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APPENDIX A

The grafted natural rubber could be separated from the products of emulsion polymerization by the extraction with suitable solvent [16]. In this work, the extraction time of free polymers (e.g. SAN, ungraft rubber) from graft natural rubber was studied. Table A and Figure A show the time of extraction. The appropriate extraction time was 24 hours.

Table A. Extraction time of the free polymers.

time (h.)	Weight of sample (g) : extracted by LPE	Weight of sample (g) : extracted by DMF
0.0	2.355	1.303
6.0	1.752	1.230
12.0	1.502	1.212
18.0	1.364	1.182
24.0	1.303	1.173
30.0	1.303	1.173

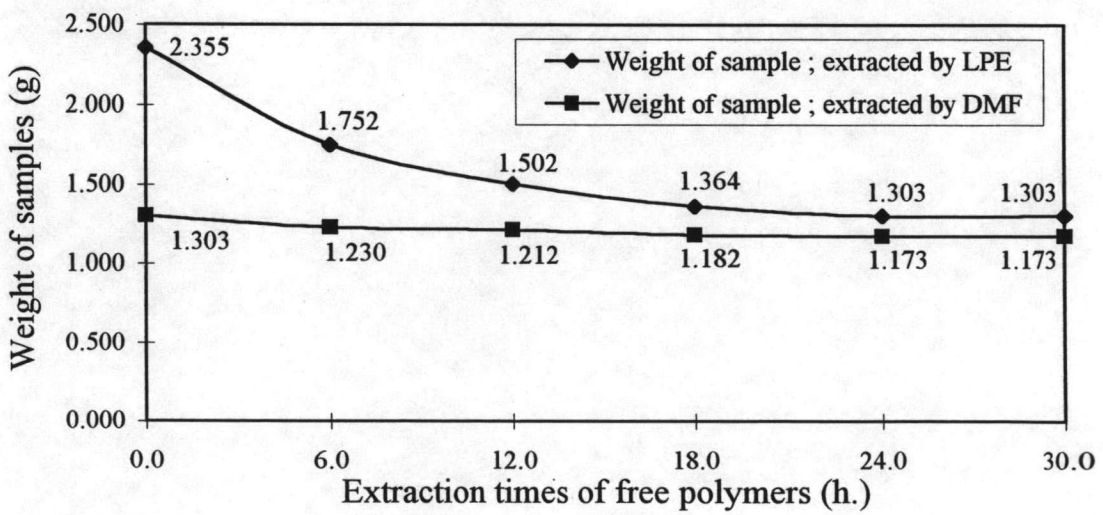


Figure A. Extraction time of the free polymer.

APPENDIX B

Calculation of Monomers Conversion [18]

The monomers conversion is defined as the mass of SAN formed (graft and free) divided by the initial mass of monomers. The definition of conversion of monomers is

$$\text{conversion} = \frac{\text{SAN formed}}{\text{initial mass of momomers in sample}}$$

Calculation of Grafting Efficiency [18]

The grafting efficiency is readily defined as the mass of the grafted SAN divided by the total SAN produced. The definition of grafting efficiency is

$$\text{grafting efficiency} = \frac{\text{weight of graft SAN}}{\text{weight of free SAN and free NR} + \text{weight of grafted SAN}}$$

Calculation of Graft Ratio [18]

The graft ratio is defined as the mass of grafted SAN per unit mass of backbone polymer. The definition of graft ratio is

$$\text{graft ratio} = \frac{\text{weight of grafted SAN}}{\text{weight of backbone } cis-1,4-\text{polyisoprene}}$$

Table B. Effect of emulsifier concentration on the degree of monomers conversion and the grafting efficiency.

Emul (%Wt)	Samp. No.	Testing of % DRC of natural rubber (DRC : dried rubber content)			Calculation for degree of monomers conversion					Grafting efficiency			
		wt of latex rubber (g)	wt of dried rubber (g)	% DRC	wt of latex NR (g)	wt of monomers (g)	wt of grafted products (g)	% conversion		wt of Sample	wt A*	wt B*	% grafting efficiency
								No 1,2	Avg.				
1.0	1	10.0	6.04	**60.4**	300	180	246.78	37.10	**36.65**	2.4269	2.1021	1.6156	**66.57**
	2	10.0	6.04	**60.4**	300	180	245.16	36.20					
1.5	1	10.0	6.04	**60.4**	300	180	244.46	35.81	**35.22**	2.8883	2.5405	2.4746	**85.67**
	2	10.0	6.04	**60.4**	300	180	242.33	34.63					
2.0	1	10.0	6.04	**60.4**	300	180	242.93	34.96	**35.05**	2.7181	2.2615	1.8896	**69.51**
	2	10.0	6.05	**60.5**	300	180	243.25	35.14					

A* : Graft products were extracted by light petroleum ether at 80 °C for 24 hours.

B* : Graft products were extracted by light petroleum ether at 80 °C for 24 hours., and extracted by DMF at 140 °C for 24 hours.

APPENDIX CI

Table CI. Effect of reaction temperature on the degree monomer conversion and grafting efficiency

Temp. (°C)	Sam. No	Testing of %DRC of natural rubber (% dried rubber content)			Calculation for degree of monomers conversion					Grafting efficiency			
		wt of NR (g)	Wt of dried NR (g)	% DRC	wt of latex NR (g)	wt of monomers (g)	wt of grafted products(g)	% conversion		wt of Sample	wt A	wt B	% grafting efficiency
								No 1,2	Avg.				
30	1	10.0	6.05	**60.5**	300	180	226.82	26.01	**25.02**	2.0128	1.5636	1.4961	**74.33**
	2	10.0	6.04	**60.4**	300	180	223.25	24.03					
40	3	10.0	6.04	**60.4**	300	180	231.41	28.56	**27.77**	2.7300	2.1879	2.0573	**75.36**
	4	10.0	6.04	**60.4**	300	180	226.56	26.98					
50	5	10.0	6.05	**60.5**	300	180	283.00	57.40	**58.72**	2.7266	2.2760	2.0633	**75.67**
	6	10.0	6.05	**60.5**	300	180	288.07	60.04					
65	7	10.0	6.05	**60.5**	300	180	244.64	35.91	**35.22**	2.8883	2.5405	2.4746	**85.67**
	8	10.0	6.05	**60.5**	300	180	242.15	34.53					

A* : Graft products were extracted by light petroleum ether at 80 °C for 24 hours.

B* : Graft products were extracted by light petroleum ether at 80 °C for 24 hours., and extracted by DMF at 140 °C for 24 hours.

APPENDIX CII

In this research the GPC method was chosen for determination of the molecular weight of free SAN ; in tetrahydrofuran at 30 °C. The details are as follows :

Detector 1 Calibration report

METHOD NAME : DEMO METHOD 1

Calibration Type : Narrow Standards

Curve Type : 6th Order

Equation of Curve : $\log Mw = -5.37E+03 + 1.24E+03*R - 1.18E+02*R^2 + 5.95E-00*R^3 - 1.68E-01*R^4 + 2.51E-03*R^5 - 1.56E-05*R^6$

Correlation Coef : $r^2 = 0.99997095$

Std Err of Estimate : 0.00000000

Calibration Points :

Ret time (min.)	Specified Molecular Wt	Calculated Molecular Wt	Valid
21.17	5484000	5482373	Yes
24.09	1090000	1089497	Yes
28.25	190000	191194	Yes
29.45	96400	95264	Yes
31.02	37000	37620	Yes
32.17	18100	17918	Yes
32.92	9100	9156	Yes

