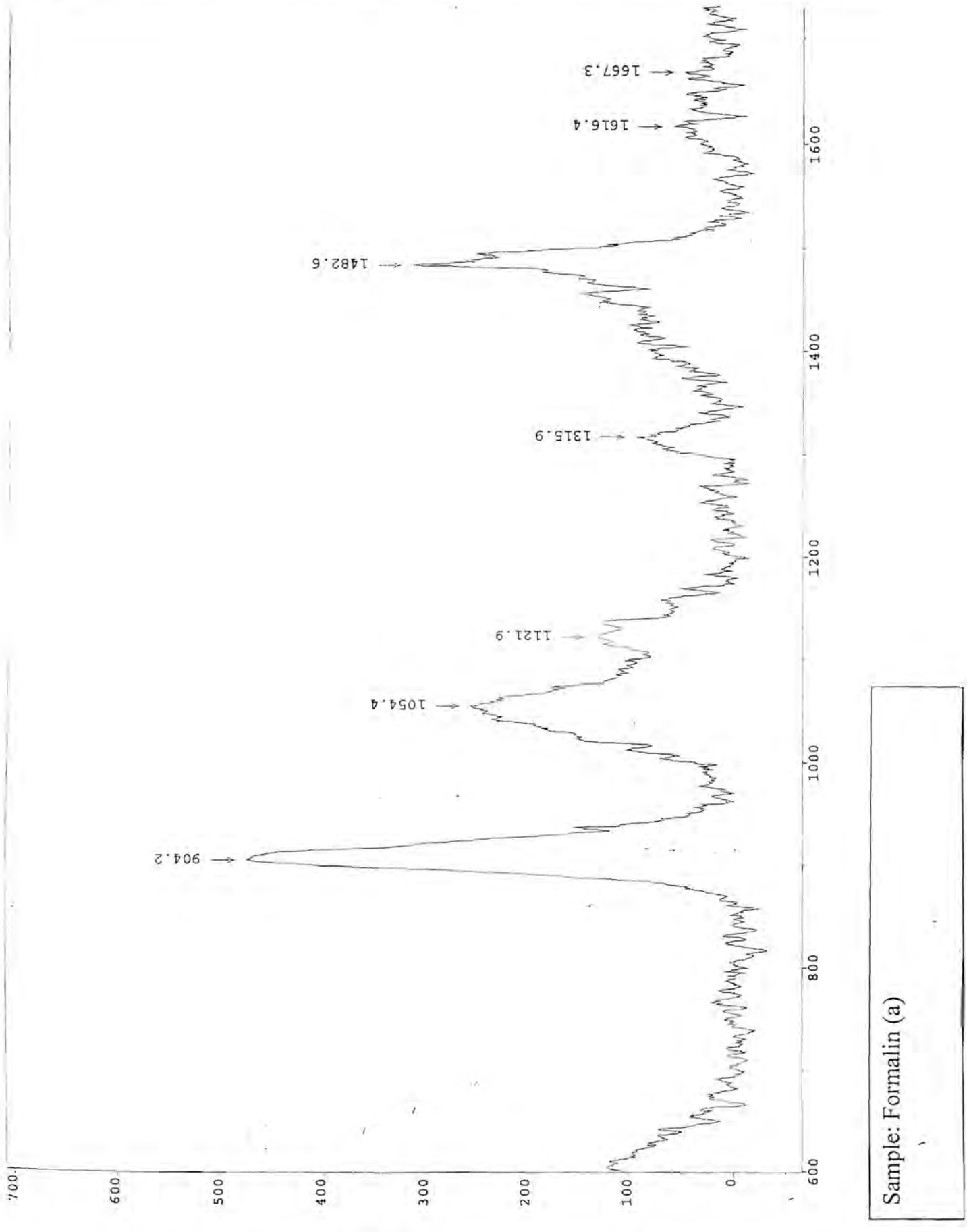
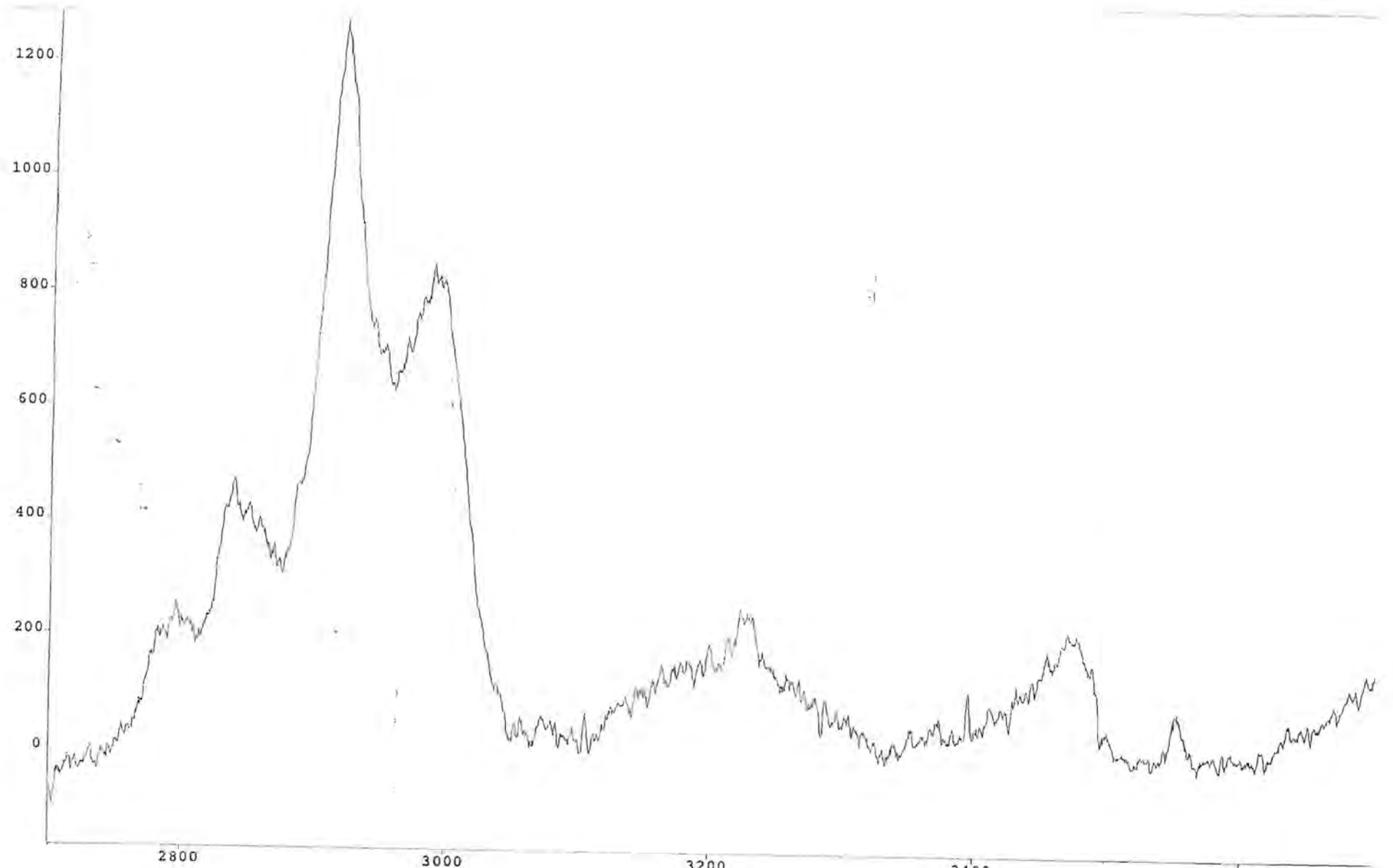
APPENDIX A

