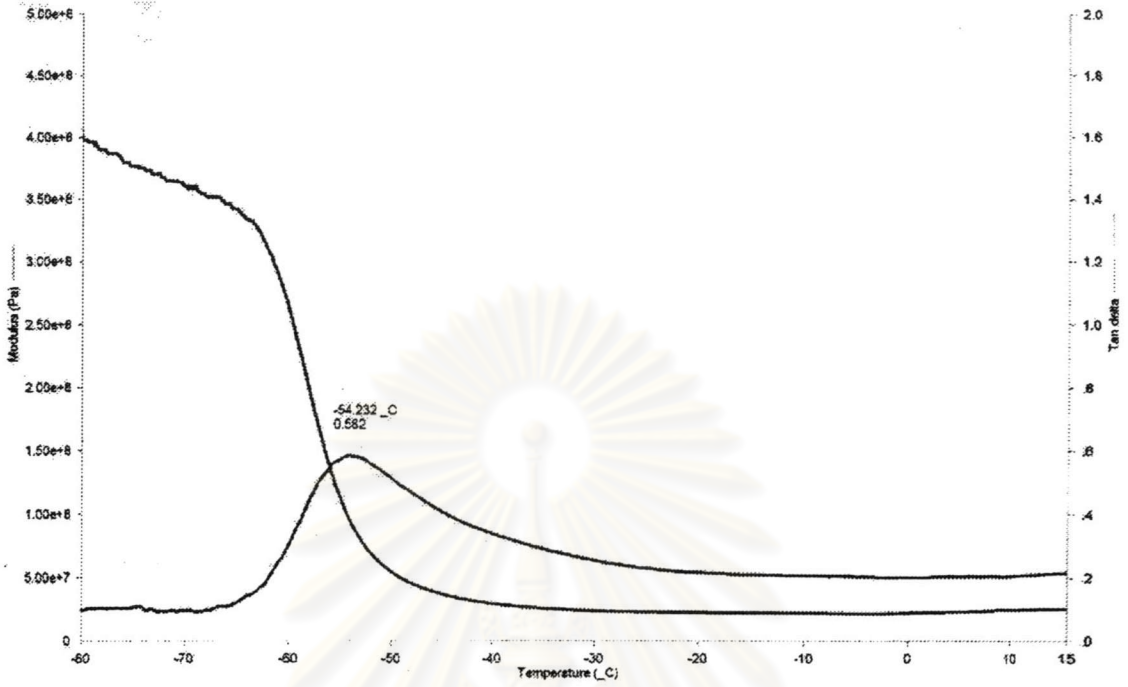
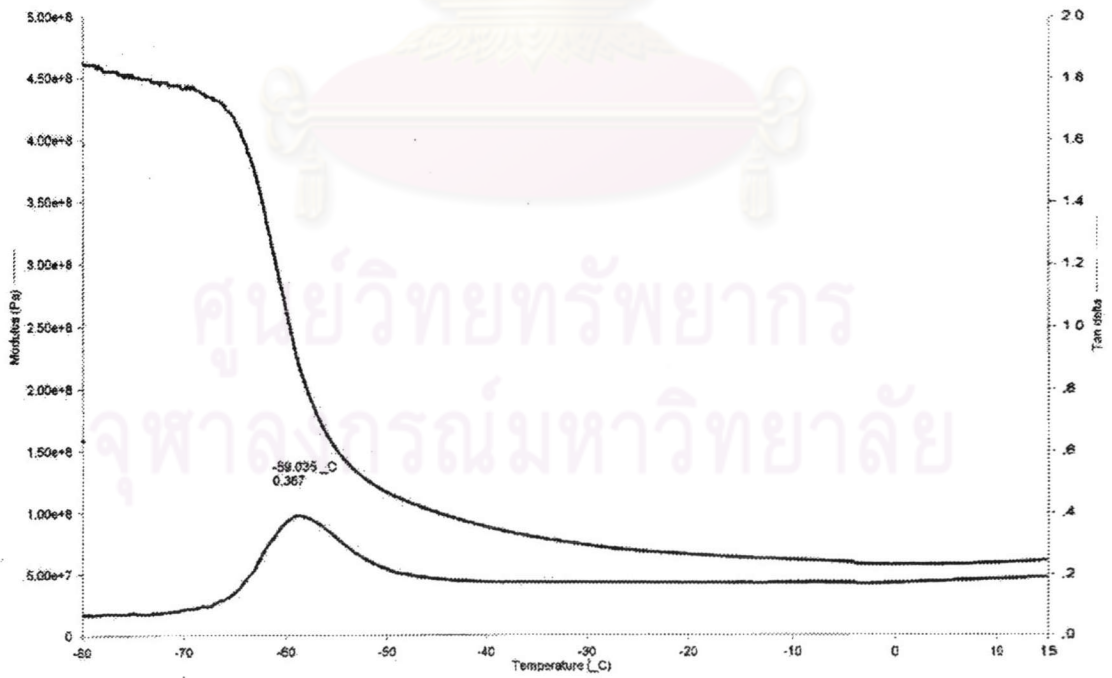