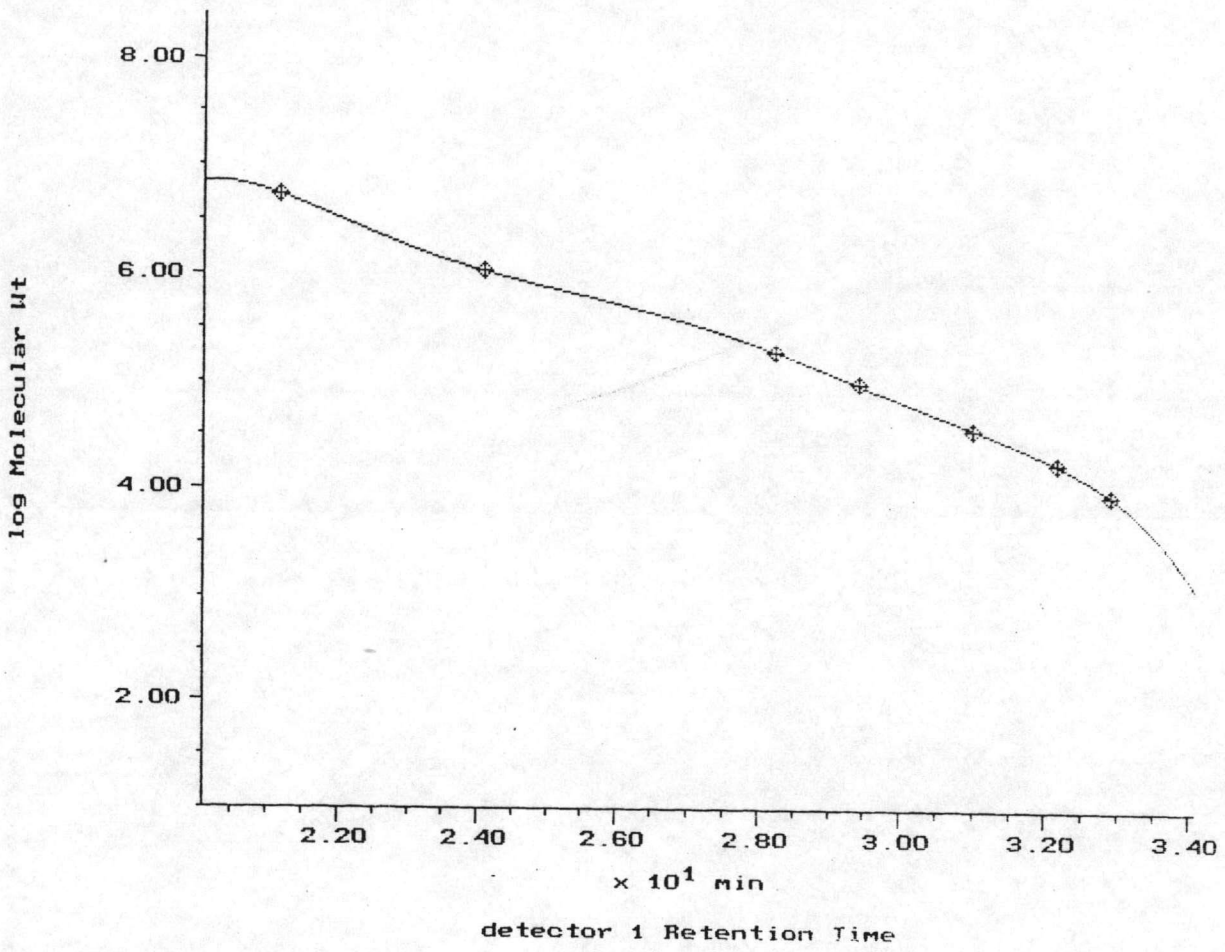
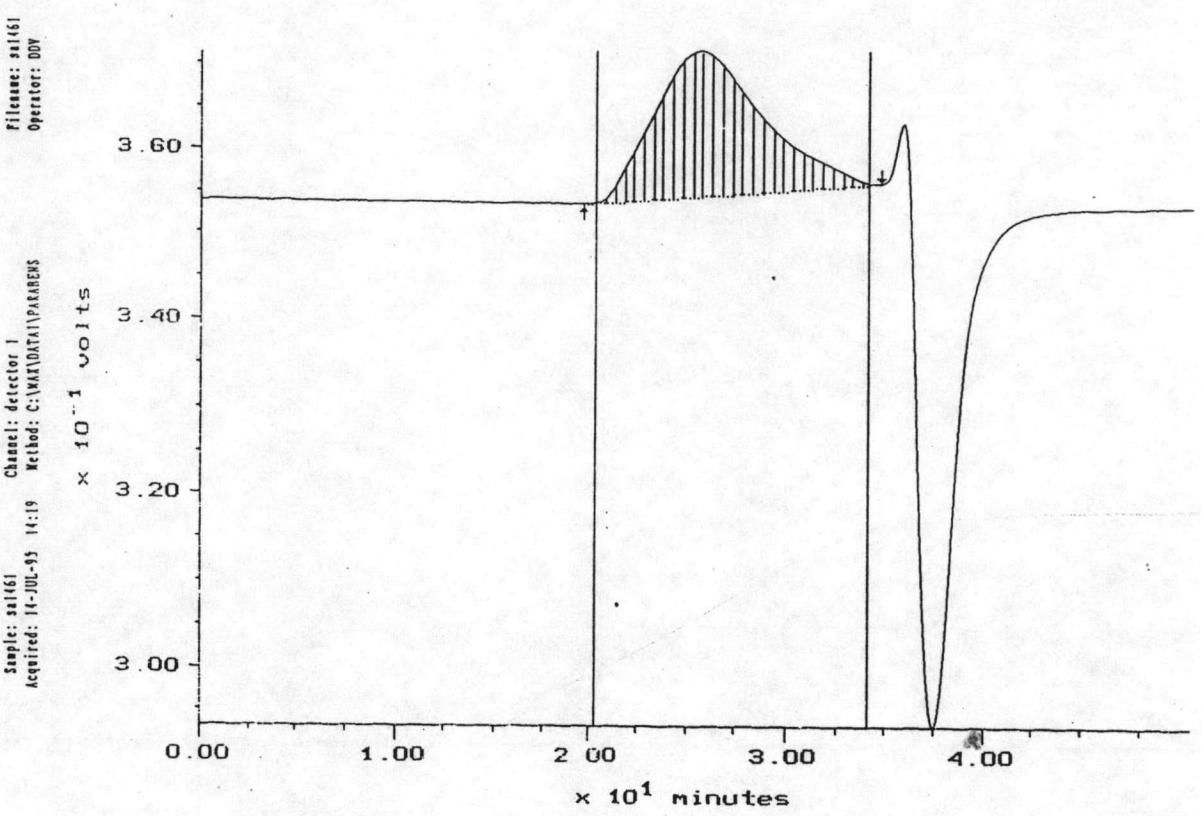


Figure CII.1. The calibration curve, standard of polystyrene from GPC chromatograms.



SAMPLE: REVIEW

Method : DEMO METHOD 1
Acquired : 14-JUL-1995 14:19
Rate : 2.000 points/sec
Duration : 50.000 minutes
Operator : DDV

Instrument : Instrument 1
Filename : SA1461

ANALYSIS PARAMETERS:

Processing Start : 20.32 minutes
Processing End : 34.08 minutes
Number of Slices : 28
Slice Width : 30 seconds

Baseline Start : 19.60 minutes
Baseline End : 34.80 minutes

Calibration : Narrow Standards

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average : 135702
Weight Average : 762858
Viscosity Average : 762858
Z Average : 1772839
Z+1 Average : 3011469

Polydispersity : 5.621582
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.323945
Z+1 avg / Wt avg : 3.947616

Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

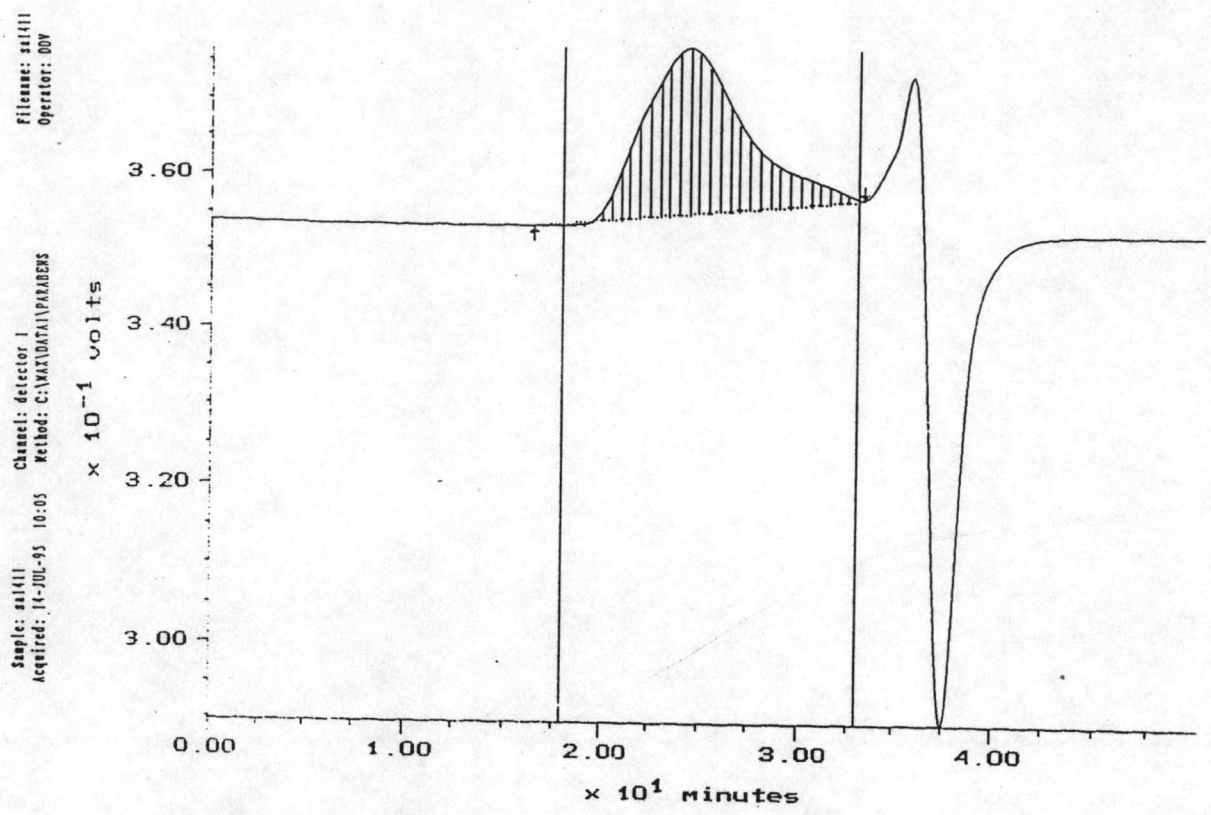
Number Average : 202485
Weight Average : 760820
Viscosity Average : 760820
Z Average : 1627379
Z+1 Average : 2978496

Polydispersity : 3.757418
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.138980
Z+1 avg / Wt avg : 3.914851

Peak Maximum:

Slice # : 11
Molecular Wt : 630096

Figure CII.2. GPC chromatogram of natural rubber.



SAMPLE: REVIEW

Method : DEMO METHOD 1
Acquired : 14-JUL-1995 10:05
Rate : 2.000 points/sec
Duration : 50.000 minutes
Operator : DDV

Instrument : Instrument 1
Filename : SA1411

ANALYSIS PARAMETERS:

Processing Start : 17.98 minutes
Processing End : 33.00 minutes
Number of Slices : 31
Slice Width : 30 seconds

Baseline Start : 16.45 minutes
Baseline End : 33.27 minutes

Calibration : Narrow Standards

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average : 316912
Weight Average : 1383542
Viscosity Average : 1383542
Z Average : 3035832
Z+1 Average : 4552889

Polydispersity : 4.365700
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.194246
Z+1 avg / Wt avg : 3.290748

Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

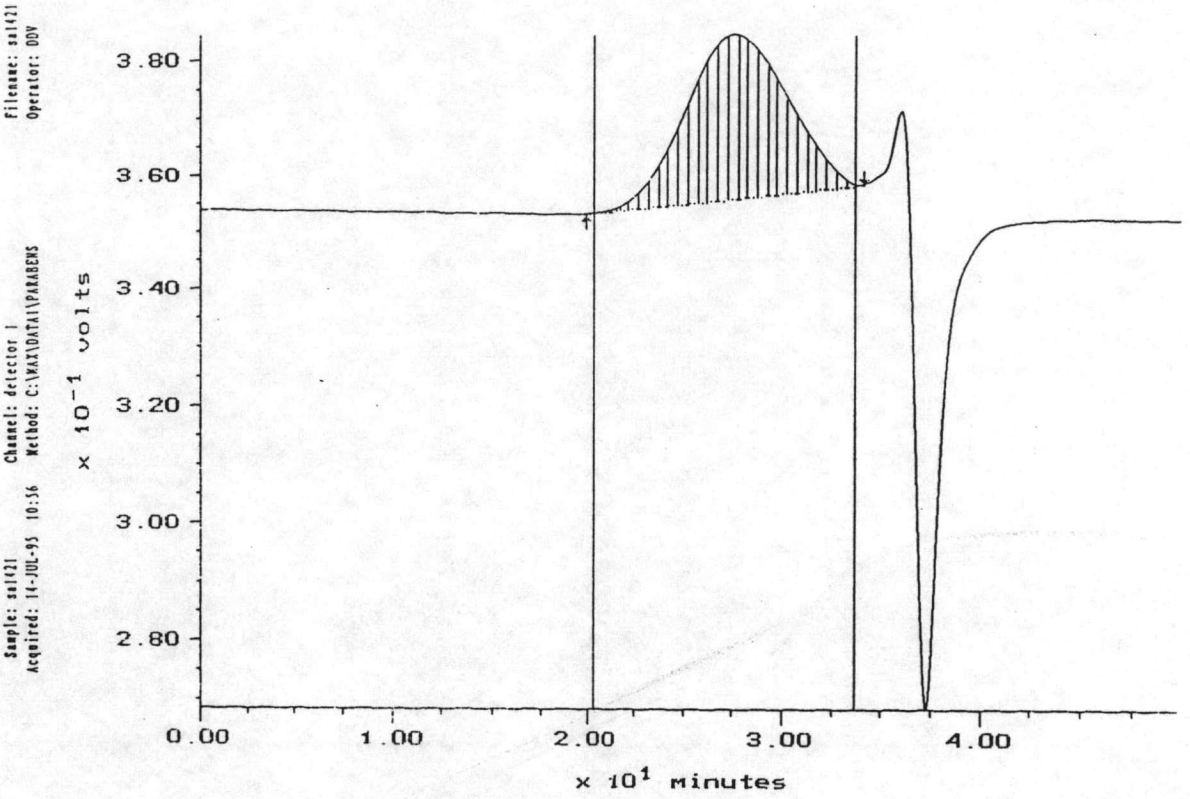
Number Average : 240048
Weight Average : -2252126
Viscosity Average : -2252126
Z Average : 11276417
Z+1 Average : 7909288

Polydispersity : -9.381985
Intrinsic viscosity : 0.000000
Z avg / Wt avg : N/A
Z+1 avg / Wt avg : N/A

Peak Maximum:

Slice # : 13
Molecular Wt : 1026849

Figure CII.3. GPC chromatogram of free SAN extracted from the products of graft copolymerization at 30 °C for 8 hours.



SAMPLE: REVIEW

Method : DEMO METHOD 1
Acquired : 14-JUL-1995 10:56
Rate : 2.000 points/sec
Duration : 50.000 minutes
Operator : DDV

Instrument : Instrument 1
Filename : SA1421

ANALYSIS PARAMETERS:

Processing Start : 20.23 minutes
Processing End : 33.72 minutes
Number of Slices : 27
Slice Width : 30 seconds

Calibration : Narrow Standards

Baseline Start : 19.87 minutes
Baseline End : 34.08 minutes

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average : 107597
Weight Average : 390694
Viscosity Average : 390694
Z Average : 893813
Z+1 Average : 1652135

Polydispersity : 3.631097
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.287759
Z+1 avg / Wt avg : 4.228723

Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

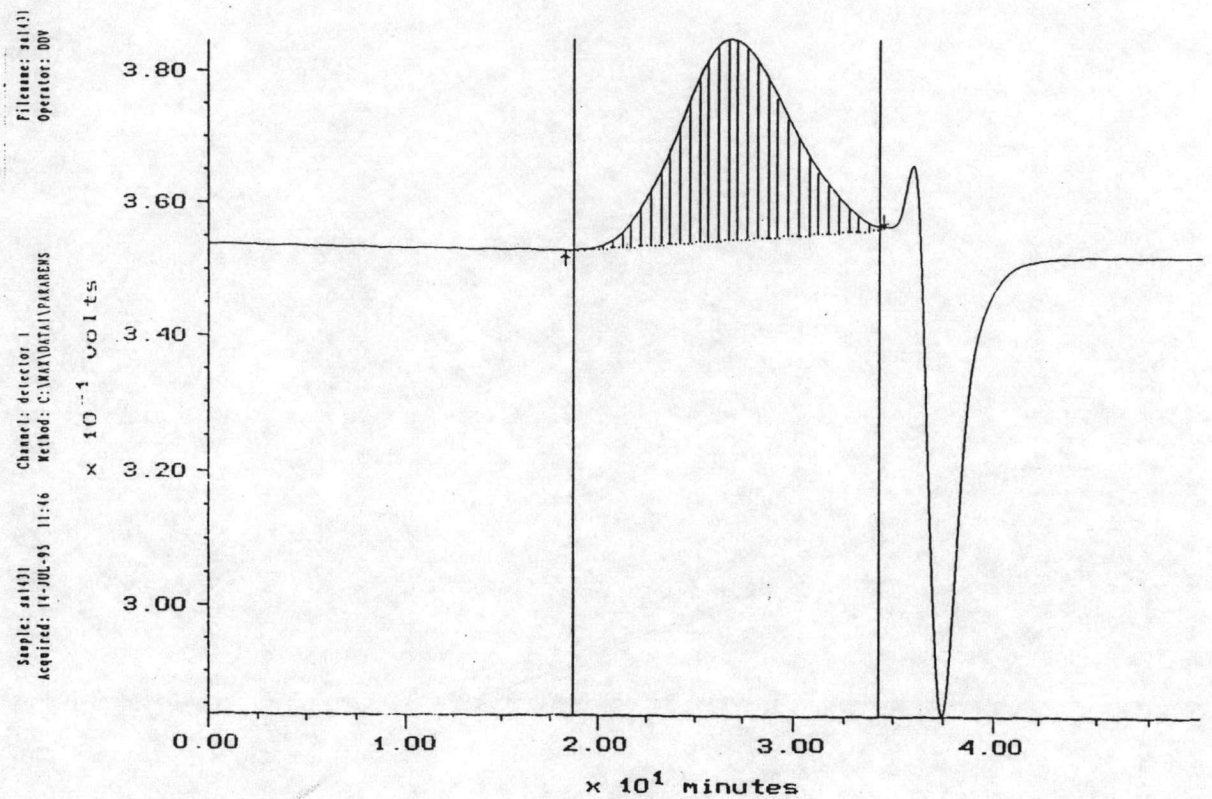
Number Average : 138792
Weight Average : 433036
Viscosity Average : 433036
Z Average : 842848
Z+1 Average : 1461391

Polydispersity : 3.120028
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 1.946369
Z+1 avg / Wt avg : 3.374756

Peak Maximum:

Slice # : 15
Molecular Wt : 284905

Figure CII.4. GPC chromatogram of free SAN extracted from the products of graft copolymerization at 40 °C for 8 hours.



SAMPLE: REVIEW

Method : DEKO ... HOD ;
Acquired : 14-JUL-1995 11:46
Rate : 2.000 points/sec
Duration : 50.000 minutes
Operator : DDV

Instrument : Instrument 1
Filename : SA1431

ANALYSIS PARAMETERS:

Processing Start : 18.70 minutes
Processing End : 34.26 minutes
Number of Slices : 32
Slice Width : 30 seconds

Baseline Start : 18.25 minutes
Baseline End : 34.43 minutes

Calibration : Narrow Standards

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average : 113599
Weight Average : 589629
Viscosity Average : 589629
Z Average : 1702689
Z+1 Average : 3416289

Polydispersity : 5.190431
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.887729
Z+1 avg / Wt avg : 5.793962

Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

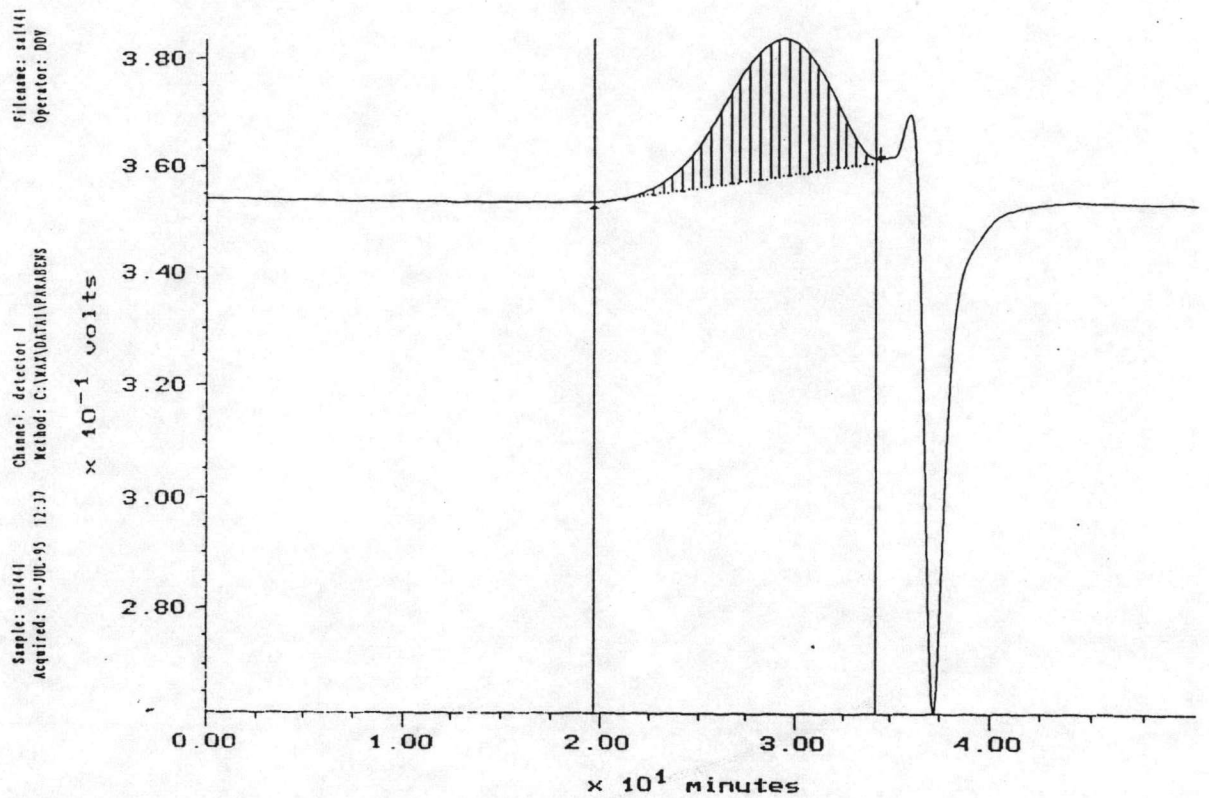
Number Average : 162405
Weight Average : 626173
Viscosity Average : 626173
Z Average : 1688248
Z+1 Average : 3704839

Polydispersity : 3.855613
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 2.696138
Z+1 avg / Wt avg : 5.916641

Peak Maximum:

Slice # : 17
Molecular Wt : 365742

Figure CII.5. GPC chromatogram of free SAN extracted from the products of graft copolymerization at 50 °C for 8 hours.