RAMAN SPECTRA

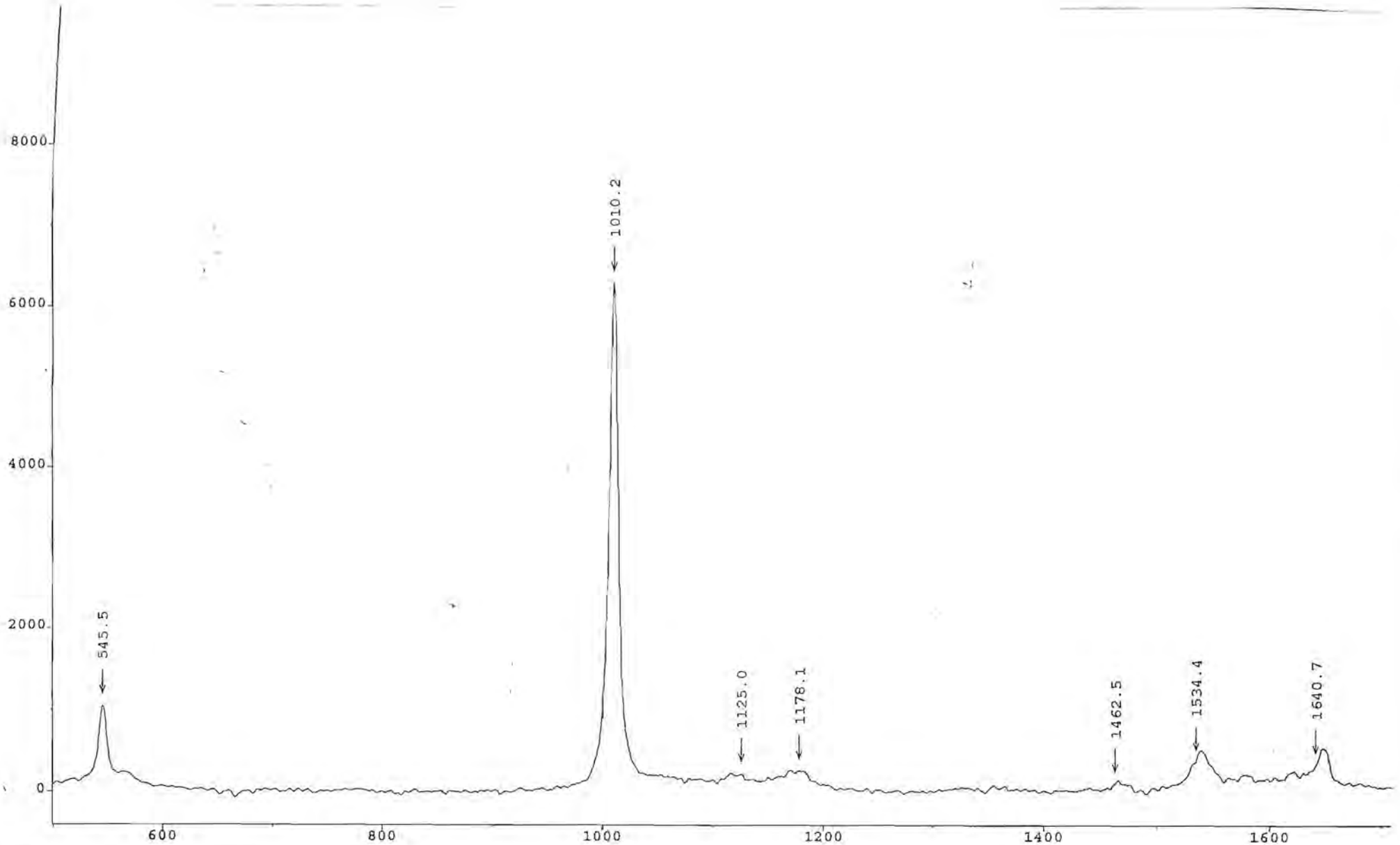
APPENDIX A

RAMAN SPECTRA



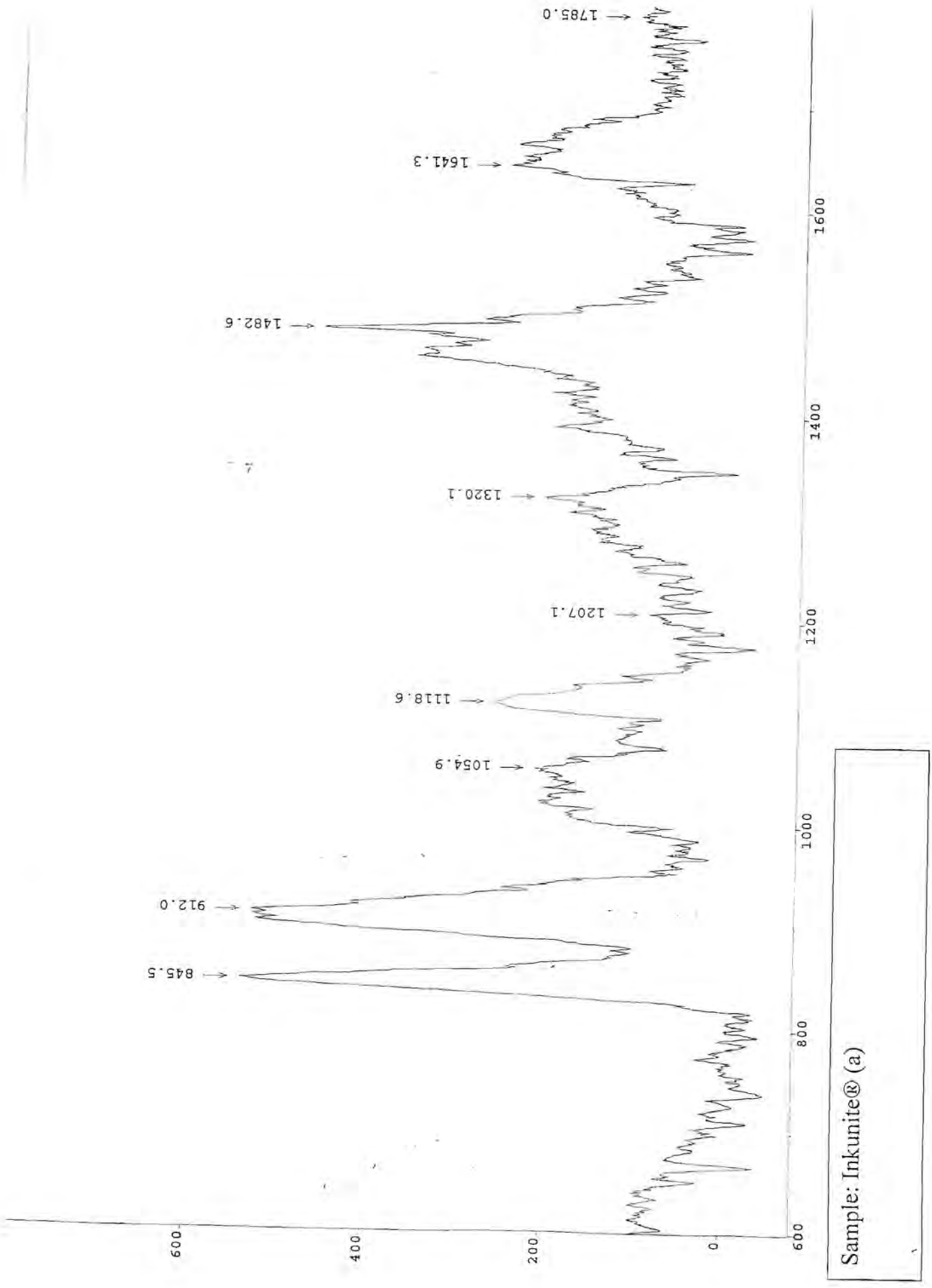


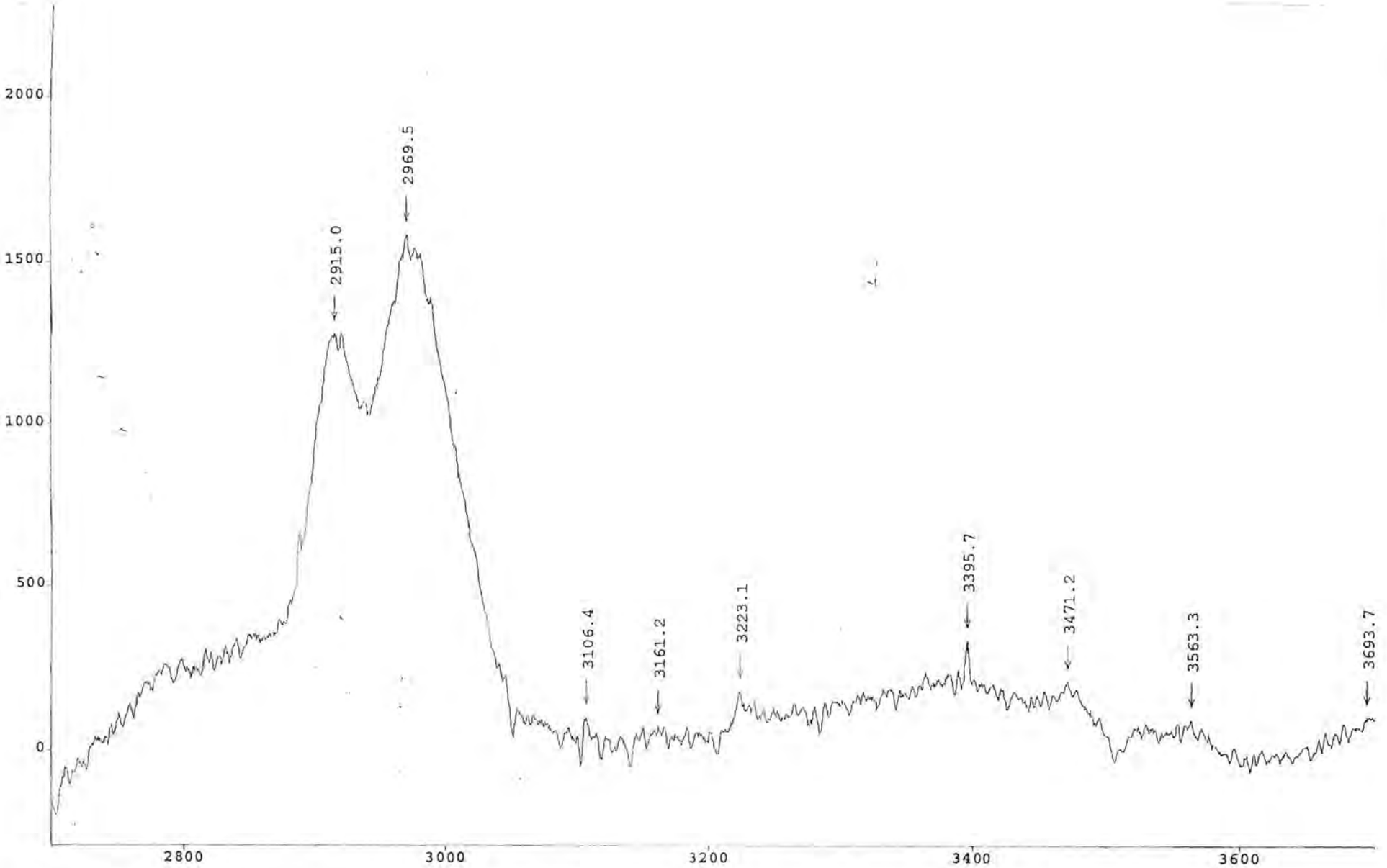
Sample: Formalin (b)