Figure B-2 Dynamic Mechanical Properties of Grafted Natural Rubber

(Monomer 50 phr)



**Figure B-3** Dynamic Mechanical Properties of Grafted Natural Rubber  
(Monomer 100 phr)



**Figure B-4** Dynamic Mechanical Properties of Grafted Natural Rubber  
(Monomer 150 phr)

## APPENDIX C

### Mechanical Properties of STR 5L/PMMA/NR-g-St/GMA Blends

**Table C-1** Tensile Strength of STR5L/PMMA Blends at Ratio of 70/30

NR-g-St/GMA content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Tensile strength, (MPa)	0.65	1.06	3.13	2.15	1.85	1.64	2.31	4.13	2.61	2.76
	0.53	1.17	2.81	2.09	1.90	1.80	2.61	3.36	2.45	2.52
	0.58	1.27	2.90	1.94	1.82	1.45	2.25	3.43	2.62	2.60
Mean	0.58	1.16	2.94	2.06	1.85	1.63	2.39	3.64	2.56	2.62
S.D.	0.06	0.10	0.16	0.10	0.04	0.17	0.19	0.42	0.09	0.12

**Table C-2** Elongation at Break of STR5L/PMMA Blends at Ratio of 70/30

NR-g-St/GMA content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Elongation at break, (%)	52.8	236.8	114.7	289.2	174.4	515.2	637.6	715.6	507.0	394.0
	70.4	204.8	165.3	236.4	230.7	491.2	749.3	680.0	509.0	285.7
	68.8	254.4	146.7	262.4	202.0	429.1	761.8	649.7	460.0	374.4
Mean	64.0	232.0	142.2	260.6	202.4	478.5	716.2	681.7	492.0	351.4
S.D.	9.73	25.1	25.5	23.4	28.3	44.43	68.3	33.0	27.7	57.7

**Table C-3 Stress @ 100% Modulus of STR5L/PMMA Blends at Ratio of 70/30**

NR-g-St/GMA content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Stress @ 100% modulus, (MPa)	0.60	0.92	3.12	1.69	1.64	0.62	0.66	0.90	0.89	1.07
	0.52	1.05	2.55	1.74	1.58	0.68	0.65	0.89	0.83	1.17
	0.57	1.09	2.67	1.49	1.59	0.67	0.58	0.90	0.95	1.00
Mean	0.56	1.02	2.78	1.64	1.60	0.65	0.63	0.89	0.89	1.08
S.D.	0.04	0.08	0.30	0.13	0.03	0.03	0.04	0.01	0.06	0.08

**Table C-4 Tear Strength of STR5L/PMMA Blends at Ratio of 70/30**

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Tear strength (N/mm)	7.45	10.24	13.67	14.11	12.51	13.19	15.17	18.18	16.80	16.06
	8.60	10.98	13.75	14.57	12.88	13.85	16.69	18.59	18.69	16.82
	8.45	9.71	14.68	14.02	12.29	13.58	16.49	18.02	17.99	17.93
Mean	8.16	10.31	14.03	14.23	12.56	13.54	16.11	18.26	17.82	16.93
S.D.	0.62	0.63	0.56	0.29	0.29	0.33	0.82	0.29	0.95	0.94

**Table C-5** Hardness of STR5L/PMMA Blends at Ratio of 70/30

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Hardness (Shore A)	43.1	40.9	67.5	61.9	57.6	48.4	40.5	50.0	46.1	42.0
	40.1	40.4	71.0	57.5	49.7	48.7	40.8	46.6	42.6	40.0
	43.4	47.9	64.8	58.1	49.0	47.9	43.7	51.1	44.4	39.9
	53.4	47.7	71.0	58.0	40.9	47.3	47.7	52.1	45.8	40.0
	47.1	45.1	64.6	54.6	45.9	51.2	41.4	47.0	46.6	40.7
Mean	43.4	45.1	64.8	58.0	49.0	48.7	41.4	50.0	45.8	40.0
S.D.	5.6	3.7	4.6	2.6	6.1	1.5	3.4	2.6	1.8	1.1

**Table C-6** Tensile Strength of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Tensile strength, (MPa)	1.61	2.32	1.63	1.43	1.10	3.11	3.93	3.63	3.84	2.39
	1.82	2.31	1.49	1.47	1.18	3.02	4.70	3.34	3.79	2.86
	1.54	2.11	1.58	1.29	1.16	2.82	5.24	4.94	3.86	2.70
Mean	1.65	2.24	1.56	1.39	1.14	2.98	4.62	3.97	3.83	2.65
S.D.	0.14	0.12	0.07	0.09	0.04	0.15	0.65	0.85	0.04	0.10