SAMPLE: REVIEW

Method	: P\xO METHOD 1	Instrument	: Instrument 1
Acquired	: 14-JUL-1995 12:37	Filename	: SA1441
Rate	: 2.000 points/sec		
Duration	: 50.000 minutes		
Operator	: DDV		

ANALYSIS PARAMETERS:

Processing Start	: 19.69 minutes	Baseline Start	: 19.60 minutes
Processing End	: 34.26 minutes	Baseline End	: 34.43 minutes
Number of Slices	: 30		
Slice Width	: 30 seconds		
Calibration	: Narrow Standards		

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average	: 53051		
Weight Average	: 243840	Polydispersity	: 4.596310
Viscosity Average	: 243840	Intrinsic viscosity	: 0.000000
Z Average	: 647890	Z avg / Wt avg	: 2.657027
Z+1 Average	: 1190351	Z+1 avg / Wt avg	: 4.881683

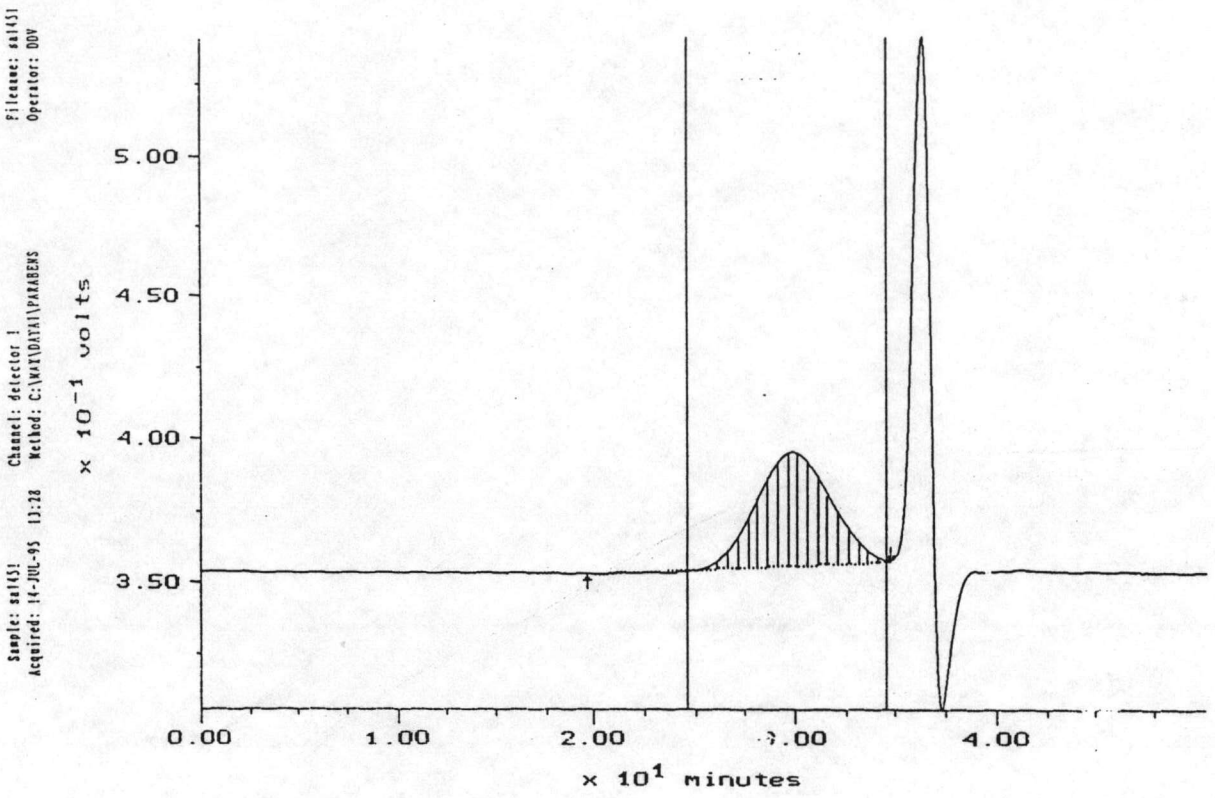
Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

Number Average	: 74638		
Weight Average	: 291290	Polydispersity	: 3.902701
Viscosity Average	: 291290	Intrinsic viscosity	: 0.000000
Z Average	: 652250	Z avg / Wt avg	: 2.239174
Z+1 Average	: 1083074	Z+1 avg / Wt avg	: 3.718193

Peak Maximum:

Slice #	: 20
Molecular Wt	: 95416

Figure CII.6. GPC chromatogram of free SAN extracted from the products of graft copolymerization at 65 °C for 8 hours.



SAMPLE: REVIEW

Method : DEMO METHOD 1
Acquired : 14-JUL-1995 13:28
Rate : 2.000 points/sec
Duration : 50.000 minutes
Operator : DDV

Instrument : Instrument 1
Filename : SA1451

ANALYSIS PARAMETERS:

Processing Start : 24.63 minutes
Processing End : 34.53 minutes
Number of Slices : 20
Slice Width : 30 seconds

Baseline Start : 19.60 minutes
Baseline End : 34.80 minutes

Calibration : Narrow Standards

DETECTOR: detector 1

Molecular Weight Distribution Averages (Area Normalization [W(t)]):

Number Average : 35450
Weight Average : 106293
Viscosity Average : 106293
Z Average : 199375
Z+1 Average : 286427

Polydispersity : 2.998416
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 1.875702
Z+1 avg / Wt avg : 2.694685

Molecular Weight Distribution Averages (Molecular Weight Normalization [W(t) / -d(log MW)/dt]):

Number Average : 48944
Weight Average : 119927
Viscosity Average : 119927
Z Average : 218677
Z+1 Average : 307504

Polydispersity : 2.450281
Intrinsic viscosity : 0.000000
Z avg / Wt avg : 1.823426
Z+1 avg / Wt avg : 2.564104

Peak Maximum:

Slice # : 11
Molecular Wt : 73298

Figure CII.7. GPC chromatogram of SAN (330PC) from TPI Co. Ltd.,

Appendix CIII

Calculation of Graft Frequency [18]

The graft frequency is the number of backbone polymer repeat units between graft chains. To obtain this we first calculate the number of graft chains per backbone chain. For 37.5 g of grafted SAN at an M_n of 316,912 (via Table 4.5) and 130 g of grafted *cis*-1,4-polyisoprene at an M_n 135,702 (via Table 4.5), one chain of *cis*-1,4-polyisoprene has 1,995.6 (135,702/68) repeat units. Hence the total number of grafted SAN chains is (3,705/316,912) x (Avogadro's number) or 1.18×10^{-4} x (Avogadro's number). The total number of grafted *cis*-1,4-polyisoprene chains is (130/135,702) x (Avogadro's number) or 9.58×10^{-4} x (Avogadro's number). The number of grafted chains per backbone chains is (1.18/9.58) = 0.12. The number of repeat units of rubber backbone per one of grafted chain is (1,995.6/0.12) = 16,630.

APPENDIX D

Table D1. The ratio of acrylonitrile and styrene in free SAN calculated from the specific peak area of FTIR spectra.

Reaction Temperature	Peak area at		Styrene/Acrylonitrile
(°C)	1510 cm^{-1}	2238 cm^{-1}	
30	3.165	3.133	50.3 : 49.7
40	3.722	1.713	68.5 : 31.5
50	3.817	2.960	56.3 : 43.7
65	3.465	1.397	71.3 : 28.7

Table D2. The ratio of acrylonitrile, isoprene and styrene in graft natural rubber calculated from the specific peak area of FTIR spectra.

Reaction Temperature	Peak area at			Isoprene/Styrene
(°C)	810 cm^{-1}	1510 cm^{-1}	2238 cm^{-1}	/Acrylonitrile
30	13.412	1.065	1.054	86.4 : 6.9 : 6.8
40	21.044	4.932	2.270	74.5 : 17.5 : 8.0
50	8.355	1.745	1.353	72.9 : 15.2 : 11.8
65	5.230	1.176	0.474	76.0 : 17.1 : 6.9

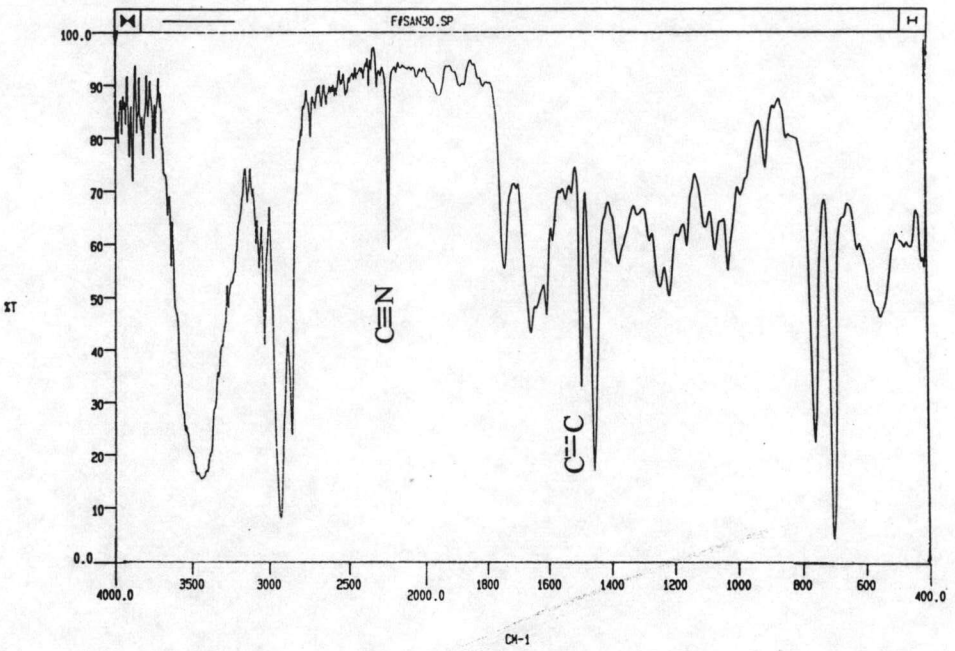


Figure D.1 FTIR spectrum of free SAN extracted from the products of graft copolymerization at 30 °C for 8 hours.

