REFERENCES

1. สมศักดิ์ ศรีอำพันธุ์ "แผนวิจัยเพื่อหาวัสดุที่เหมาะสมใช้ทดแทนไม้ ในการผลิตคอนแขวนเคเบิลของ ทศท." รายงานวิจัยขององค์การโทรศัพท์แห่งประเทศไทย 23 พฤศจิกายน 2543 (เอกสารไม่ได้ตีพิมพ์เผยแพร่)
2. วราภรณ์ ขจรไชยกุล "การออกสูตรยางและกระบวนการผลิต" เอกสารประกอบการฝึกอบรมหลักสูตรเทคโนโลยียาง (ยางสังเคราะห์) กรกฎาคม 2541 หน้า 8-21.
3. Tinker, A. J. and Jones, K. P. Blends of Natural Rubber, London: Chapman & Hall, 1998, Chapters 1, 3 and 14.
4. องค์การโทรศัพท์แห่งประเทศไทย "ข้อกำหนดหมายเลข OES-003-102-01 คอนเหล็กเคลือบฉนวนและไอโซเลเตอร์" ข้อกำหนดอุปกรณ์ของ ทศท. กุมภาพันธ์ 2545 (เอกสารไม่ได้ตีพิมพ์เผยแพร่)
5. Ulracki, L. A. Polymer Alloys and Blends, Thermodynamics and Rheology, New York: Hanser , 1990, pp.16-20.
6. Hepburn, C. "Rubber Compounding Ingredients-Need, Theory and Innovation part 1", Rapra Review Reports, 1994, pp. 54-65.
7. เจริญ นาคะสรรค์ กระบวนการแปรรูปพลาสติก กรุงเทพมหานคร: สำนักพิมพ์นิติธรรม 2542 หน้า 52-68.
8. Barlow, F.W. Rubber Compounding, Principles, Materials and Techniques, New York: Marcel Dekker, 1988, pp. 17-72.
9. Morton, M. Rubber Technology, 3rd ed., New York: Van Nostrand Reinhold, 1987, pp. 20-279.
10. Brydson, J. A. Rubbery Materials and Their compounds, London: Elsevier Applied Science, 1988, Chapters 7 and 18.
11. Folkes, M. J. and Hope, P. S. Polymer Blends and Alloys, London: Blackie Academic & Professional, 1993, pp. 46-122.

12. Coran, A.Y. Blends of Dissimilar Rubbers: Cure-rate Incompatibility, Rubber Chemical Technology, 61 (2), 1988: 281-292.

13. พรพรรณ นิธิอุทัย สารเคมีสำหรับยาง คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี 2528 หน้า 176-219.

14. Mernagh, L.R. Rubber Handbook: Design Engineering Series, Morgan-Grampian, 1969, pp. 30-32.

15. Chapman, J.M. Basic Electricity Part 2, London: William Clowes and Sons, 1963, pp. 9-20.

16. Baker, D., Koehler, D.C., Fleckenstein, W.O., Roden, C.E. and Sabia, R. Physical Design of Electronic Systems, Prentice-Hall, 1970, pp. 73-79.

17. สำรวย สังข์สะอาด วิศวกรรมไฟฟ้าแรงสูง คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย 2528 หน้า 389-400.

18. Tobing, S.D. Co-vulcanization in NR/EPDM blends, Rubber World, 2 (1988): 33-37.

19. Cesare, F.C. Ozone-resistant Natural Rubber Blends, Rubber World, 201(3), 1989: 14-17.

20. Bengtsson, P., Klason, C., Kubat, J., and McQueen, D.H. Electrical Noise Characteristics of Carbon Black-filled Chloroprene Rubber, Journal Physical D: Appl Physics, 22, 1989: 1736-1741.

21. Ghoneim, A.M., and Ismail M.N. Studies on EPDM/NR Blends.1. Dielectric and Machanical Properties, Polymer Plastic Technology Engineering, 38 (5), 1999: 979-995.

22. Zaharescu, T., Meltzer, V., and Vilcu, R., Thermal Properties of EPDM/NR Blends, Polymer Degradation and Stability, 70, 2000: 341-345.

23. Brown, P.S., and Tinker, A.J. Effect of Modifying EPDM on the Crosslink Distribution in NR/EPDM Blends., Journal of Natural Rubber Research, 11(4), 1996: 227-239.

24. Nakason, C. Kaesaman, A., Wongkul, T., and Kiatkamjornwong, S. Rheological and Curing Properties of Reactive Blending Products of Epoxidised Natural Rubber and Cassava Starch, Plastics, Rubber and Composites, 30, 2001: 154-161.

25. Tanaka, H. and Nishi, T., Real-time Pulsed NMR Measurement System for the Study of Nonequillibrium Phenomena in Polymers., Journal Appl Physics, 60 (4), 1986: 1306-1309.

26. Blow, C.M. Rubber Technology and Manufacture, London: Butterworth & Co, 1977, pp. 73-473.

27. Burton, L.C., Hwang, K., and Zhang, T. Dynamic Electrical and Electromechanical Properties of Carbon-black-loaded Rubber, Rubber Chemistry and Technology, 62 (1989): 838-849.