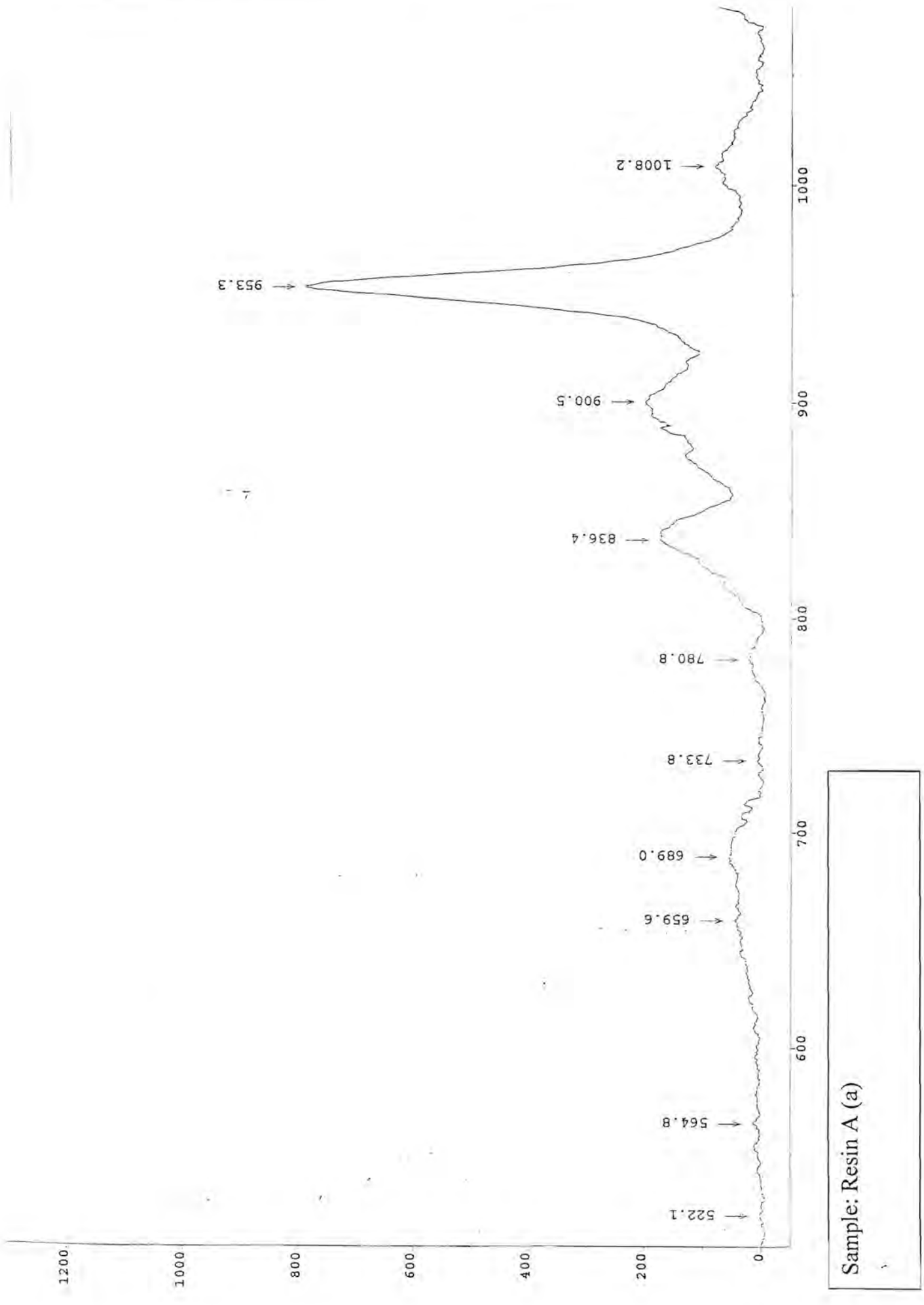
Sample: Urea (a)

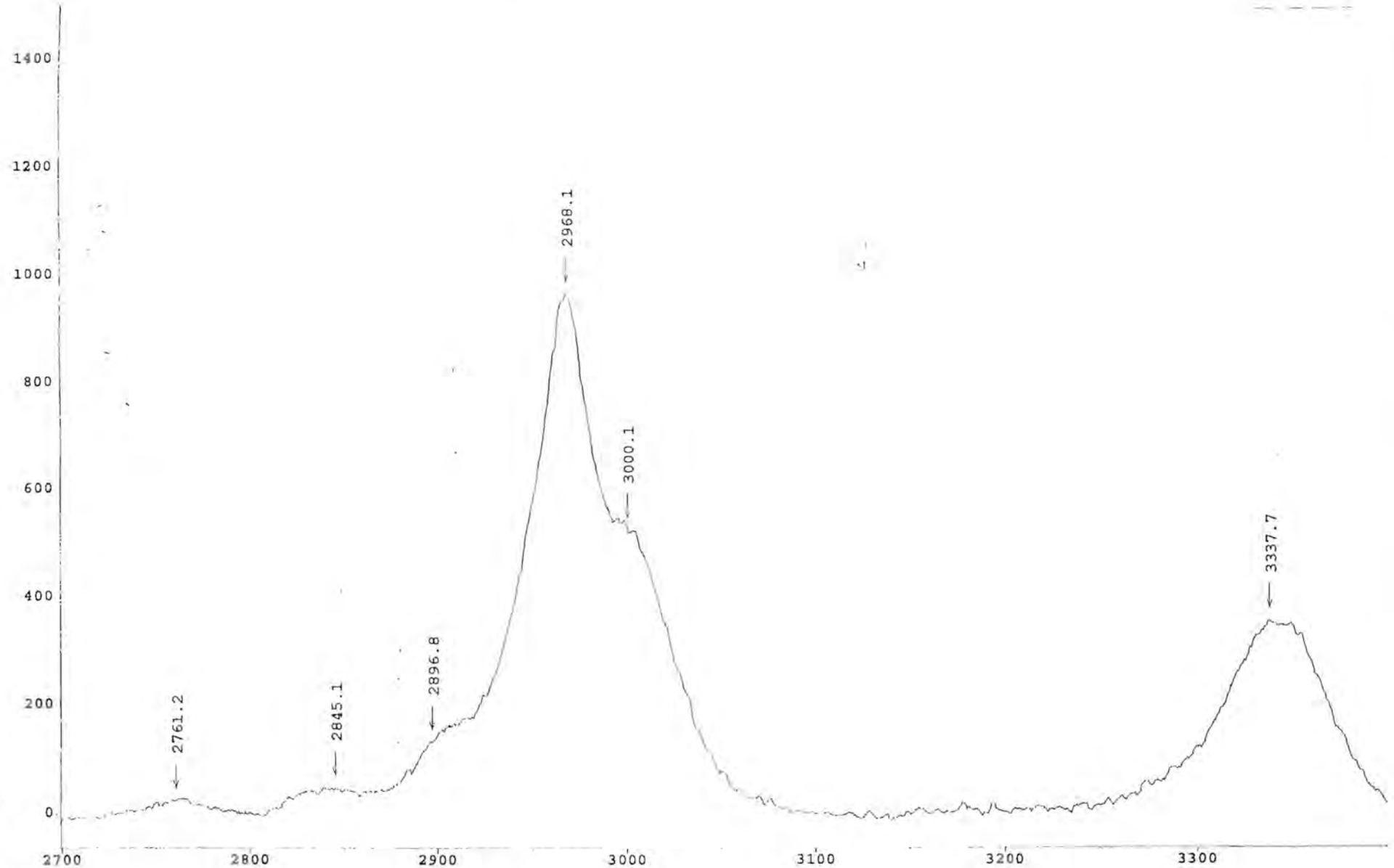
Sample: Urea (b)


Sample: Inkunite® (a)
600
400
200
0
800
1000
1200
1400
1600
845.5
912.0
1054.9
1118.6
1207.1
1320.1
1482.6
1641.3
1785.0