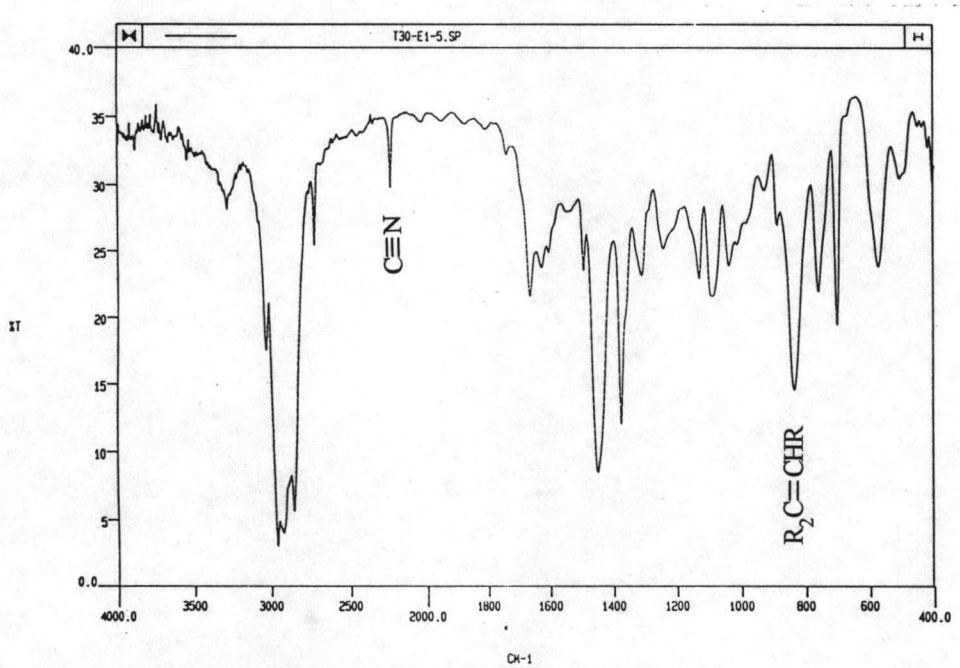


Figure D.2 FTIR spectrum of graft natural rubber extracted from the products of graft copolymerization at 30 °C for 8 hours.

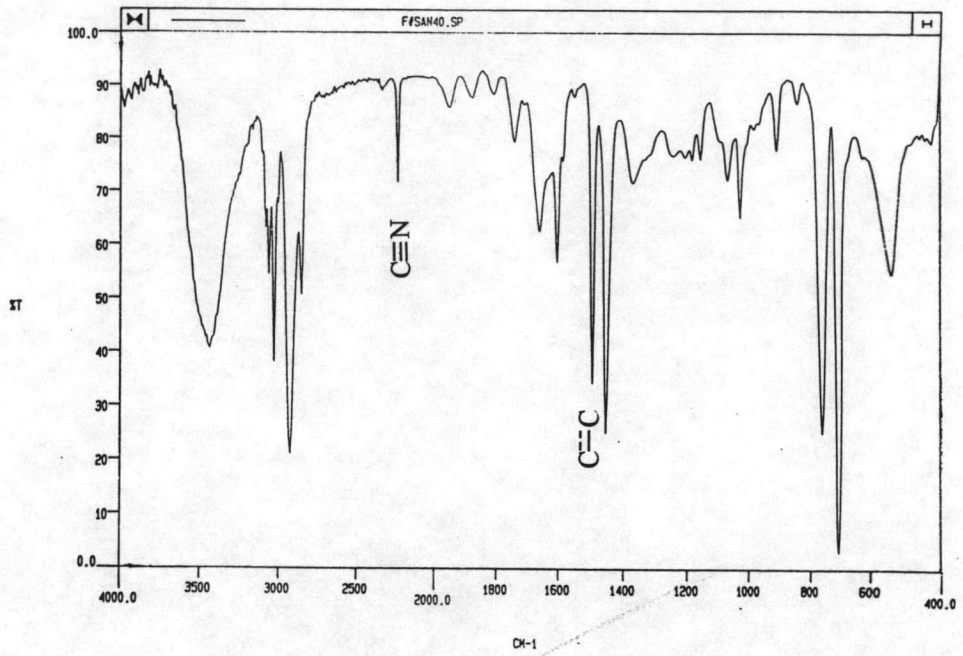


Figure D.3 FTIR spectrum of free SAN extracted from the products of graft copolymerization at 40 °C for 8 hours.

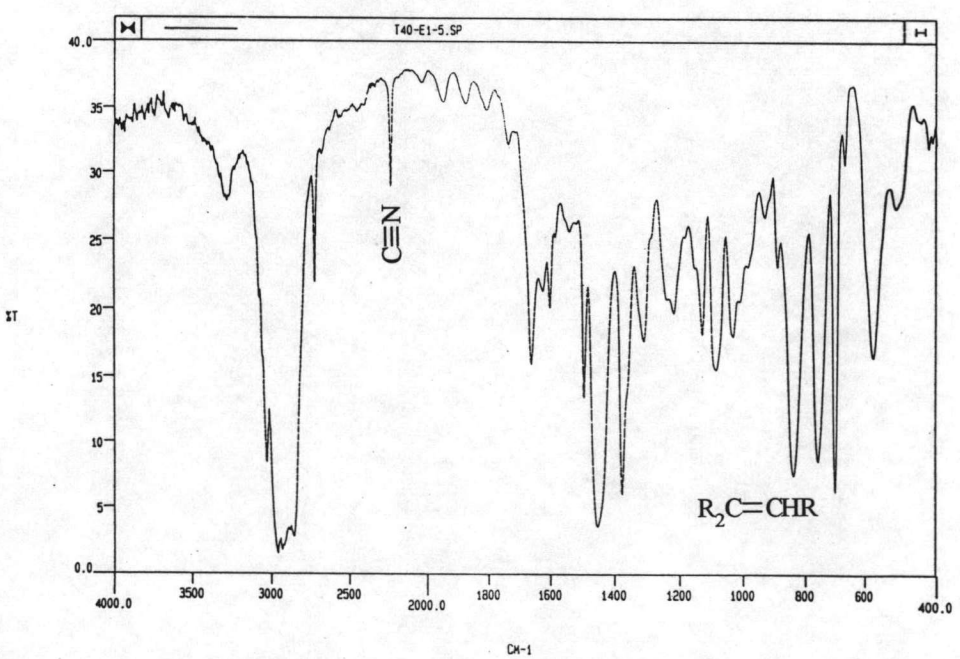


Figure D.4 FTIR spectrum of graft natural rubber extracted from the products of graft copolymerization at 40 °C for 8 hours.

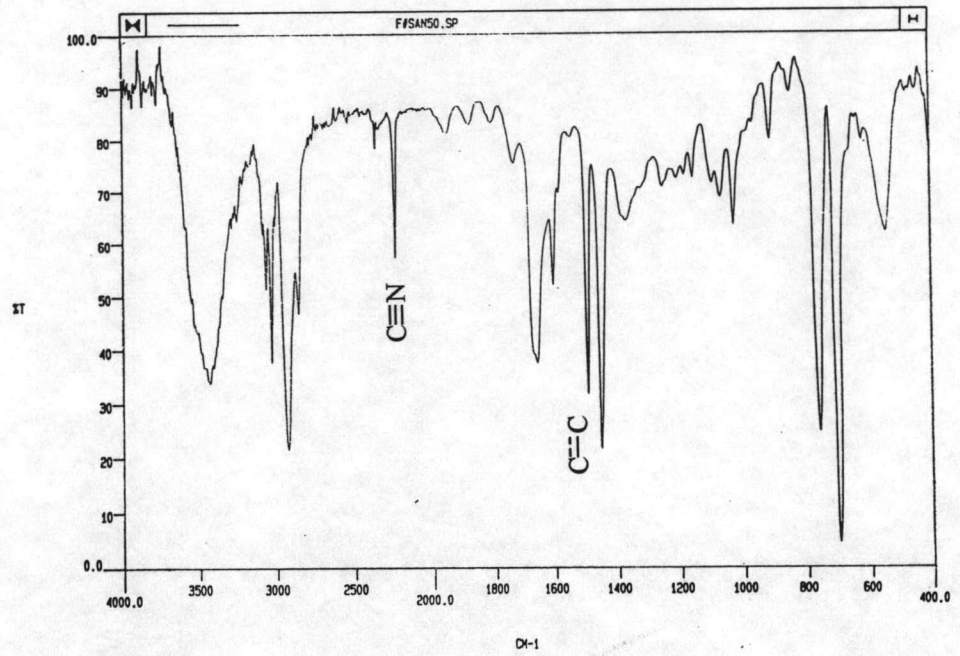


Figure D.5 FTIR spectrum of free SAN extracted from the products of graft copolymerization at 50 °C for 8 hours.