28. Norman, R.H. Conductive Rubbers and Plastics, Amsterdam: Elsevier, 1970, pp. 181-209.

29. John, K.F. Effects of Carbon black Properties on Conductive Coating, Cabot Corporation Technical Report, 1990.

30. Asaletha, R., Kumaran, M.G., and Thomus, S. Thermoplastic Elastomers from Blends of Polystyrene and Natural Rubber: Morphology and Mechanical Properties, European Polymer Journal, 35 (1999): 253-271.

31. Cheremisinoff, N.P. Elastomer Technology Handbook, Florida: CRC Press, 1993, pp. 13-16.

32. Krause, A., Lange, A., and Ezrin, M. Plastics Analysis Guide, New York: Hanser, 1979, pp.230-268.

33. Brandrup, J. and Immergut, E.H. Polymer Hand book, 2nd ed., New York: A wiley-interscience, 1975, pp. IV8-V6.

34. Performance Additives Sdn. Bhd. Information of Performance additives: Ultra-blend, Behn Meyer Group, Sabung Jaya.

35. Ikehara, T. and Nishi, T. Primary and Secondary Crystallization Processes of Poly (∈-caprolactone)/Styrene Oligomer Blends Investigated by Pulsed NMR, Polymer, 41 (2000): 7855-7864.

APPENDICES

APPENDIX A

Specification for ingredients

EPDM Nordel IP 4640

This amorphous ethylene propylene diene monomer (EPDM) has a medium viscosity for excellent flow characteristics combined with good hot green strength. Designed for extrusion and molding processes in general purpose compounds, it can be sulfur or peroxide cured.

Typical polymer properties

Table A.1 The specification of EPDM

Property	Specification value
Mooney Viscosity (ML1+4, 398 K), MU	40
<u>Composition</u>	
- Ethylene, wt %	55
- Propylene, wt %	40
- ENB, wt %	5
Specific Gravity, kg m^{-3}	860
Residual Transition Metal, ppm	<10
Ash Content, wt %	<0.1
Total Volatiles, wt %	<0.4
Product Form	Bale

STR 5L (natural rubber)

Table A.2 The specification of natural rubber

Composition property	Specification value
Dirt (retained on 45 aperture sieve), wt %	0.008
Ash Content, wt %	0.25
Volatile Matter, wt %	0.19
Nitrogen, wt %	0.31
Initial Wallace Plasticity, Po, min	38
Po & range, min	36-41
PRI (P30/Po) x100	92

Ultrablend 4000 (homogenizing agent)

It is a mixture of dark aromatic hydrocarbon resins. Due to its dark color, Ultrablend 4000 is not recommended for light colored compounds.

Table A.3 The specification of Ultrablend 4000

Composition property	Specification value
Appearance	Dark brown pastilles
Specific gravity, kg m^{-3}	106
Ash content (%, max)	2
Softening point, K	368-383
Storage stability	At least 1 year under normal conditions

Zinc Oxide

Effective as an activator of accelerators in the vulcanization process. Other prominent rubber applications include foam control in lattices, reinforcement filler, improved heat conductivity and ageing flexing in stocks.

Table A.4 The specification of zinc oxide

Composition property	Specification value
Zinc Oxide (%, Min)	99.5
Lead Oxide (%, Max)	0.01
Cadmium Oxide (%, Max)	0.005
Copper Oxide (%, Max)	0.0004
Manganese (%, Max)	0.0002
Metallic Metals (As/Zn) (%, Max)	None
Heat Loss (378 K) (%, Max)	0.02
Water Soluble (%, Max)	0.15
Insoluble in HCl (%, Max)	0.01
Sieve Reject (325 mesh) (%, Max)	0.05

RUBATOR MBTS

Table A.5 The specification of MBTS

Composition property	Specification value
Compositon	Benzothiazyl Disulphide
C.A.S number	120-78-5
Molecular weight	332
Characteristics	
- Real content, %	94%
- Appearance	A cream colored to light gray-white free-flowing power of characteristic odor and slightly bitter flavor. Also provided in pellets.
- Specific gravity, kg m^{-3}	150
- Melting point, K	443
- Moisture, %	Less than 0.5
- Ash, %	Less than 0.5
- Oil, %	0.5 to 2.5
- Free MBT, %	Less than 1.0
- Fineness, %	Less than 0.5
- Toxicity	Not considered hazardous in the normal conditions of use
- Storage stability	Excellent at moderate temperatures
- Solubility	Soluble in warm benzene and chloroform

RUBATOR TMTD

Table A.6 The specification of TMTD

Composition property	Specification value
Compositon	Tetramethylthiuram disulfide
C.A.S Number	137-26-8
Molecular Weight	240
Characteristics	
- Appearance	White to yellowish powder
- Specific gravity, kg m^{-3}	142
- Purity or assay (%, Min)	95% Min
- Melting point, K	417
- Moisture, %	Less than 0.5
- Ash, %	Less than 0.5
- Oil, %	0.5 to 2.5
- Fineness (%, Max)	0.5
- Toxicity	Not toxic under normal conditions of use
- Storage stability	Excellent at normal temperatures
- Solubility	Soluble in benzene, acetone, ether, carbon disulfide, carbon tetrachloride, ethylene dichloride and warm alcohol.