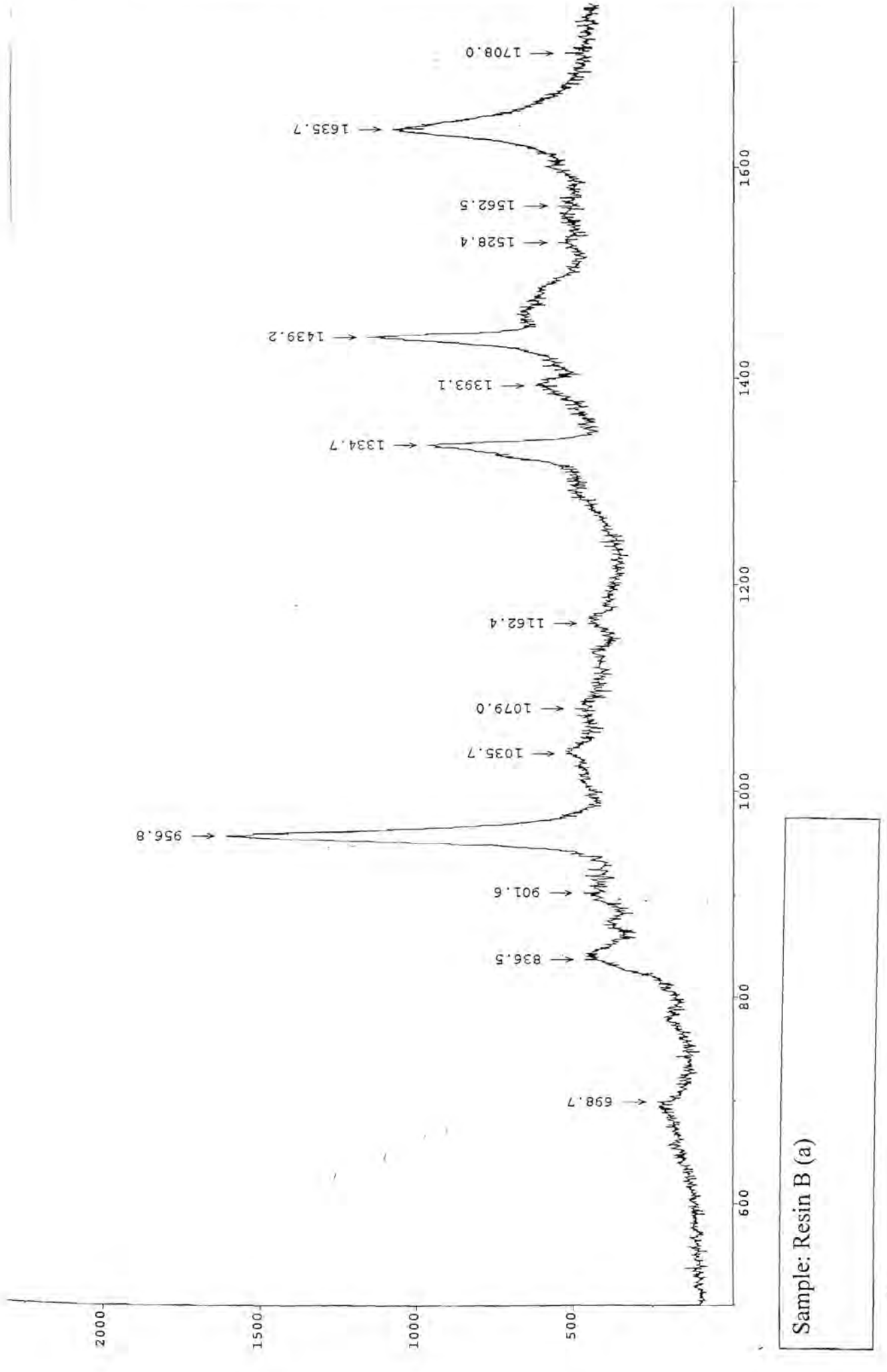


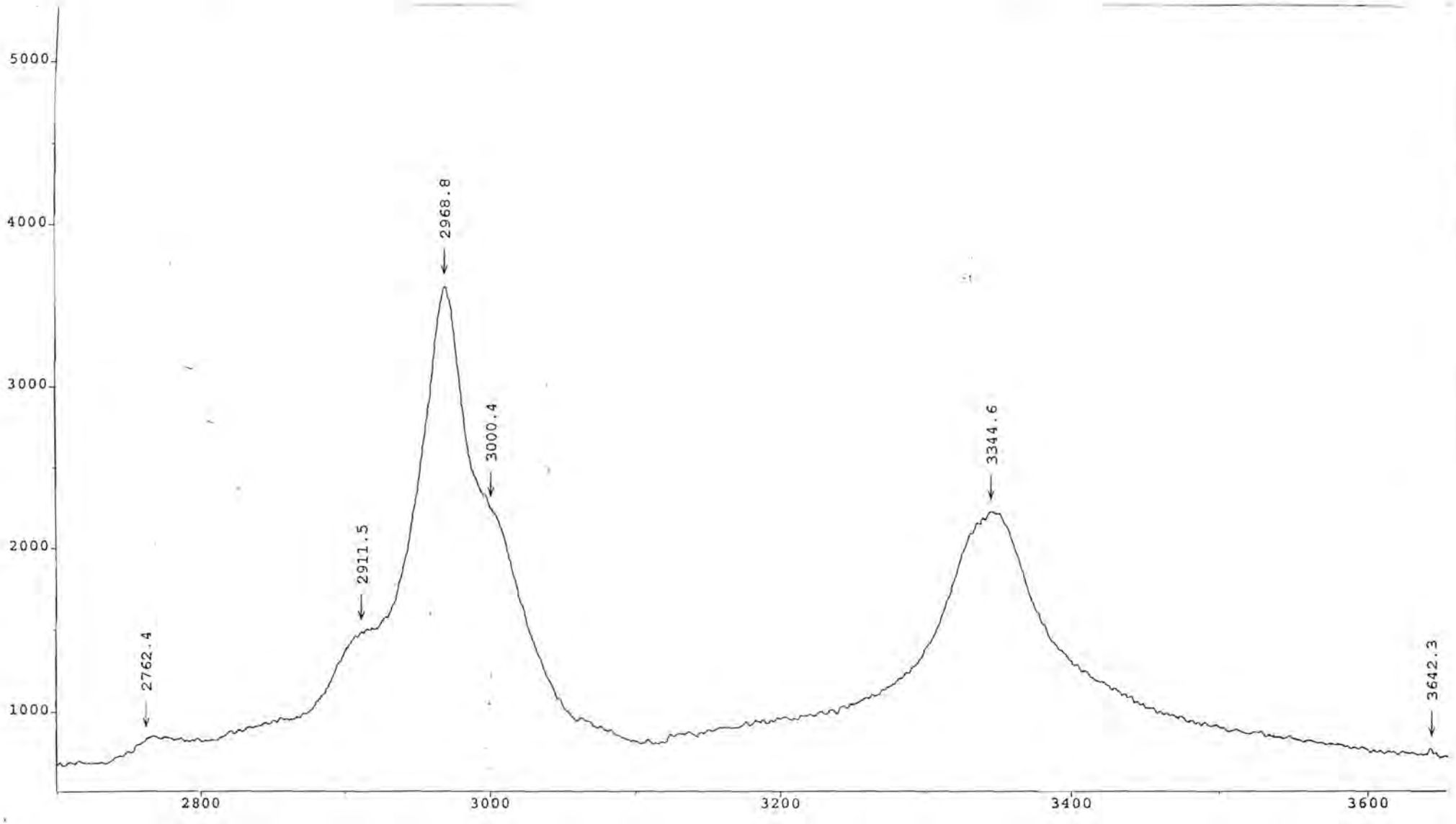
Sample: Inkunite® (b)


1008.2
953.3
900.5
836.4
780.8
733.8
689.0
659.6
564.8
522.1
1200
1000
800
600
400
200
0
1000
900
800
700
600
Sample: Resin A (a)



Sample: Resin A (b)





Sample: Resin B (b)

APPENDIX B

BITUMEN EMULSION SPECIFICATION SHEETS

APPENDIX B

BITUMEN EMULSION SPECIFICATION SHEETS

DATA SHEET : NO E1

TOSAS

PRODUCT : ANIONIC SS60 (SABS 309)

Uses	Slurry seals, stabilisation of base and fogsprays, can be diluted to extremely low binder contents for surface enrichment		
Application rate	See TRH3-1986		
Spraying/application temperature	Ambient for hand spraying between 50°C - 70°C for bulk spraying		
		LIMITS	
		MIN	MAX
Physical and Chemical properties	1 Appearance - Brown		
	2 Viscosity at 50°C, sec, Saybolt Furol	-	-
	3 Binder Content, % (m/m)	60	62
	4 Residue on sieving, g/100 ml	-	0,25
	5 Sedimentation after 60 complete rotations	-	Nil
	6 Coagulation value, % (m/m)		
	Dolerite Chippings	-	-
	Portland Cement	-	2
Surface preparation	Surface must be well compacted with no loose material.		
Package	200 litre drums / Available at Felbitem Bulk / Available at Felbitem		
Point of supply	Felbitem		
Conversion	Kg to litre : Divide by 1,00 Litre to kg : Multiply by 1,00		
Cleaning of hands and tools	Use water when wet, paraffin or suitable hand cleaner if emulsion has set.		
Safety	Use protective clothing. Non flammable and non hazardous.		

NOTE :

This data sheet is issued as a guide to the use of the product(s) concerned, and whilst every effort is made to ensure the accuracy of the text which is in accordance with the latest technical developments we cannot accept responsibility for any work carried out with our materials, as we have no control over the method of application used, or condition of site involved.

In view of the constant research and development being undertaken in our Laboratories we advise customers in their own interest to ensure that this data sheet has not been superseded by a more up-to-date publication. All products are sold subject to our standard conditions of sale which are available on demand.

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Issued : July 1995. DES

P.O. BOX 14159
WADEVILLE

DATA SHEET : NO E3

PRODUCT : KRS 60%, 65%, 70% (SABS 548)

Uses	Chip and spray with electro negative aggregates. + Tack coat for chip and spray.			
Application rate	See TRH 3-1986. Variable depending on type of seal.			
Spraying/application temperature	Ambient for hand spraying. Between 50°C - 70°C bulk spraying.			
Physical and Chemical properties		60	65	70
	1 Appearance - Brown to black			
	2 Viscosity at 50°C, Saybolt Furol seconds	20-50	51-200	51-400
	3 Binder Content, % (m/m)	60-63	65-68	70-73
	4 Fluxing agent content, % (m/m) of binder, max.	5	5	5
	5 Residue on sieving, g/100 ml, max	0,25	0,25	0,25
	6 Particle charge a) Modified procedure b) Standard procedure	Positive -	Positive -	Positive -
	7 Binder deposit on the cathode after 30 min.g, min	1,0	1,0	1,0
	8 Sedimentation after 60 complete rotations	Nil	Nil	Nil
Surface preparation	Surface must be well compacted with no loose material.			
Package	60 % and 65 % available in drums at Felbitem 60 %, 65 % and 70 % available in bulk at Felbitem			
Point of supply	Felbitem			
Conversion	Kg to litre : Divide by 1,00 Litre to kg : Multiply by 1,00			
Cleaning of hands and tools	Use water when wet, paraffin or suitable hand cleaner if emulsion has set			
Safety	Use protective clothing. Non flammable and non hazardous.			