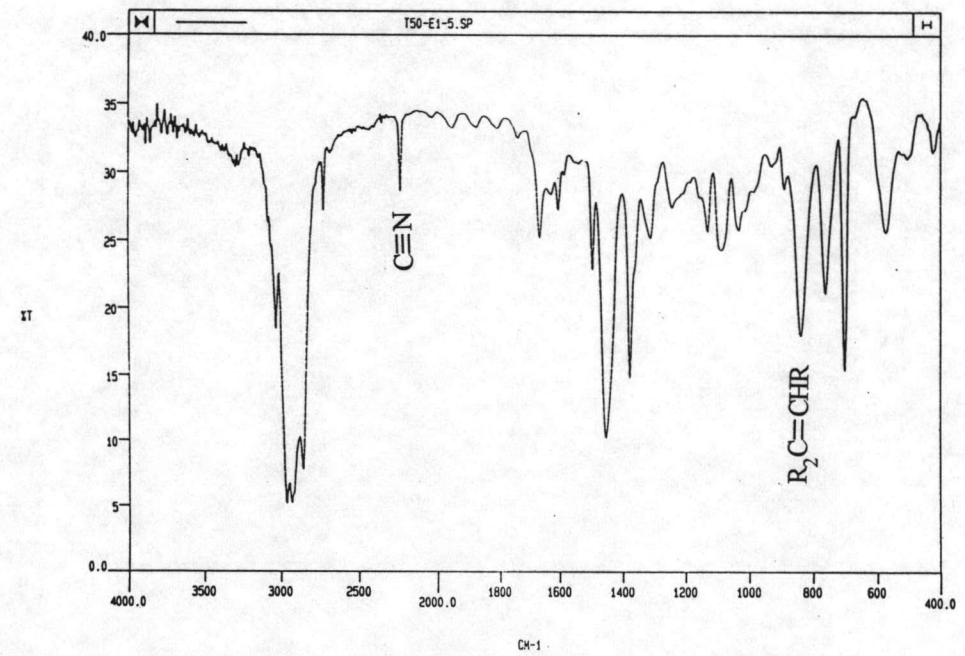


Figure D.6 FTIR spectrum of graft natural rubber extracted from the products of graft copolymerization at 50 °C for 8 hours.

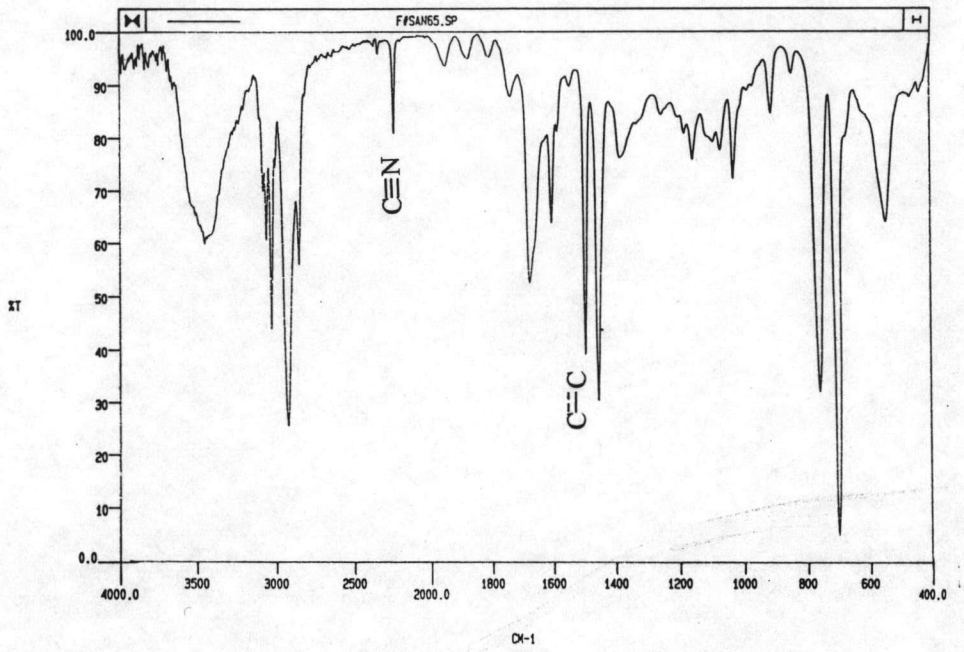


Figure D.7 FTIR spectrum of free SAN extracted from the products of graft copolymerization at 65 °C for 8 hours.

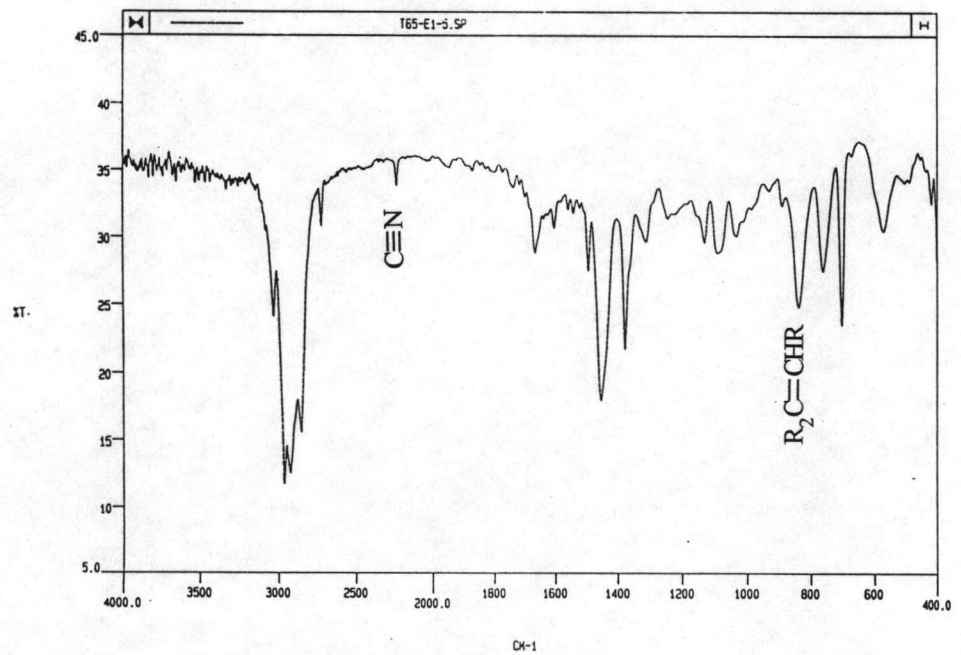


Figure D.8 FTIR spectrum of graft natural rubber extracted from the products of graft copolymerization at 65 °C for 8 hours.

APPENDIX E

Determination of Copolymer Compositions of CHN\O Method

Example of Calculation

1) For graft natural rubber : from Graft Copolymerization at 50 °C

Assume A : I : S		=	a : b : c	mole %
(C_3H_3N) Acrylonitrile		=	a[C_3H_3N]	
(C_5H_8) Isoprene		=	b[C_5H_8]	
(C_8H_8) Styrene		=	c[C_8H_8]	
From CHN\O method	C : H : N	=	87.22 : 10.50 : 1.73	
Carbon	C = [3a + 5b + 8c] x 12	=	87.22 gm	(1.1)
Hydrogen	H = [3a + 8b + 8c] x 1	=	10.50 gm	(1.2)
Nitrogen	N = [a] x 14	=	1.73 gm	(1.3)
From Eq 1.3	∴ a	=	0.124	
From Eq 1.1	0.372 + 5b + 8c	=	7.268	
From Eq 1.2	0.372 + 8b + 8c	=	10.50	
	5b + 8c	=	6.896	(1.4)
	8b + 9c	=	10.128	(1.5)
(1.4) x 8	8 x (5b + 8c)	=	55.168	(1.6)
(1.5) x 5	5 x (8b + 9c)	=	90.64	(1.7)
(1.6) - (1.7)	64c - 40c	=	4.528	
	c	=	0.189	
From Eq 1.4	5b + 1.509	=	6.896	
	b	=	1.077	
a + b + c =	0.124 + 1.077 + 0.189	=	1.39	
	a : b : c	=	8.9 : 77.5 : 13.6 mole %	

2. For Free SAN : from graft copolymerization at 50 °C

Assume A : S = a : b mole %

(C_3H_3N) Acrylonitrile = a[C_3H_3N]

(C_5H_8) Isoprene = b[C_5H_8]

From CHN/O method C H N = 85.53 : 7.70 : 6.62

Carbon C = [3a + 8b] x 12 = 85.53 gm. (2.1)

Hydrogen H = [3a + 8b] x 1 = 7.70 gm. (2.2)

Nitrogen N = [a] x 14 = 6.62 gm. (2.3)

From Eq (2.3) $\therefore$ a = 0.473

From Eq (2.1) 3a + 8b = 7.218

8b = 7.218 - 1.419

b = 0.713

a + b = 1.96

a : b = 39.5 : 59.6 mole %

Table E. Analysis of CHN\O in free SAN and the graft natural rubber.