HAF N330 (carbon black)

Table A.7 The specification of carbon black (N330)

Composition property	Specification value
Iodine No., mg/g	82.5
TINT strength, %IRB#3	102.8
Ash content (%, Max)	0.21
Heat loss (%, Max)	0.7
Sieve residue #325 (%, Max)	0.023
Fine 5 min (%, Max)	4.0
Pellet hardness	16.8

Ultrasil VN3 granulate (silica)

Table A.8 The specification of silica (Ultrasil VN 3)

Composition property	Specification value
Specific surface area, m^2/g	155-195
Volatiles at 378 K, %	4-7
pH value, 5% in water	5.4-7
Sieve analysis >50 mesh, %	$\geq$ 80

Carbowax 3350 (Polyethylene glycol)

Table A.9 The specification of poly(ethylene glycol)

Composition property	Specification value
Average molecular weight range	3000-3700
Density, kg m^{-3}	109
Average Hydroxyl range	37 to 30
Average of repeating oxyethylene units	75.7
pH 5% in aqueous solution	4.5-7.5

Struktol EF 44

Processing additive for natural rubber and synthetic rubber. The composition consists with the blend of fatty acid derivative (predominantly zinc soaps)

Table A.10 The specification of EF44

Composition property	Specification value
Density, kg m^{-3}	1100
Dropping point, K	368
Zinc content, %	8.3

APPENDIX B

1. Tensile strength of vulcanized rubber

Table B.1 Tensile strength of (70/30) NR/EPDM blends at Ultrablend 4000 concentrations of 0, 3, 5, and 7 phr

Conditions	Formulation	Tensile strength (MPa)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEH0	5.29	3.70	5.11	4.50	4.05	4.53	0.68
	NEH3	12.62	12.65	9.59	12.69	10.46	11.60	1.47
	NEH5	15.05	15.22	13.95	14.44	14.89	14.71	0.51
	NEH7	11.64	10.70	11.19	11.01	11.45	11.20	0.37
Aged	NEH0	2.86	2.55	2.70	3.22	3.11	2.89	0.28
	NEH3	2.75	3.43	3.32	3.99	3.62	3.42	0.45
	NEH5	3.95	3.66	3.37	3.99	3.62	3.72	0.26
	NEH7	4.91	2.75	2.14	3.24	3.24	3.26	1.03
% change	NEH0	-45.88	-31.16	-47.15	-28.49	-23.26	-35.19	10.73
	NEH3	-78.21	-72.86	-65.36	-68.54	-65.41	-70.08	5.48
	NEH5	-73.77	-75.98	-75.85	-72.35	-75.70	-74.73	1.61
	NEH7	-57.81	-74.25	-80.90	-70.57	-71.70	-71.05	8.42

Table B.2 Tensile strength of (70/30) NR/EPDM blends containing fillers (carbon black and silica)

Conditions	Formulation	Tensile strength (MPa)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEC3	15.05	15.22	13.95	14.44	14.89	14.71	0.51
	NES30	10.85	10.36	10.34	11.13	12.07	10.95	0.71
	NEC3S30	14.33	12.92	13.26	14.89	14.35	13.95	0.83
Aged	NEC3	3.95	3.66	3.37	3.99	3.62	3.72	0.26
	NES30	8.16	7.88	8.12	8.06	8.16	8.07	0.12
	NEC3S30	10.97	11.2	10.52	11.84	11.46	11.20	0.50
% change	NEC3	-73.77	-75.98	-75.85	-72.35	-75.70	-74.73	1.61
	NES30	-24.79	-23.94	-21.47	-27.58	-32.39	-26.03	4.17
	NEC3S30	-23.45	-13.31	-20.66	-20.48	-20.14	-19.61	3.76

Table B.3 Tensile strength of (70/30) NR/EPDM blends at carbon black concentrations of 0, 3, 5, 7, 10, 20, and 30 phr

Conditions	Formulation	Tensile strength (MPa)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEC0	12.05	12.52	12.57	14.84	11.63	12.72	1.24
	NEC3	15.05	15.22	13.95	14.44	14.89	14.71	0.51
	NEC5	11.39	11.69	11.45	11.32	11.7	11.51	0.17
	NEC7	9.53	12.63	14.79	11.01	11.91	11.97	1.95
	NEC10	15.79	15.84	15.78	15.95	15.83	15.84	0.07
	NEC20	13.55	14.02	13.46	13.94	14.25	13.84	0.33
	NEC30	14.81	15.68	15.37	14.10	14.23	14.84	0.69
Aged	NEC0	3.77	2.66	3.88	3.22	3.11	3.33	0.50
	NEC3	3.95	3.66	3.37	3.99	3.62	3.72	0.26
	NEC5	4.40	4.72	3.85	3.98	4.20	4.23	0.34
	NEC7	2.58	2.45	2.75	2.49	2.77	2.61	0.15
	NEC10	4.36	4.08	3.99	3.59	4.60	4.12	0.38
	NEC20	5.22	4.98	5.02	5.04	5.15	5.08	0.10
	NEC30	6.21	7.50	6.98	7.38	7.21	7.06	0.51
% change	NEC0	-68.71	-78.77	-69.16	-78.32	-73.28	-73.64	4.82
	NEC3	-73.77	-75.98	-75.85	-72.35	-75.70	-74.73	1.61
	NEC5	-61.37	-59.62	-66.37	-64.84	-64.10	-63.26	2.72
	NEC7	-72.93	-80.60	-81.41	-77.38	-76.74	-77.81	3.39
	NEC10	-72.39	-74.24	-74.71	-77.49	-70.94	-73.96	2.49
	NEC20	-61.48	-64.48	-62.70	-63.85	-63.86	-63.27	1.19
	NEC30	-58.06	-52.20	-54.62	-47.66	-49.31	-52.37	4.15