**Table C-7** Elongation at Break of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Elongation at break, (%)	6.85	5.00	6.80	6.00	7.11	7.27	20.80	33.00	34.00	33.14
	7.00	7.00	6.85	9.14	7.11	9.33	18.00	21.20	28.00	22.60
	6.85	6.85	6.85	6.85	7.60	17.60	22.00	37.60	22.00	25.00
Mean	6.90	6.61	6.85	7.33	7.27	11.40	20.26	30.60	28.00	26.90
S.D.	0.08	0.54	0.04	1.62	0.28	5.46	2.05	8.45	6.00	5.52

**Table C-8** Stress @ 100% Modulus of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Stress@ 100% modulus, (MPa)	-	-	-	-	-	1.29	2.06	1.15	1.33	-
	-	-	-	-	-	1.46	2.05	1.47	1.31	-
	-	-	-	-	-	1.26	1.96	1.56	1.35	-
Mean	-	-	-	-	-	1.33	2.02	1.39	1.33	-
S.D.	-	-	-	-	-	0.11	0.06	0.22	0.02	-



**Table C-9** Tear Strength of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Tear strength (N/mm)	13.00	14.63	18.82	19.33	18.55	17.47	22.30	19.67	16.01	13.82
	14.68	14.20	18.48	16.98	19.37	17.60	20.79	19.53	16.32	13.71
	17.28	14.21	19.71	17.61	19.33	17.95	21.48	19.86	16.12	11.93
Mean	14.98	14.34	19.00	17.97	19.08	17.67	21.52	19.68	16.15	13.15
S.D.	2.16	0.25	0.64	1.21	0.46	0.25	0.76	0.17	0.15	1.06

**Table C-10** Hardness of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Hardness (Shore A)	85.0	88.2	89.3	86.7	86.0	69.6	73.9	74.0	76.0	68.9
	77.6	83.4	90.8	86.6	79.9	64.8	68.1	74.2	67.9	62.5
	76.8	86.7	80.4	83.1	78.1	80.1	70.4	74.4	67.6	50.1
	81.3	85.1	90.2	88.3	75.9	65.3	70.7	75.7	68.3	59.9
	81.7	85.2	90.1	86.6	82.5	76.7	69.2	76.0	72.9	70.2
Mean	81.3	85.2	90.1	86.6	77.9	69.6	70.4	74.4	68.3	62.5
S.D.	3.5	1.9	4.9	1.9	4.0	7.1	2.2	1.1	4.5	8.1

**Table C-11** Impact Energy of STR5L/PMMA Blends at Ratio of 50/50

NR-g-St/GMA Content (phr)	Unvulcanization					Vulcanization				
	0	5	10	15	20	0	5	10	15	20
Impact energy (J)	0.18	0.20	0.20	0.28	0.30	-	-	-	-	-
	0.20	0.22	0.24	0.28	0.30	-	-	-	-	-
	0.22	0.24	0.26	0.28	0.32	-	-	-	-	-
	0.18	0.24	0.26	0.30	0.32	-	-	-	-	-
	0.24	0.26	0.26	0.30	0.30	-	-	-	-	-
	0.24	0.26	0.28	0.32	0.34	-	-	-	-	-
	0.24	0.28	0.28	0.34	0.36	-	-	-	-	-
	0.22	0.28	0.30	0.34	0.42	-	-	-	-	-
	0.26	0.28	0.32	0.36	0.42	-	-	-	-	-
	0.26	0.26	0.28	0.38	0.36	-	-	-	-	-
Mean	0.22	0.25	0.26	0.31	0.34	-	-	-	-	-
S.D.	0.03	0.03	0.01	0.04	0.05	-	-	-	-	-

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## APPENDIX D

### Oil Absorption

Oil absorption of vulcanized STR5L/PMMA blends at ratio of 70/30 and at ratio of 50/50 were reported as percentage of weight change. The weight of the sample was recorded and the calculation of the change in mass is as follows (ASTM 471-79) :

$$\text{Change in mass (\%)} = (M_2 - M_1) / M_1 \times 100$$

Where  $M_1$  = initial mass of specimen, g and  
 $M_2$  = mass of specimen, g, after immersion