Reaction Temperature (°C)	Sample No.	Free SAN			Graft natural rubber		
		%C	%H	%N	%C	%H	%N
30	1	82.20	8.04	6.46	86.50	11.04	1.07
	2	82.08	7.69	6.26	86.76	11.44	0.98
	3	-	-	-	86.58	11.25	0.92
	Mean	82.14	7.87	6.36	86.61	11.24	0.99
40	1	86.12	7.47	4.25	87.65	10.99	1.13
	2	86.09	7.54	4.29	87.55	10.84	1.21
	Mean	86.11	7.51	4.27	87.60	10.92	1.17
50	1	85.36	7.51	6.64	87.33	10.55	1.74
	2	85.70	7.88	6.59	87.10	10.44	1.71
	Mean	85.53	7.70	9.62	87.22	10.50	1.73
65	1	86.58	8.00	4.21	87.46	10.13	0.98
	2	86.31	7.68	4.23	87.52	10.28	0.98
	Mean	86.45	7.48	4.22	87.49	10.21	0.98

APPENDIX F

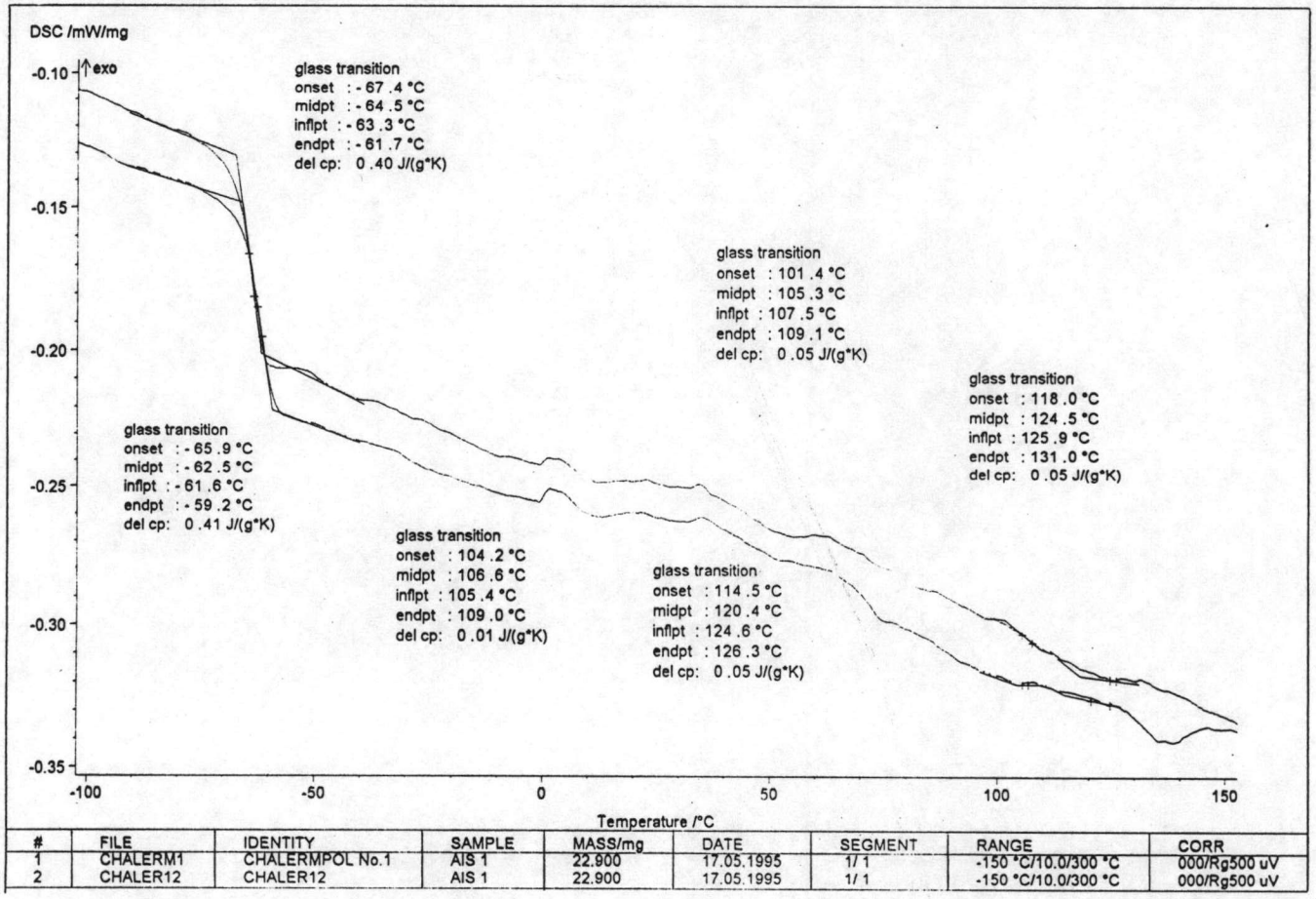


Figure F.1. DSC thermogram of graft natural rubber : polymerization at 30 °C for 8 hours.

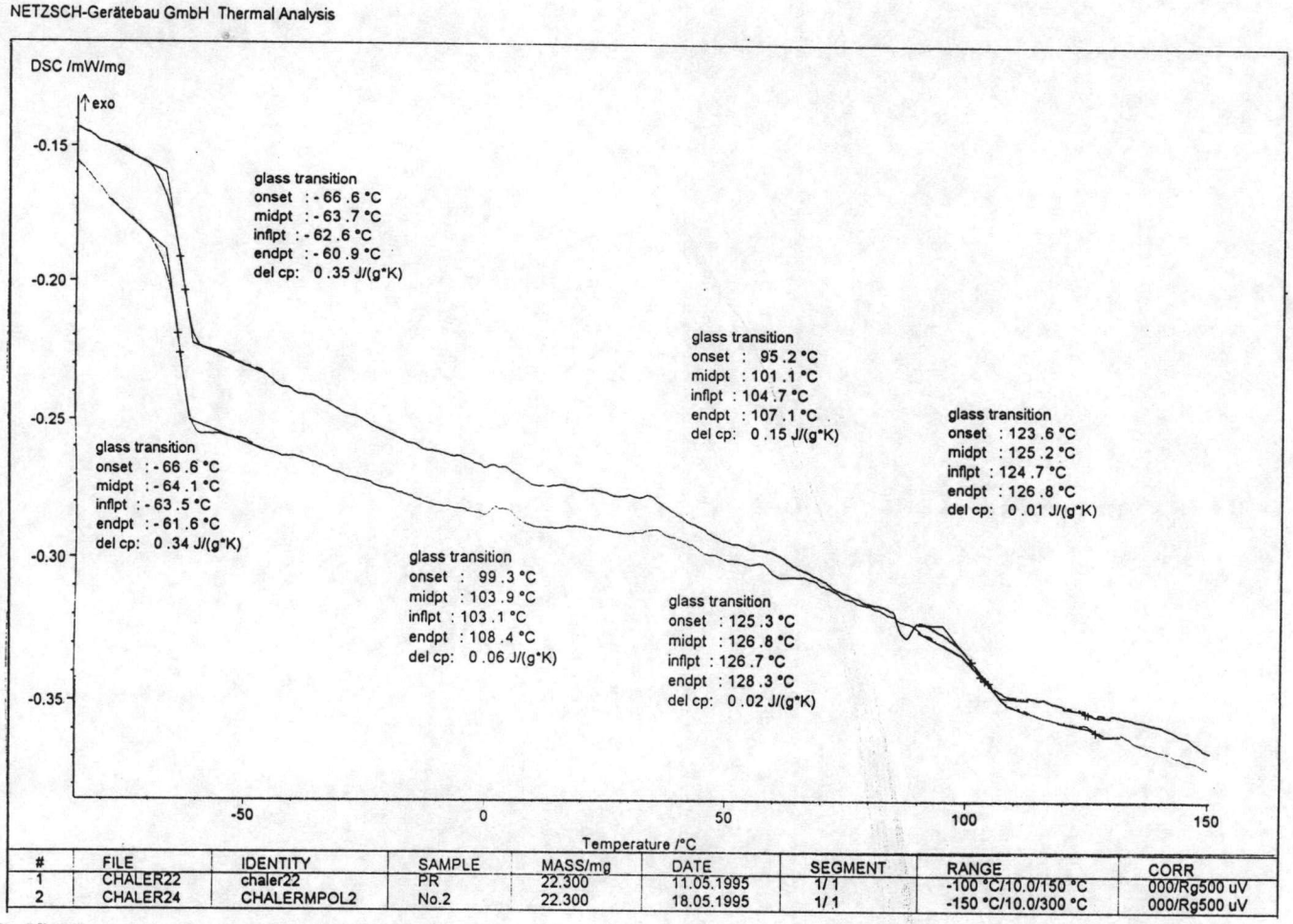


Figure F.2. DSC thermogram of graft natural rubber : polymerization at 40 °C for 8 hours.