Table B.4 Tensile strength of filled and unfilled NR/EPDM blends

Conditions	Formulation	Tensile strength (MPa)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NS	28.65	28.77	28.89	29.01	29.12	28.89	0.19
	N8E2S	19.23	20.27	17.41	20.19	19.89	19.40	1.18
	N7E3S	14.33	12.92	13.26	14.89	14.35	13.95	0.83
	N6E4S	8.38	9.31	8.51	9.17	8.48	8.77	0.43
	ES	16.78	16.56	16.43	16.54	16.75	16.61	0.15
	N8E2	18.32	17.05	18.27	14.87	16.42	16.99	1.43
	N7E3	15.05	15.22	13.95	14.44	14.89	14.71	0.51
	N6E4	9.33	7.85	8.67	9.26	9.435	8.91	0.66
Aged	NS	23.89	23.80	23.91	23.85	24.12	23.91	0.12
	N8E2S	14.45	13.81	13.12	12.92	13.09	13.48	0.64
	N7E3S	10.97	11.2	10.52	11.84	11.46	11.20	0.50
	N6E4S	6.57	7.28	7.17	6.56	6.145	6.75	0.47
	ES	9.03	9.26	8.79	9.55	9.01	9.13	0.29
	N8E2	7.75	6.11	4.32	6.24	3.55	5.59	1.67
	N7E3	3.95	3.66	3.37	3.99	3.62	3.72	0.26
	N6E4	4.37	5.01	3.82	3.84	3.55	4.12	0.58
% change	NS	-16.61	-17.27	-17.24	-17.79	-17.17	-17.22	0.42
	N8E2S	-24.86	-31.87	-24.64	-36.01	-34.19	-30.31	5.29
	N7E3S	-23.45	-13.31	-20.66	-20.48	-20.14	-19.61	3.76
	N6E4S	-21.66	-21.80	-15.68	-28.41	-27.54	-23.02	5.17
	ES	-46.19	-44.08	-46.50	-42.26	-46.21	-45.05	1.83
	N8E2	-57.69	-64.16	-76.35	-58.04	-78.39	-66.93	9.90
	N7E3	-73.77	-75.98	-75.85	-72.35	-75.70	-74.73	1.61
	N6E4	-53.19	-36.12	-55.86	-58.57	-62.40	-53.23	10.15

2. Tear strength of vulcanized rubber

Table B.5 Tear strength of (70/30) NR/EPDM blends at Ultrablend 4000 concentrations of 0, 3, 5, and 7 phr.

Conditions	Formulation	Tear strength (N/mm)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEH0	29.15	27.98	28.08	-	-	28.40	0.65
	NEH3	25.07	30.67	25.05	-	-	26.93	3.24
	NEH5	25.2	26.03	26.78	25.24	27.41	26.13	0.86
	NEH7	28.87	31.69	26.95	-	-	29.17	2.38
Aged	NEH0	11.59	20.17	16.33	-	-	16.03	4.30
	NEH3	20.78	17.31	19.69	-	-	19.26	1.77
	NEH5	16.32	14.68	16.2	18.34	18.55	16.82	1.45
	NEH7	21.84	21.43	12.53	-	-	18.60	5.26

Table B.6 Tear Strength of (70/30) NR/EPDM blends filled with silica at Ultrablend 4000 concentrations of 0, 3, 5, and 7 phr

Conditions	Formulation	Tear strength (N/mm)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEC3	25.2	26.03	26.78	25.24	27.41	26.13	0.86
	NES30	30.9	31.99	30.29	29.38	29.97	30.5	0.89
	NEC3S30	30.13	30.25	30.65	30.12	30.89	30.41	0.31
Aged	NEC3	16.32	14.68	16.2	18.34	18.55	16.82	1.45
	NES30	33.22	33.45	32.09	29.43	29.19	31.48	1.83
	NEC3S30	33.5	35.49	32.62	36.75	32.81	34.23	1.62

Table B.7 Tear strength of (70/30) NR/EPDM blends at carbon black concentrations of 0, 3, 5, 7, 10, 20, and 30 phr

Conditions	Formulation	Tear strength (N/mm)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NEC0	27.29	26.1	24.47	24.52	23.15	25.11	1.44
	NEC3	25.2	26.03	26.78	25.24	27.41	26.13	0.86
	NEC5	30.71	29.24	32.3	29.97	32.92	31.03	1.39
	NEC7	28.7	28.39	31.84	30.82	29.44	29.84	1.31
	NEC10	30.35	30.42	29.98	30.36	30.69	30.36	0.23
	NEC20	32.45	31.94	32.46	32.52	32.31	32.34	0.21
	NEC30	36.28	37.31	34.32	35.65	34.73	35.66	1.07
Aged	NEC0	21.44	15.52	21.54	15.07	15.33	17.78	3.03
	NEC3	16.32	14.68	16.2	18.34	18.55	16.82	1.45
	NEC5	18.28	18.22	18.63	18.68	18.81	18.52	0.23
	NEC7	18.58	18.58	17.76	18.13	18.27	18.26	0.31
	NEC10	19.80	19.58	19.54	19.57	19.94	19.69	0.16
	NEC20	21.70	21.72	21.97	21.90	22.05	21.87	0.14
	NEC30	24.97	23.05	25.16	28.76	30.68	26.52	2.78