NOTE :

This data sheet is issued as a guide to the use of the product(s) concerned, and whilst every effort is made to ensure the accuracy of the text which is in accordance with the latest technical developments we cannot accept responsibility for any work carried out with our materials, as we have no control over the method of application used, or condition of site involved.

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P.O. BOX 14159
WADEVILLE

PRODUCT : KMS 60% & 65% (SABS 548)

Uses	Premixes of medium or coarse grading, single sized aggregate when mixed cold. Used for repairing pot holes		
Application rate	± 7 Parts stone to 1 part KMS 60/65		
Spraying/application temperature	Mixing at ambient temperatures		
Physical and Chemical properties		60	65
	1 Appearance - Brown		
	2 Viscosity at 50°C, Saybolt Furol seconds	20-50	51-200
	3 Binder Content, % (m/m)	60-63	65-68
	4 Fluxing agent content, % (m/m) of binder	5-10	5-10
	5 Residue on sieving, g/100 ml, max	0,25	0,25
	6 Particle charge		
	a) Modified procedure	Positive	Positive
	b) Standard procedure	-	-
	7 Sedimentation after 60 complete rotations	Nil	Nil
Mix	Stop mixing when aggregate is coated ± 1 minute.		
Package	Drums 200 litre / Available : Felbitem Bulk / Available : Felbitem		
Point of supply	Felbitem		
Conversion	Kg to litre : Divide by 1,00 Litre to kg : Multiply by 1,00		
Cleaning of hands and tools	Use water when wet, paraffin or suitable hand cleaner		
Safety	Use protective clothing. Non flammable and non hazardous.		

NOTE :

This data sheet is issued as a guide to the use of the product(s) concerned, and whilst every effort is made to ensure the accuracy of the text which is in accordance with the latest technical developments we cannot accept responsibility for any work carried out with our materials, as we have no control over the method of application used, or condition of site involved.

In view of the constant research and development being undertaken in our Laboratories we advise customers in their own interest to ensure that this data sheet has not been superseded by a more up-to-date publication. All products are sold subject to our standard conditions of sale which are available on demand.