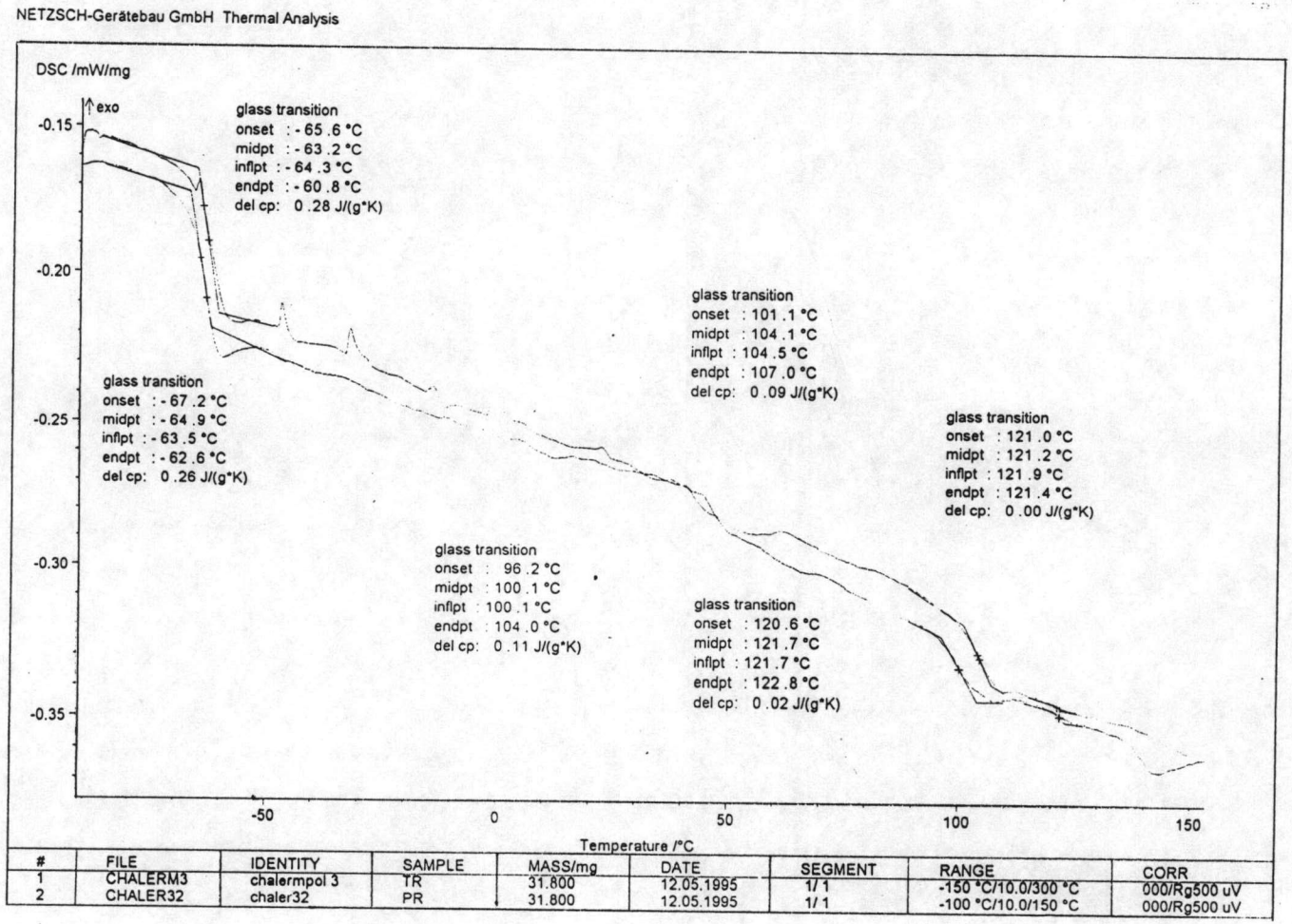
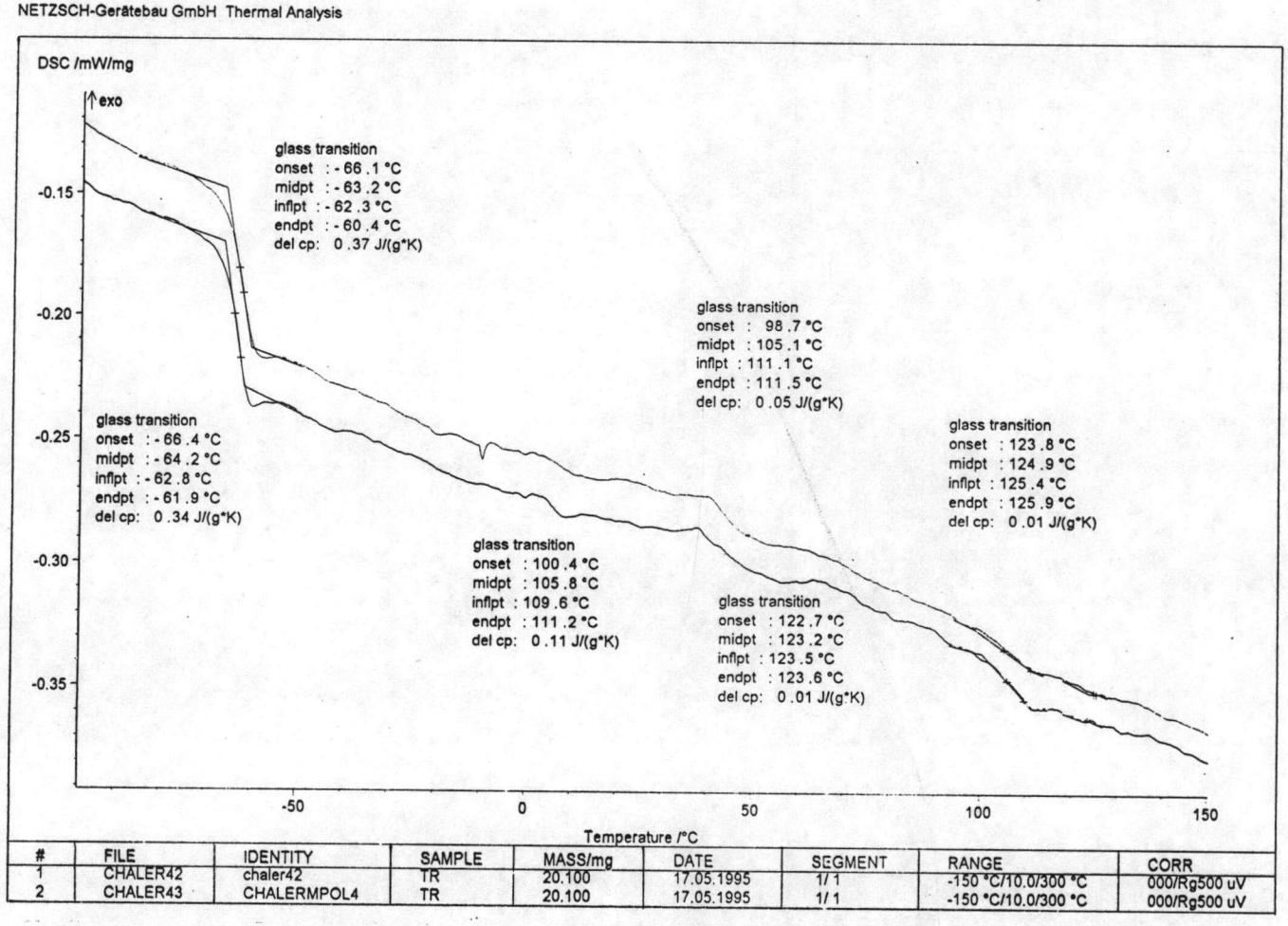


Figure F.3. DSC thermogram of graft natural rubber : polymerization at 50 °C for 8 hours.



#	FILE	IDENTITY	SAMPLE	MASS/mg	DATE	SEGMENT	RANGE	CORR
1	CHALER42	chaler42	TR	20.100	17.05.1995	1/ 1	-150 °C/10.0/300 °C	000/Rg500 uV
2	CHALER43	CHALERMPOL4	TR	20.100	17.05.1995	1/ 1	-150 °C/10.0/300 °C	000/Rg500 uV

Figure F.4. DSC thermogram of graft natural rubber : polymerization at 65 °C for 8 hours.

APPENDIX G

Table G.1 Tensile strength of thermoplastic blends at various ratio of graft NR and SAN.

Graft NR /SAN	Specimen	Width (mm)	Thick (mm)	Tensile Strength (MPa)	Elongation at Break (%)
20 : 80	1	12.56	3.26	44.8	5.0
	2	12.56	3.26	44.6	4.0
	Mean	12.56	3.26	44.7	4.5
30 : 70	1	12.45	3.19	23.9	2.5
	2	12.45	3.20	22.9	2.4
	Mean	12.45	3.20	23.4	2.5
40 : 60	1	12.50	3.20	16.6	3.0
	2	12.48	3.20	16.0	2.0
	Mean	12.49	3.20	16.3	2.5
50 : 50	1	12.40	3.15	8.3	2.0
	2	12.44	3.16	9.3	2.0
	Mean	12.42	3.16	8.8	2.0

Table G.2. Flexural strength and flexural modulus of thermoplastic blends at various ratio of graft NR and SAN.

Graft NR /SAN	Specimen	Width (mm)	Thick (mm)	Flexural Strength (MPa)	Flexural Modulus (GPa)
20 : 80	1	12.59	6.17	69.4	2.56
	2	12.59	6.16	70.0	2.76
	Mean	12.59	6.17	69.7	2.66
30 : 70	1	12.52	6.22	38.2	1.21
	2	12.40	6.25	38.0	1.21
	Mean	12.28	6.24	38.1	1.21
40 : 60	1	12.56	6.22	26.4	1.39
	2	12.50	6.20	28.4	1.50
	Mean	12.53	6.21	27.4	1.45
50 : 50	1	12.81	6.26	-	-
	2	12.80	6.28	-	-
	Mean	12.81	6.27	-	-

Table G.3 Impact resistance of thermoplastic blends at various ratio of graft NR and SAN.

Graft NR/SAN	Specimen	Width (mm)	Depth (mm)	Impact Strength (J/m)
20 : 80	1	6.33	10.18	31.4
	2	6.25	10.21	34.3
	3	6.22	10.21	28.4
	4	6.18	10.21	17.6
	5	6.18	10.21	35.3
	Mean	6.23	10.20	29.4
	S.D.	0.062	0.013	7.12
30 : 70	1	6.23	10.12	30.4
	2	6.22	10.18	26.5
	3	6.17	10.17	23.5
	4	6.26	10.17	26.5
	5	6.25	10.14	26.5
	Mean	6.23	10.16	26.7
	S.D.	0.035	0.025	2.45
40 : 60	1	6.18	10.24	25.5
	2	6.20	10.24	25.5
	3	6.30	10.24	24.5
	4	6.26	10.24	28.4
	5	6.24	10.23	25.5
	Mean	6.24	10.24	25.9
	S.D.	0.048	0.004	1.47
50 : 50	1	6.20	10.05	29.4
	2	6.11	10.04	32.3
	3	6.15	10.08	30.4
	4	6.15	10.13	27.4
	5	6.14	10.08	29.4
	Mean	6.15	10.08	29.8
	S.D.	0.032	0.035	1.78

Table G.4. Rockwell hardness (R-scale) of thermoplastic blends at various ratio of graft NR and SAN.

Specimen No.	Hardness			
	Graft NR/SAN	20 : 80	30 : 70	40 : 60	50 : 50
1		113.6	88.0	44.2	-
2		114.3	86.9	50.7	-
3		115.2	64.9	47.3	-
4		113.9	93.6	50.8	-
5		114.1	95.1	44.1	-
6		115.6	85.0	59.4	-
7		115.7	96.3	67.6	-
8		116.7	63.3	60.8	-
9		114.9	89.3	64.2	-
10		115.3	93.5	31.1	-
Mean		114.9	85.6	52.0	-
S.D.		0.96	11.92	11.10	-

Table G.5. Heat distortion temperature of thermoplastic blends at various ratio of graft NR and SAN.

Graft NR/SAN	Specimen	Width (mm)	Thick (mm)	Temp °C
20 : 80	1	6.15	12.55	86.3
	2	6.20	12.55	88.7
	Mean	6.18	12.55	87.2
30 : 70	1	6.27	12.53	84.7
	2	6.28	12.51	87.7
	Mean	6.28	12.52	86.2
40 : 60	1	12.54	6.20	78.8
	2	12.61	6.15	78.4
	Mean	12.58	6.18	78.6
50 : 50	1	12.47	6.31	69.1
	2	12.39	6.25	72.0
	Mean	12.43	6.28	70.6

VITA

Chaloampol Rujinirun was born on October 13, 1970 in Ranong, Thailand. He received his Bachelor Degree of Science in Chemistry, Prince of Songkla University in 1993. He continued his Master's degree study at Chulalongkorn University in 1993.