Table B.8 Tear strength of filled and unfilled NR/EPDM blends

Conditions	Formulation	Tear strength (N/mm)						
		Sample						
		1	2	3	4	5	Average	S.D.
Unaged	NS	111.42	114.76	113.23	114.36	112.69	113.29	1.20
	N8E2S	32.14	35.57	36.51	35.82	35.14	35.04	1.51
	N7E3S	30.13	30.25	30.65	30.12	30.89	30.41	0.31
	N6E4S	27.46	28.81	27.71	27.41	26.21	27.52	0.83
	ES	43.66	44.01	44.38	44.60	44.68	44.27	0.38
	N8E2	27.87	28.45	29.86	28.95	29.96	29.02	0.81
	N7E3	25.2	26.03	26.78	25.24	27.41	26.13	0.86
	N6E4	19.63	22.4	22.36	22.95	19.8	21.43	1.42
Aged	NS	78.05	78.29	77.61	77.58	77.58	77.82	0.29
	N8E2S	36.65	38	37.5	36.36	38.33	37.37	0.76
	N7E3S	33.5	35.49	32.62	36.75	32.81	34.23	1.62
	N6E4S	27.77	29.06	28.24	27.67	27.41	28.03	0.58
	ES	52.87	52.40	52.53	51.74	51.69	52.25	0.46
	N8E2	22.36	22.22	19.58	21.79	23.89	21.97	1.39
	N7E3	16.32	14.68	16.2	18.34	18.55	16.82	1.45
	N6E4	16.76	16.01	18.77	18.19	15.97	17.14	1.14

APPENDIX C

Table C.1 Property range of the vulcanized compounded NR/EPDM

Formulation	Max. Torque, M_H (dNm)	Min. Torque, M_L (dNm)	Scorch time, t_2 (min)	Optimum cure time, t_{90} (min)
NEC0	48.34	9.97	4.97	7.97
NEC3	50.85	9.11	4.72	7.44
NEC5	54.51	7.96	4.94	7.72
NEC7	51.78	9.11	3.47	6.92
NEC10	59.67	8.32	3.33	7.08
NEC20	64.98	7.75	2.64	5.72
NEC30	64.12	13.27	2.42	4.86
NEH0	55.15	11.76	3.72	6.89
NEH3	53.36	10.26	4.81	7.78
NEH5	50.85	9.11	4.72	7.44
NEH7	51.21	9.11	4.86	7.78
NEC3S30	61.03	16.28	2.50	5.36
NES30	69.85	17.21	2.22	4.33
N8E2	55.08	8.39	4.06	7.14
N7E3	50.85	9.11	4.72	7.44
N6E4	49.92	8.18	4.94	8.72
NS	72.22	23.16	3.31	5.75
N8E2S	62.39	15.92	2.94	5.86
N7E3S	61.03	16.28	2.50	5.36
N6E4S	57.52	14.70	2.72	6.06
ES	99.26	18.86	4.61	14

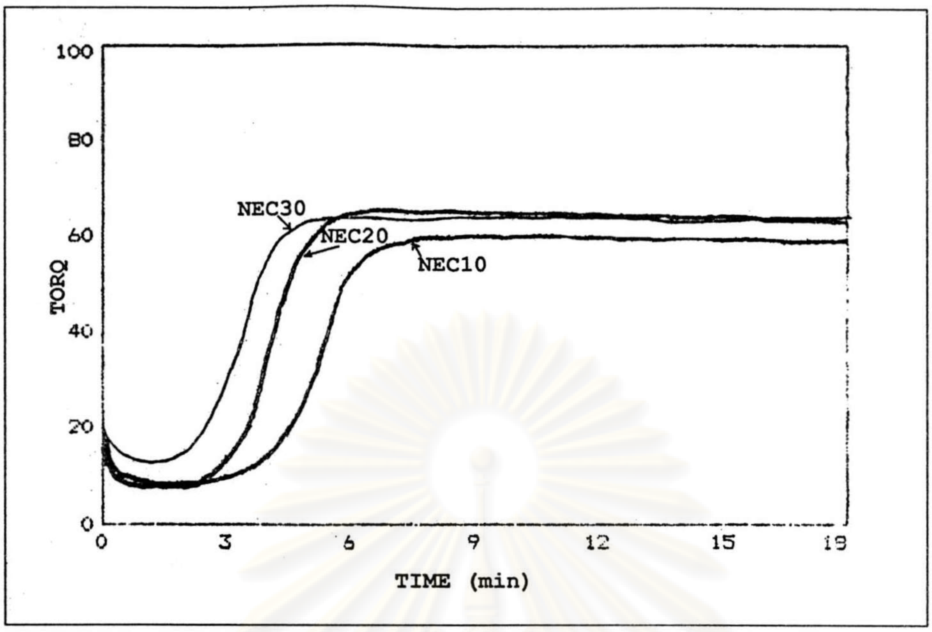

Figure C.1 Rheograph of NR/EPDM blends at carbon black concentrations of 10, 20, and 30 phr