**Table D-1** The Percentage of Weight Change of Vulcanized STR5L/PMMA Blends

%Grafted natural rubber content, (phr)	%Weight change at ratio of 70/30					%Weight change at ratio of 50/50				
	0	5	10	15	20	0	5	10	15	20
1	20.95	22.92	21.23	19.96	24.14	17.17	14.62	14.12	18.35	19.08
2	20.15	25.58	19.85	21.50	25.94	15.04	15.18	13.39	18.07	21.25
3	22.15	25.96	21.76	20.06	23.22	16.05	13.63	15.18	18.16	18.32
Mean	21.08	24.82	20.94	20.50	24.43	16.08	14.47	14.23	18.19	19.55
S.D.	1.00	1.65	0.98	0.86	1.38	1.06	0.78	0.90	0.14	1.50

## APPENDIX E

### Mechanical Properties of Grafted Natural Rubber/PMMA Blends

**Table E-1** Tensile Strength of Grafted Natural Rubber/PMMA Blends

	NR-g-St/GMA/PMMA blends				NR-g-MMA 60/PMMA blends[19]			
	100/0	70/30	60/40	50/50	100/0	70/30	60/40	50/50
Tensile strength, (MPa)	0.48	2.90	3.03	5.95	3.70	4.00	5.30	7.90
	0.47	2.79	3.52	4.98	3.70	4.10	5.30	8.20
	0.50	2.73	3.56	5.59	3.30	4.20	5.40	8.10
Mean	0.48	2.80	3.37	5.50	3.50	4.10	5.30	8.10
S.D.	0.02	0.09	0.29	0.49	0.21	0.10	0.06	0.15

**Table E-2** Elongation at Break of Grafted Natural Rubber/PMMA Blends

	NR-g-St/GMA/PMMA blends				NR-g-MMA 60 /PMMA blends[19]			
	100/0	70/30	60/40	50/50	100/0	70/30	60/40	50/50
Elongation at break, (%)	784.0	148.0	10.0	7.0	421.2	106.5	25.1	21.3
	778.8	186.0	10.7	6.9	429.2	107.3	21.3	18.7
	766.8	102.0	17.6	9.1	379.8	103.2	18.6	21.3
Mean	776.5	145.3	12.8	7.7	410.1	105.7	21.7	20.4
S.D.	8.8	42.1	4.2	1.3	26.5	2.2	3.3	1.5

**Table E-3 Stress @ 100% Modulus of Grafted Natural Rubber/PMMA Blends**

	NR-g-St/GMA/PMMA blends				NR-g-MMA 60 /PMMA blends[19]			
	100/0	70/30	60/40	50/50	100/0	70/30	60/40	50/50
Stress@ 100% modulus, (MPa)	0.14	2.73	-	-	1.80	4.00	-	-
	0.15	2.49	-	-	1.80	4.00	-	-
	0.16	2.72	-	-	1.60	4.20	-	-
Mean	0.15	2.64	-	-	1.70	4.10	-	-
S.D.	0.01	0.14	-	-	0.12	0.12	-	-

**Table E-4 Tear Strength of Grafted Natural Rubber/PMMA Blends**

	NR-g-St/GMA/PMMA blends				NR-g-MMA 60 /PMMA blends[19]			
	100/0	70/30	60/40	50/50	100/0	70/30	60/40	50/50
Tear strength (N/mm)	6.27	17.49	18.15	23.53	14.30	16.00	16.80	25.50
	6.70	17.91	16.98	22.48	14.60	15.80	16.20	25.00
	6.92	16.63	17.42	23.27	14.60	14.80	15.80	24.40
Mean	6.63	17.34	17.51	23.09	13.20	15.50	16.30	25.00
S.D.	0.33	0.65	0.59	0.55	2.48	0.64	0.50	0.55

**Table E-5 Hardness of Grafted Natural Rubber/PMMA Blends**

	NR-g-St/GMA/PMMA blends				NR-g-MMA 60/PMMA blends[19]			
	100/0	70/30	60/40	50/50	100/0	70/30	60/40	50/50
Hardness (Shore A)	18.6	67.0	86.0	89.1	14.8	21.2	37.6	47.8
	16.1	64.6	82.2	89.3	15.3	21.3	36.5	47.0
	16.2	65.5	84.4	93.5	15.0	21.6	35.8	49.1
	16.5	79.0	83.5	94.3	15.3	22.5	35.8	49.3
	20.6	61.6	86.3	90.7	14.9	22.4	35.6	46.8
Mean	16.5	65.5	84.4	90.7	15.0	21.6	35.8	47.8
S.D.	2.3	7.1	1.7	2.5	0.2	0.6	0.8	1.2

## VITA

Miss Pachareeya Suriyachai was born on July 15, 1976 in Phayao, Thailand. She received her Bachelor's degree of Science in Chemistry, from the Faculty of Science, Chiang Mai University in 1999. She has pursued Master's Degree in Petrochemistry and Polymer Science, Program of Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University since 1999 and finished her study in 2001.



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