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Issued : July 1995, DES

P.O. BOX 14159
WADEVILLE

APPENDIX C

INFLUENCE OF BITUMEN EMULSION ON RESINS A AND B

APPENDIX C

INFLUENCE OF BITUMEN EMULSION ON RESINS A AND B

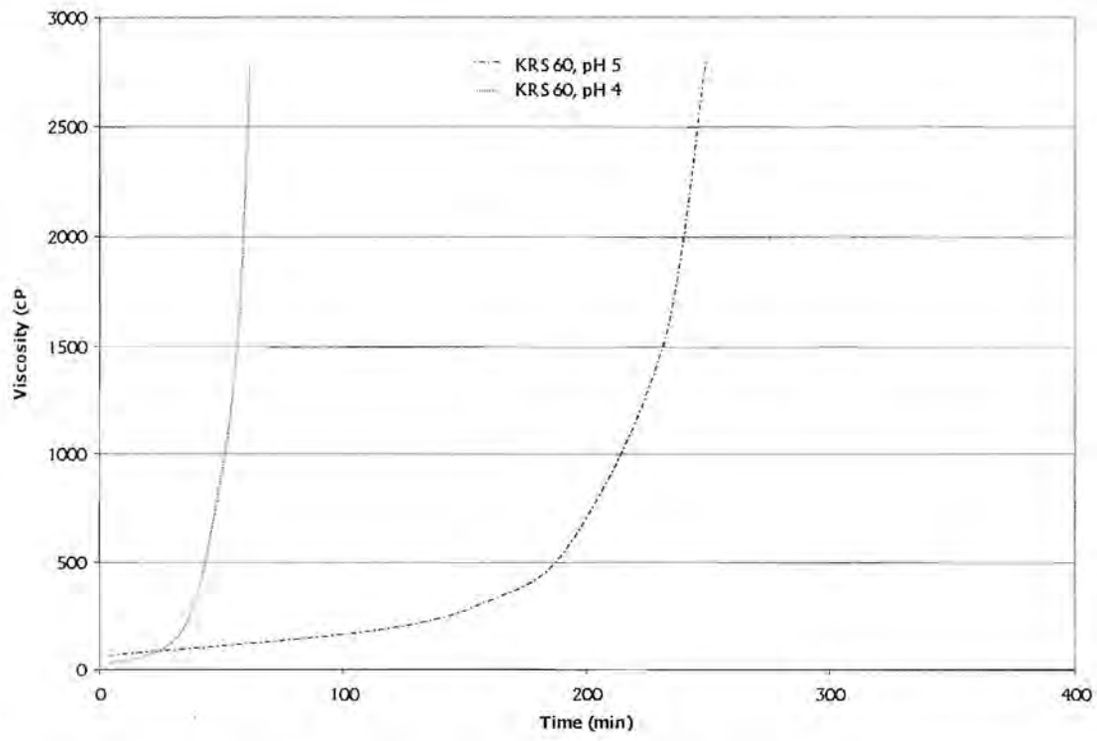

Figure 36. *Influence of KRS60 on the viscosity of Resin A at pH 4 and 5*

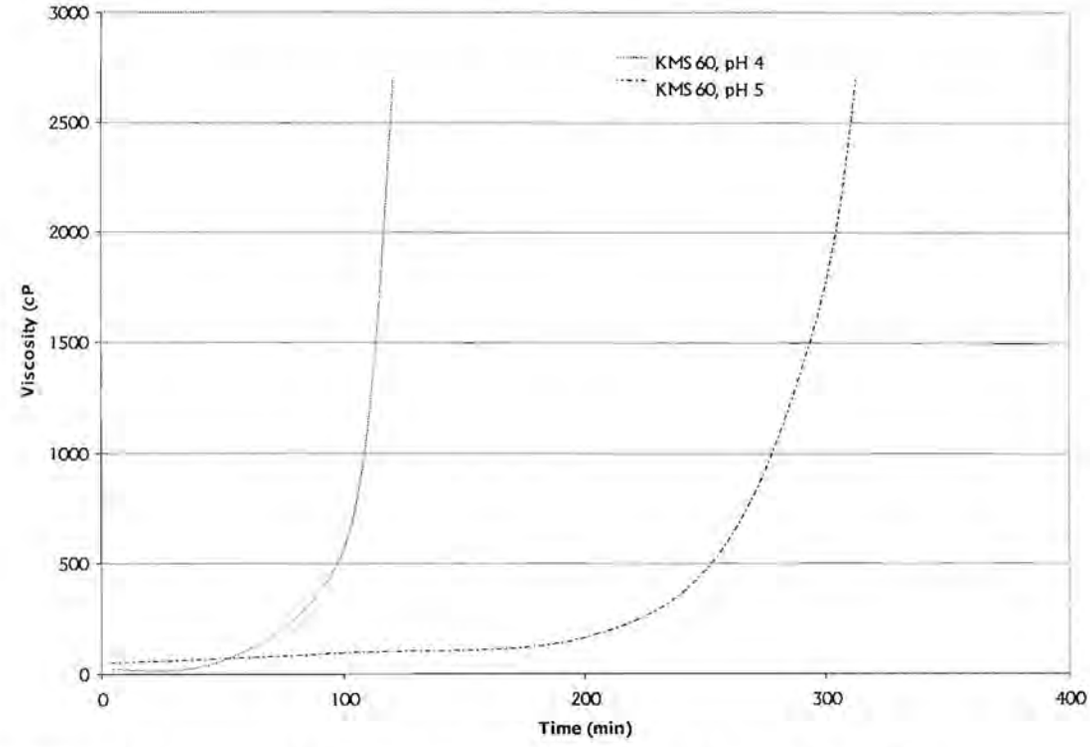

Figure 37. *Influence of KMS60 on the viscosity of Resin A at pH 4 and 5*

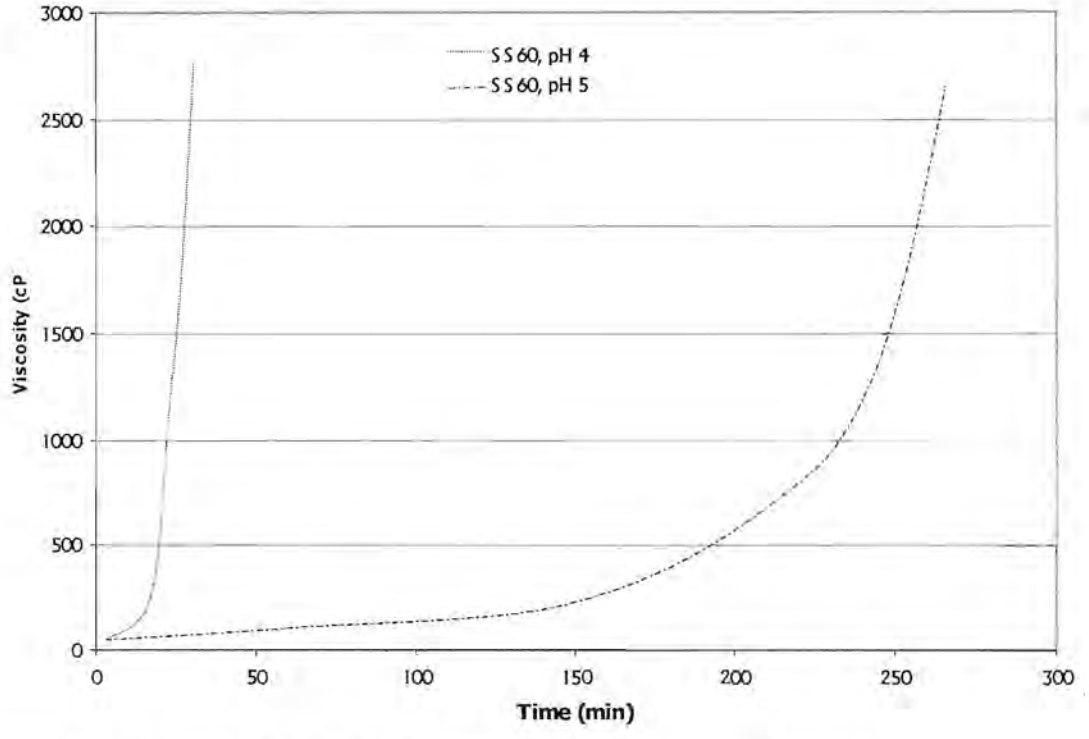

Figure 38. *Influence of SS60 on the viscosity of Resin A at pH 4 and 5*

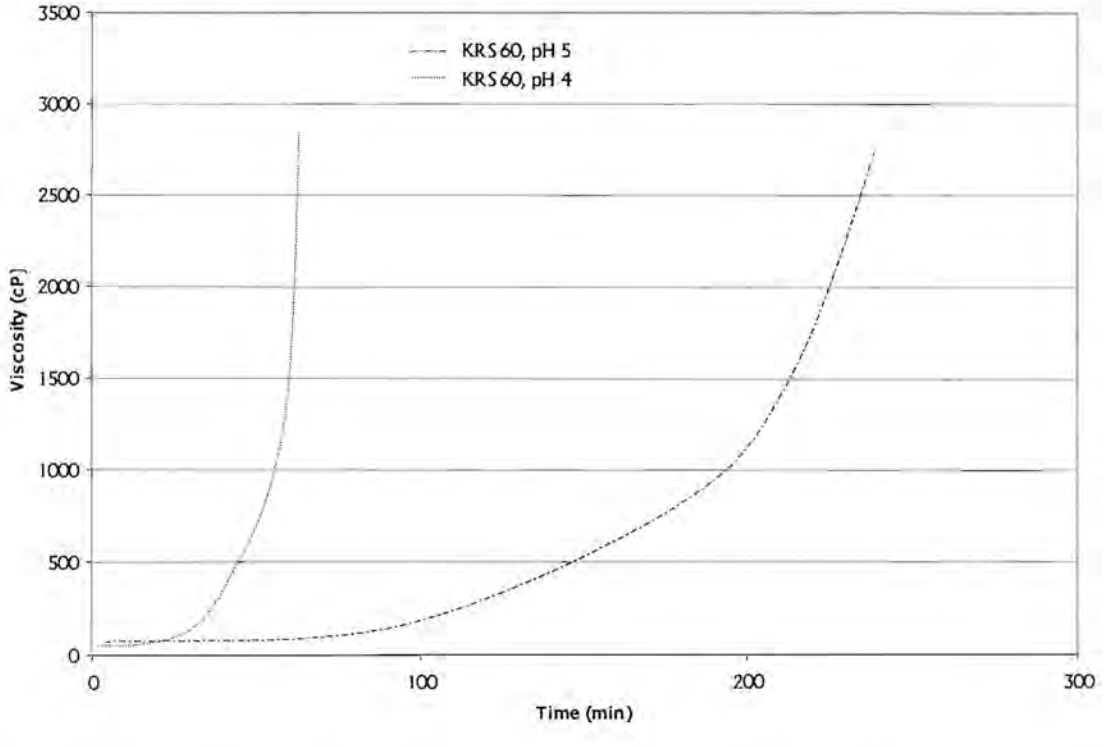

Figure 39. *Influence of KRS60 on the viscosity of Resin B at pH 4 and 5*

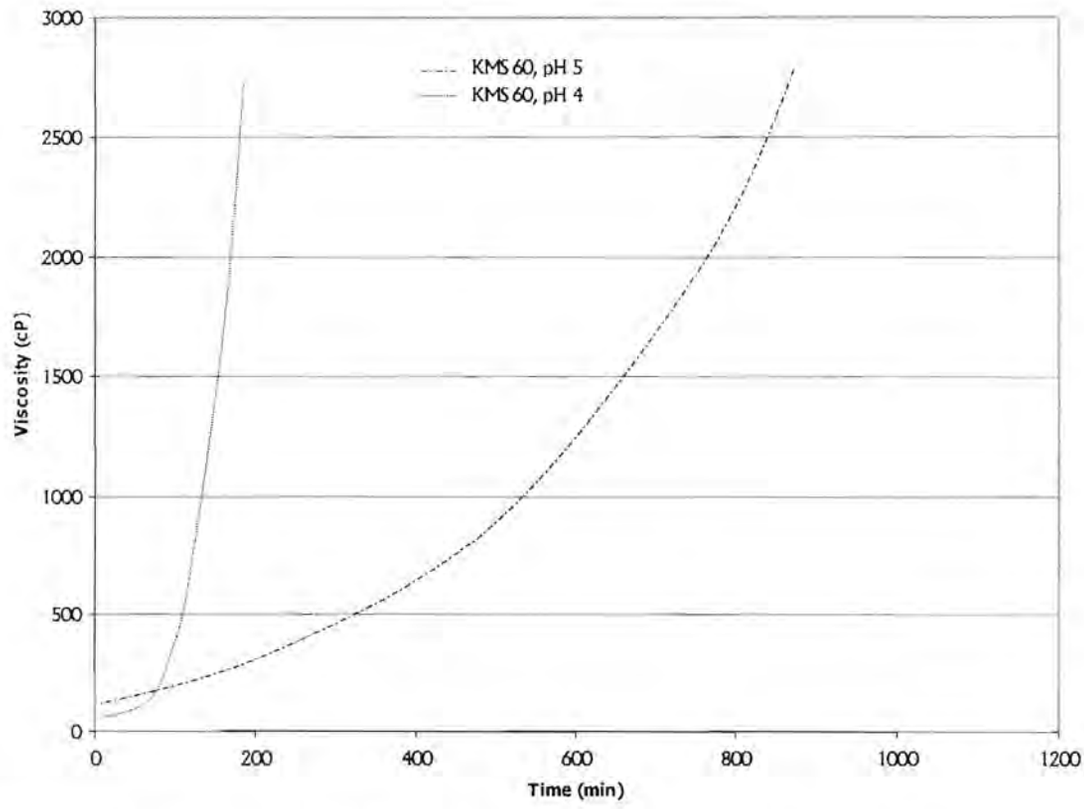

Figure 40. *Influence of KMS60 on the viscosity of Resin B at pH 4 and 5*

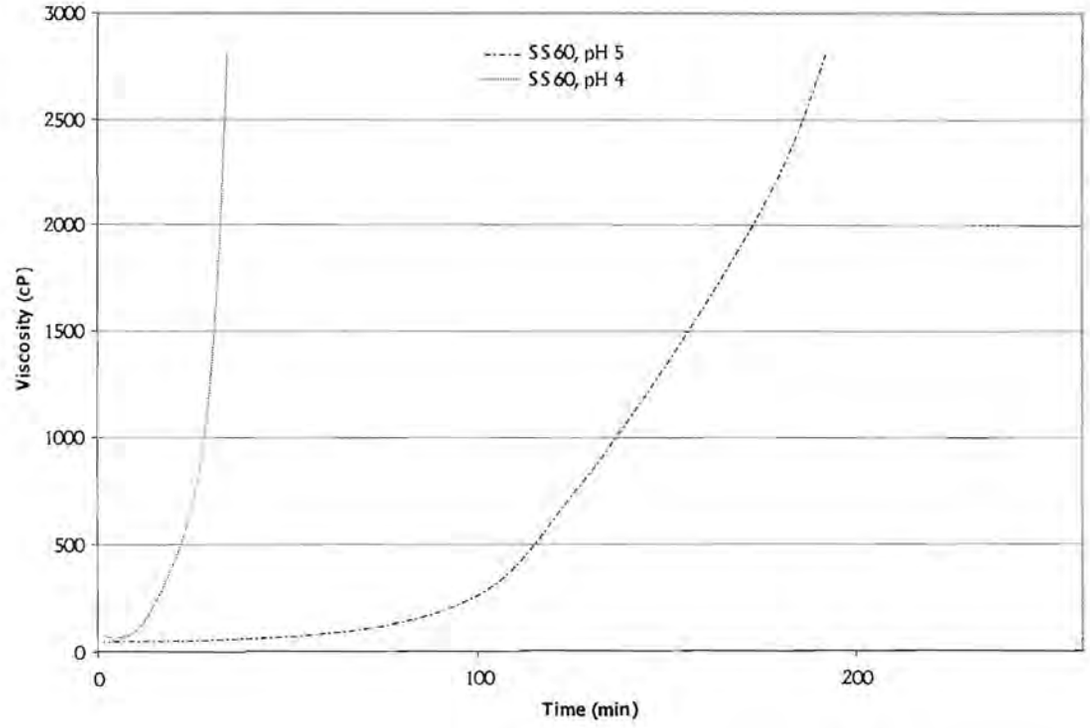

Figure 41. *Influence of SS60 on the viscosity of Resin B at pH 4 and 5*

APPENDIX D

SOIL PROPERTIES

APPENDIX D

SOIL PROPERTIES

SOIL ANALYSIS BY: SOILLAB (Pty) Ltd - PRETORIA
Lab Reference No: S99-000

Customer . . . . : UNIVERSITY OF PRETORIA
Job Description : UP NAGRAADSE NAVORSING
Road Number . . .
Job Number . .
Contract Numbe
Date. . . . . .