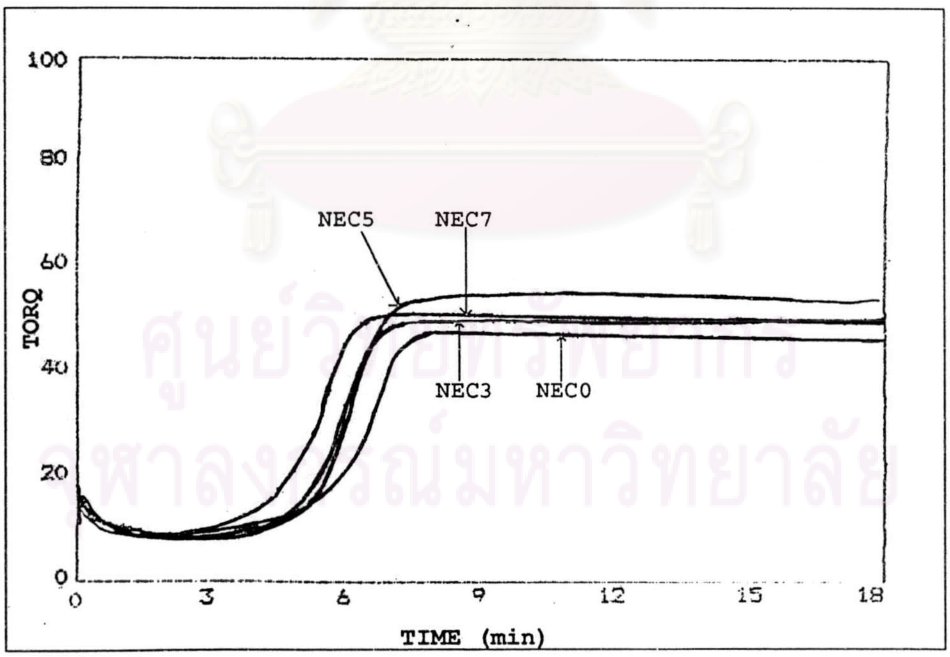

Figure C.2 Rheograph of NR/EPDM blends at carbon black concentrations of 0, 3, 5, and 7 phr

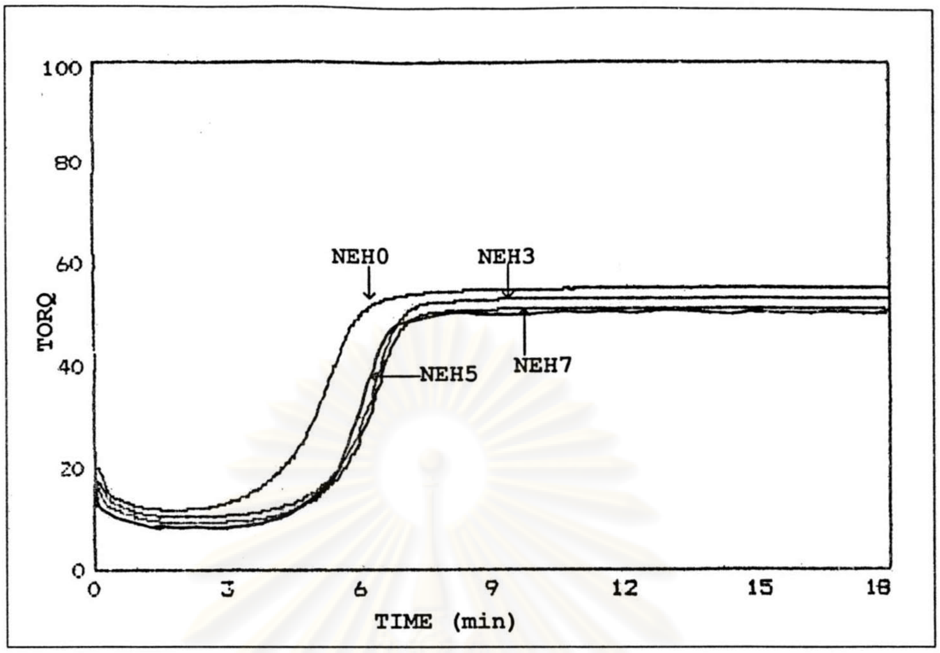

Figure C.3 Rheograph of NR/EPDM blends at homogenizing agent concentrations of 0, 3, 5, and 7 phr

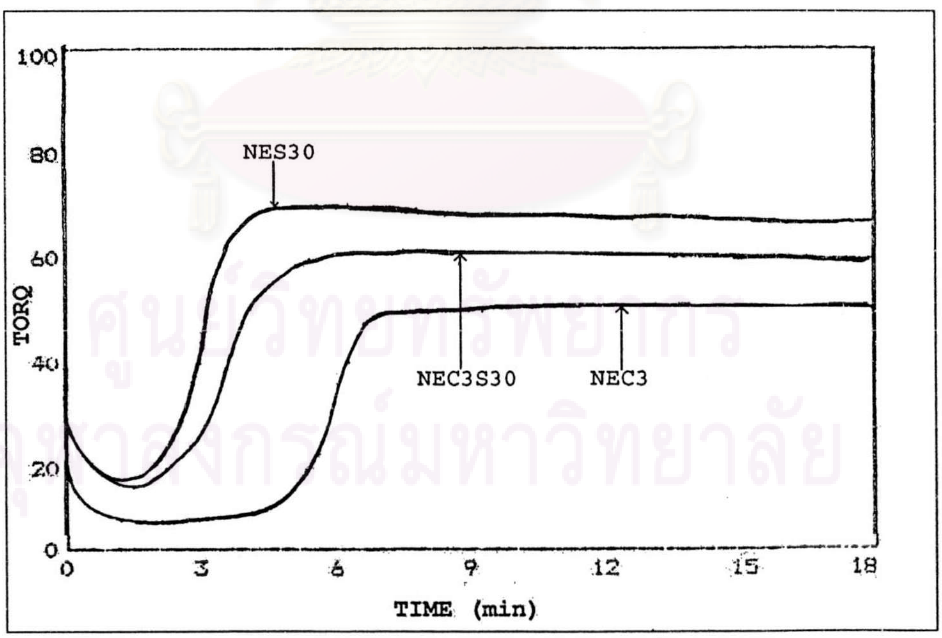

Figure C.4 Rheograph of NR/EPDM blends containing carbon black and silica fillers

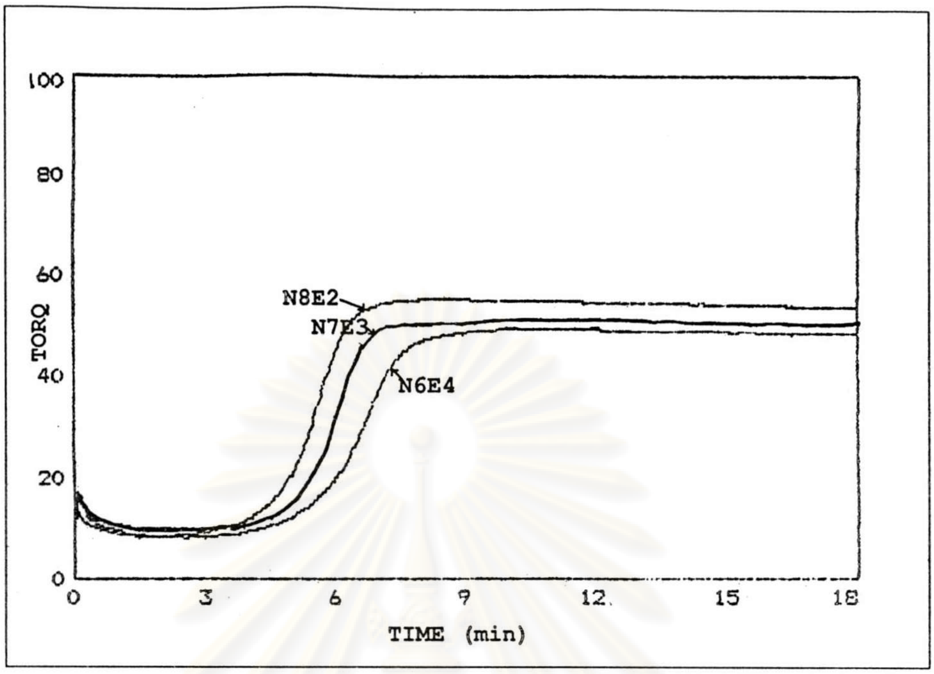

Figure C.5 Rheograph of NR/EPDM blends at ratios of NR/EPDM (80/20, 70/30, and 60/40)

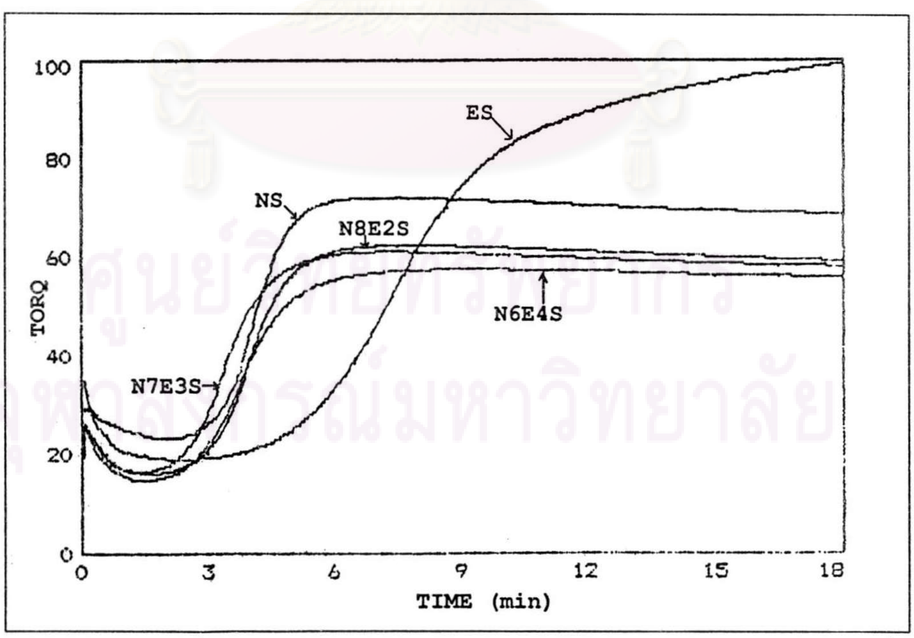

Figure C.6 Rheograph of NR/EPDM blends filled with silica at ratios of NR/EPDM (100/0, 80/20, 70/30, 60/40 and 0/100).