SAMPLE DESCRIPTION						
Sample Number	03594					
Sample Position						
Sample Depth (mm)						
Material Description	DARK BROWN SHALE & QTC S/STONE Fine gravel					
Max size of boulder (mm)	-					
SCREEN ANALYSIS (% PASS)						
75.00 mm	100					
63.00 mm	100					
53.00 mm	100					
37.50 mm	100					
26.50 mm	100					
19.00 mm	100					
13.20 mm	95					
4.750 mm	61					
2.00 mm	60					
0.425 mm	49					
0.075 mm	13					
SOIL MORTAR						
Coarse Sand 2.000-0.425	18					
Coarse Fine Sd 0.425-0.250	27					
Medium Fine Sd 0.250-0.150	23					
Fine Fine Sand 0.150-0.075	10					
Material <0.075	22					
CONSTANTS						
Grading Modulus	1.78					
Liquid Limit	19					
Plasticity Index	5					
Linear Shrinkage (%)	1.5					
Sand Equivalent						
Classification - TRB	A-1-b(0)					
Classification - TRH14	G7					
TYPE OF TEST (CBR/UCS)	CBR					
MOD. AASHTO						
Max Dry Density (kg/m3)	1985					
Optimum Moisture Cont (%)	9.6					
Moulding Moisture Cont (%)	9.5					
Dry Density (kg/m3)	1977					
% of Max Dry Density	100					
100% Mod CBR/UCS	56					
% Swell	0.1					
NRB						
Dry Density (kg/m3)	1889					
% of Max Dry Density	95					
100% NRB CBR/UCS	32					
% Swell	0.2					
PROCTOR						
Dry Density (kg/m3)	1842					
% of Max Dry Density	93					
100% Proc CBR/UCS	22					
% Swell	0.2					
CBR / UCS VALUES						
100% Mod AASHTO	59					
98% Mod AASHTO	46					
97% Mod AASHTO	40					
95% Mod AASHTO	31					
93% Mod AASHTO	23					
90% Mod AASHTO	14					

SOILLAB (PTY) LTD. Reg No 71/00112/07
200 Albertus Street, La Montagne, Tel (012) 481 3930
Fax 72928, Wood Ridge 0040, (012) 481 3812

APPENDIX E

STATISTICAL ANALYSIS

APPENDIX E

STATISTICAL ANALYSIS

Influence	Experiment	ITS (gauge)	ITS (gauge)	ITS (gauge)	Averave ITS	Variance	Standard Deviation	Coefficient of Variation
Time	2 % Resin A, no Bitumen (dry), 4 days dried	137	121	132	130	67.00	8.19	6.30
	2 % Resin A, no Bitumen (wet), 28 days dried	13	4	23	13	90.33	9.50	73.11
	2 % Resin A, 2 % Bitumen (wet), 6 days dried	180	174	156	170	156.00	12.49	7.35
	2 % Resin A, 2 % Bitumen (covered), 4 days dried	25	8	3	12	133.00	11.53	96.10
	2 % Resin B, 2 % Bitumen (dry), 17 days dried	95	127	87	103	448.00	21.17	20.55
	2 % Resin A, 2 % Bitumen, 6 hours in water	141	123	45	141	2604.00	51.03	36.19
Initial Moisture Content	2 % Resin A, 2 % Bitumen (dry), 7 days dried, 20 g water	113	78	103	98	325.00	18.03	18.40
	2 % Resin A, 2 % Bitumen (dry), 21 days dried, 50 g water	97	171	158	142	1561.00	39.51	27.82
	2 % Resin B, 2 % Bitumen (dry), 21 days dried, 50 g water	78	120	168	122	2028.00	45.03	36.91
Compaction	2 % Resin A, 2 % Bitumen (dry), 50 blows	92	78	100	90	124.00	11.14	12.37
Resin Dosage	2 % Resin A, 2 % Bitumen (dry), 7 days dried	121	143	126	130	133.00	11.53	8.87
	4 % Resin A, 2 % Bitumen (wet), 21 days dried	32	68	128	76	2352.00	48.50	63.81
	1 % Resin B, 2 % Bitumen (wet), 21 days dried	0	9	12	7	39.00	6.24	89.21
Bitumen Dosage	2 % Resin A, 3 % Bitumen added (dry), 7 days dried	81	105	120	102	387.00	19.67	19.29
	2 % Resin A, 5 % Bitumen (wet 24 h), 7 days dried	39	78	87	68	651.00	25.51	37.52
	2 % Resin B, 2 % Bitumen (wet), 21 days dried	27	9	12	16	93.00	9.64	60.27
pH	2 % Resin A, 2 % Bitumen (wet), 7 days dried, pH 7.33	87	93	99	93	36.00	6.00	6.45
	2 % Resin A, 2 % Bitumen (wet), 7 days dried, pH 4.55	143	127	96	122	571.00	23.90	19.59
	2 % Resin A, 2 % Bitumen (dry), 21 days dried, pH 3.85	76	153	152	127	1951.00	44.17	34.78
	2 % Resin A, 2 % Bitumen (wet), 21 days dried, pH 6.2	0	12	9	7	39.00	6.24	89.21
Molar Ratio	2 % Resin A, 2 % Bitumen (wet), 7 days dried, 1.5:1	23	25	30	26	13.00	3.61	13.87
	2 % Resin A, 2 % Bitumen (dry), 21 days dried, 1:1	136	139	124	133	63.00	7.94	5.97
	2 % Resin B, 2 % Bitumen (dry), 21 days dried, 2:1	83	106	105	98	169.00	13.00	13.27
	2 % Resin B, 2 % Bitumen (wet), 21 days dried, 3:1	45	27	42	38	93.00	9.64	25.38
Type of Bitumen	2 % Resin A, 2 % Bitumen (dry), KMS 60	137	67	123	109	1372.00	37.04	33.98
	2 % Resin A, 2 % Bitumen (wet), KRS 60	1	0	0	0	0.33	0.58	0.00
	2 % Resin B, 2 % Bitumen (dry), KMS 60	104	121	105	110	91.00	9.54	8.67
	2 % Resin B, 2 % Bitumen (wet), SS 60	4	7	37	16	333.00	18.25	114.05
Cement	0 % Resin A with 4 % Cement, Cement Method (dry)	13	34	13	20	147.00	12.12	60.62
	2 % Resin A with 6 % Cement, Cement Method (wet)	63	43	50	52	103.00	10.15	19.52
	2 % Resin A with 2 % Cement, Experimental Method (dry)	45	48	72	55	219.00	14.80	26.91
Lime	0 % Resin A with 4 % Lime, Lime Method (wet)	0	3	9	4	21.00	4.58	114.56
	2 % Resin A with 4 % Lime, Experimental Method (wet)	12	8	19	13	31.00	5.57	42.83

APPENDIX F

EXPERIMENTAL DATA

APPENDIX F

EXPERIMENTAL DATA

Influence of Time on Stabilised Soil Properties

2 % Resin A, no Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.54	975	969	0.62	0.056	2148.62	45	115.41
1	4.52	969	939	3.10	0.055	2174.22	40	102.59
2	4.53	969	928	4.23	0.055	2174.22	18	46.16
3	4.53	971	928	4.43	0.055	2178.71	60	153.88
4	4.5	975	920	5.64	0.056	2148.62	130	333.40
6	4.51	974	911	6.47	0.056	2146.42	110	282.11
8	4.52	975	909	6.77	0.056	2148.62	120	307.76
17	4.52	973	903	7.19	0.056	2144.21	130	333.40
24	4.56	978	906	7.36	0.056	2155.23	124	318.02
60	4.54	976	904	7.38	0.056	2150.82	130	333.40

2 % Resin A, no Bitumen emulsion (wet)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.54	973	968	0.51	0.056	2144.21	0	0.00
1	4.52	970	940	3.09	0.056	2137.60	0	0.00
2	4.53	969	930	4.02	0.055	2174.22	0	0.00
3	4.53	971	929	4.33	0.056	2139.80	0	0.00
4	4.5	972	915	5.86	0.056	2142.01	0	0.00
6	4.51	969	909	6.19	0.055	2174.22	6	15.39
8	4.52	972	903	7.10	0.055	2180.95	6	15.39
17	4.52	971	900	7.31	0.055	2178.71	12	30.78
28	4.56	970	901	7.11	0.055	2176.47	13	33.34
60	4.54	969	899	7.22	0.055	2174.22	31	79.50

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.52	979	976	0.31	0.056	2157.43	38	53.00
1	4.53	977	940	3.79	0.056	2153.03	12	89.00
2	4.54	975	940	3.59	0.055	2187.69	21	154.00
3	4.53	977	929	4.91	0.056	2153.03	96	189.00
4	4.53	973	919	5.55	0.055	2183.20	38	226.00
6	5.45	974	917	5.85	0.056	2146.42	95	243.64
8	4.56	972	912	6.17	0.055	2180.95	105	269.29
17	5.55	976	902	7.58	0.056	2150.82	172	433.24
24	4.53	969	899	7.22	0.055	2174.22	180	461.64
60	4.53	973	901	7.40	0.055	2183.20	175	448.81