APPENDIX D

Table D.1 Dependence of volume resistivity and surface resistivity of NR/EPDM blends on carbon black concentration

Carbon black (phr)	Sample No.	Volume resistivity (ohm cm)		Surface resistivity (ohm cm)	
		Unaged	Aged	Unaged	Aged
0	1	$3.26x10^{15}$	$3.13x10^{15}$	$6.66x10^{15}$	$3.47x10^{16}$
	2	$2.72x10^{15}$	$2.81x10^{15}$	$7.84x10^{15}$	$3.46x10^{16}$
	3	$2.93x10^{15}$	$3.44x10^{15}$	$8.77x10^{15}$	$7.32x10^{15}$
	4	$2.41x10^{15}$	$1.63x10^{15}$	$7.51x10^{15}$	$2.73x10^{16}$
	5	$2.18x10^{15}$	$2.45x10^{15}$	$6.87x10^{15}$	$3.06x10^{16}$
3	1	$2.07x10^{15}$	$5.43x10^{16}$	$5.90x10^{15}$	$4.83x10^{17}$
	2	$2.06x10^{15}$	$4.55x10^{15}$	$9.95x10^{15}$	$8.76x10^{15}$
	3	$2.18x10^{15}$	$6.42x10^{15}$	$5.14x10^{15}$	$4.08x10^{17}$
	4	$2.02x10^{15}$	$4.18x10^{15}$	$6.19x10^{15}$	$3.19x10^{17}$
	5	$2.61x10^{15}$	$1.27x10^{16}$	$6.99x10^{15}$	$1.99x10^{17}$
5	1	$1.73x10^{15}$	$3.91x10^{15}$	$1.28x10^{15}$	$5.62x10^{15}$
	2	$3.52x10^{15}$	$2.87x10^{15}$	$1.39x10^{15}$	$1.26x10^{16}$
	3	$3.75x10^{15}$	$5.26x10^{15}$	$2.5x10^{15}$	$4.68x10^{16}$
	4	$3.15x10^{15}$	$2.96x10^{15}$	$2.05x10^{15}$	$1.91x10^{16}$
	5	$3.88x10^{15}$	$6.67x10^{15}$	$7.57x10^{15}$	$5.51x10^{15}$
7	1	$4.01x10^{15}$	$5.5x10^{15}$	$7.16x10^{16}$	$6.93x10^{15}$
	2	$3.20x10^{15}$	$3.2x10^{15}$	$2.47x10^{16}$	$7.72x10^{15}$
	3	$3.33x10^{15}$	$2.41x10^{15}$	$9.18x10^{16}$	$5.68x10^{15}$
10	1	$3.21x10^{15}$	$3.70x10^{15}$	$2.95x10^{16}$	$3.43x10^{16}$
	2	$2.79x10^{15}$	$2.63x10^{15}$	$8.77x10^{15}$	$1.70x10^{16}$
	3	$3.77x10^{15}$	$2.37x10^{15}$	$1.02x10^{15}$	$7.21x10^{15}$
20	1	_a	$1.02x10^{10}$	$1.49x10^{10}$	$3.72x10^{10}$
	2	$1.49x10^{10}$	$4.6x10^{10}$	$9.24x10^{10}$	$6.28x10^{10}$
	3	$2.19x10^{10}$	$9.86x10^{10}$	$5.86x10^{10}$	$1.11x10^{10}$
30	1	_a	_a	_a	_a
	2	_a	_a	_a	_a
	3	_a	_a	_a	_a

_a The resistivities were higher than the measurable limit of the equipment.

Table D.2 Dependence of volume resistivity and surface resistivity of NR/EPDM blends on homogenizing agent concentration

Homogenizing agent (phr)	Sample No.	Volume resistivity (ohm cm)	Surface resistivity (ohm cm)
0	1	7.046×10^{13}	8.484×10^{14}
	2	7.113×10^{13}	5.099×10^{14}
	3	7.131×10^{13}	9.480×10^{14}
	4	7.055×10^{13}	3.644×10^{14}
	5	7.208×10^{13}	1.069×10^{14}
3	1	6.258×10^{13}	3.238×10^{13}
	2	6.259×10^{13}	5.755×10^{13}
	3	6.256×10^{13}	1.487×10^{13}
	4	6.259×10^{13}	1.487×10^{13}
	5	6.256×10^{13}	1.485×10^{13}
5	1	2.07×10^{15}	5.90×10^{15}
	2	2.06×10^{15}	9.95×10^{15}
	3	2.18×10^{15}	5.14×10^{15}
	4	2.02×10^{15}	6.19×10^{15}
	5	2.61×10^{15}	6.99×10^{15}
7	1	6.282×10^{13}	1.486×10^{13}
	2	6.272×10^{13}	1.488×10^{13}
	3	6.331×10^{13}	1.489×10^{13}
	4	6.325×10^{13}	1.490×10^{13}
	5	6.328×10^{13}	1.489×10^{13}

VITA

Kornteenee Pairpisit was born on October 8, 1973 in Nakornprathom, Thailand. She received the Bachelor's Degree of Science in Chemistry from the Faculty of Science, Srinakarintrawirote University in 1995. She has been a graduate student in the Program of Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University, since June, 2001, and completed her Master's Degree of Science in July, 2002.