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.52	981	977	0.41	0.057	2123.91	0	0.00
1	4.53	978	940	3.89	0.056	2155.23	10	25.65
2	4.54	971	942	2.99	0.055	2178.71	20	51.29
3	4.53	972	931	4.22	0.055	2180.95	40	102.59
4	4.53	974	924	5.13	0.055	2185.44	100	256.46
6	5.45	974	919	5.65	0.055	2185.44	170	435.99
8	4.56	970	912	5.98	0.055	2176.47	170	435.99
17	5.55	975	911	6.56	0.056	2148.62	175	448.81
24	4.53	970	902	7.01	0.055	2176.47	174	446.25
60	4.53	975	904	7.28	0.056	2148.62	170	435.99

2 % Resin A, no Bitumen emulsion (covered)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.5	979	978	0.10	0.057	2119.58	0	0.00
1	4.53	975	961	1.44	0.056	2148.62	0	0.00
2	4.53	972	957	1.54	0.055	2180.95	14	35.90
3	4.56	969	948	2.17	0.055	2174.22	10	25.65
4	4.52	974	946	2.87	0.055	2185.44	12	30.78
6	4.5	973	945	2.88	0.055	2183.20	17	43.60
8	4.5	979	941	3.88	0.056	2157.43	14	35.90
17	4.49	980	935	4.59	0.057	2121.75	22	56.42
24	4.48	973	938	3.60	0.055	2183.20	35	89.76
60	4.51	974	934	4.11	0.056	2146.42	60	153.88

2 % Resin A, 2 % Bitumen emulsion (covered)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.5	981	981	0.00	0.057	2123.91	1	2.56
1	4.53	980	975	0.51	0.057	2121.75	14	35.90
2	4.53	976	973	0.31	0.056	2150.82	17	43.60
3	4.56	978	965	1.33	0.057	2117.42	22	56.42
4	4.52	978	956	2.25	0.056	2155.23	12	30.78
6	4.5	980	953	2.76	0.057	2121.75	25	64.12
8	4.5	970	948	2.27	0.055	2176.47	17	43.60
17	4.49	975	949	2.67	0.056	2148.62	21	53.86
24	4.40	970	930	3.51	0.055	2176.47	30	76.04
60	4.51	975	937	3.90	0.056	2148.62	52	133.36

2 % Resin B, no Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.5	973	970	0.31	0.055	2183.20	12	30.78
1	4.51	970	952	1.86	0.055	2176.47	10	25.65
2	5.49	974	950	2.46	0.056	2146.42	38	97.46
3	4.48	970	945	2.58	0.055	2176.47	41	105.15
4	4.48	976	946	3.07	0.056	2150.82	90	230.82
6	4.5	974	925	5.03	0.056	2146.42	88	225.69
8	4.51	974	921	5.44	0.055	2185.44	91	233.38
17	4.51	969	910	6.09	0.055	2174.22	100	256.46
24	4.51	978	909	7.06	0.056	2155.23	125	320.58
60	4.55	970	902	7.01	0.055	2176.47	142	364.18

2 % Resin B, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
0.25	4.53	970	968	0.21	0.056	2137.60	12	30.78
1	4.56	972	955	1.75	0.055	2180.95	22	56.42
2	4.5	975	950	2.56	0.056	2148.62	24	61.55
3	4.5	975	948	2.77	0.056	2148.62	20	51.29
4	4.51	970	942	2.89	0.055	2176.47	34	87.20
6	4.51	980	934	4.69	0.057	2121.75	80	205.17
8	4.48	981	927	5.50	0.057	2123.91	97	248.77
17	4.51	976	911	6.66	0.056	2150.82	103	264.16
24	4.55	980	907	7.45	0.056	2159.64	120	307.76
60	4.51	981	912	7.03	0.056	2161.84	118	302.63

2 % Resin A, 2 % Bitumen emulsion (dried for 7 days)

Time in water (h)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
1	960	904.6	5.77	914.2	1.06	0.055	2154.03	156	400.08
6	970	915	5.67	946.4	3.44	0.057	2100.10	141	348.93
24	964	909	5.71	956.8	5.25	0.056	2124.38	123	304.38
48	962	909	5.51	973.5	7.10	0.055	2158.52	78	200.04
192	954	902	5.45	976.6	8.27	0.054	2180.21	15	37.12

Influence of Initial Total Moisture Content

2 % Resin A, no Bitumen emulsion (dry)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	30	6.6	942	903	4.32	0.058	1921.33	83	201.85
7	40	7.6	942	892	5.61	0.057	1931.23	95	235.09
7	50	8.6	945	896	5.80	0.056	1974.53	85	214.10
7	60	9.6	949	894	6.15	0.056	1970.12	80	201.51
7	70	10.6	942	886	6.32	0.057	1918.23	70	170.24
7	80	11.6	940	876	7.31	0.057	1896.58	75	188.91
7	90	12.6	938	867	8.19	0.058	1844.74	73	168.80

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	20	6.6	947	908	4.30	0.058	2014.95	98	238.33
7	30	7.6	948	900	5.33	0.057	2052.47	93	230.14
7	40	8.6	953	903	5.54	0.056	2100.14	84	211.58
7	50	9.6	952	894	6.49	0.056	2097.93	65	163.72
7	60	10.6	948	884	7.24	0.057	2052.47	75	185.60
7	70	11.6	946	881	7.38	0.058	2012.83	74	179.97
7	80	12.6	945	875	8.00	0.058	2010.70	70	170.24

21 days drying:

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	30	7.6	977	924	5.74	0.059	2043.55	98	234.30
21	50	9.6	981	911	7.68	0.056	2161.84	142	357.68
21	70	11.6	928	859	8.03	0.055	2082.23	112	287.24

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	30	7.6	970	916.2	5.87	0.059	2028.91	70	167.35
21	50	9.6	970	901.8	7.56	0.056	2137.60	87	219.14
21	70	11.6	966	892	8.30	0.058	2055.38	80	194.56

2 % Resin B, 2 % Bitumen emulsion (dry)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	30	7.6	986	939	5.01	0.059	2062.38	80	191.26
21	50	9.6	970	904	7.30	0.056	2137.60	122	307.30
21	70	11.6	979	907	7.94	0.057	2119.58	128	316.76

2 % Resin B, 2 % Bitumen emulsion (wet)

Time dried (days)	Water added (g)	Total moisture (%)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	30	7.6	972	925.2	5.06	0.059	2033.09	14	33.47
21	50	9.6	976	909.1	7.36	0.056	2150.82	16	40.30
21	70	11.6	984	917	7.31	0.057	2130.41	7	17.32

Effect of Compaction

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	No. of Blows	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	Dry density	ITS (gauge)	ITS (kPa)
7	10	923	872	5.85	0.064	1779.77	1681.43	63	143.33
7	20	918	871	5.40	0.063	1798.23	1706.16	91	210.43
7	30	920	873	5.38	0.06	1892.25	1795.58	85	206.72
7	40	922	875	5.37	0.058	1961.76	1861.76	89	220.24
7	50	917	876	4.68	0.055	2057.55	1965.55	90	253.90
7	60	920	882	4.31	0.054	2102.50	2015.66	84	211.58
7	70	919	880	4.43	0.054	2100.22	2011.09	109	269.74
7	80	920	876	5.02	0.053	2142.17	2039.72	114	292.37

Effect of Resin Dosage on Stabilisation

Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.5	0	60	980	917	6.43	0.058	2085.17	90	211.58
7	4.51	0.5	57.5	986	919	6.80	0.059	2062.38	75	176.32
7	4.5	1	55	978	918	6.13	0.058	2080.91	82	192.78
7	4.48	1.5	52.5	987	920	6.79	0.059	2064.47	100	235.09
7	4.48	2	50	984	927	5.79	0.059	2058.19	130	300.61
7	4.51	2.5	47.5	987	931	5.67	0.058	2100.06	120	291.84
7	4.56	3	45	980	922	5.92	0.058	2085.17	125	293.87

Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.56	0	60	973	907	6.78	965	6.39	0.055	2183.20	55	56.00
7	4.55	0.5	57.5	981	918.4	6.38	Broke	~	0.058	2087.30	0	0.00
7	4.52	1	55	976	916.8	6.07	991.5	8.15	0.057	2113.09	21	49.37
7	4.53	1.5	52.5	978	920	5.93	998.2	8.50	0.057	2117.42	28	65.83
7	4.53	2	50	976	920.5	5.69	1001	8.75	0.057	2113.09	85	199.83
7	4.5	2.5	47.5	972.5	918.7	5.53	978	6.45	0.057	2105.51	100	235.09
7	4.52	3	45	975	920	5.64	985	7.07	0.057	2110.92	105	246.85

21 days drying:

Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.59	1	55	972	905.5	6.84	0.058	2068.15	119	289.41
21	4.52	2	50	981	911	7.68	0.055	2161.84	142	357.68
21	4.5	4	40	974	905	7.08	0.056	2146.42	150	377.83

Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.54	1	55	975	910	6.67	977	7.36	0.059	2039.37	14	33.47
21	4.5	2	50	970	901.8	7.56	985.00	9.23	0.056	2137.60	87	219.14
21	4.51	4	40	969	893.1	7.83	995	11.41	0.055	2174.22	76	194.91

Resin B, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.55	1	55	971	898	7.52	0.057	2102.26	82	202.92
21	4.52	2	50	970	904	6.80	0.056	2137.60	122	307.30
21	4.5	4	40	978	903	7.67	0.058	2080.91	124	301.57

Resin B, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Resin added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.54	1	55	972	901	7.30	1001	11.10	0.058	2068.15	7	17.02
21	4.5	2	50	976	909	6.86	987	8.58	0.056	2150.82	16	40.30
21	4.51	4	40	968	897	7.33	994	10.81	0.057	2095.77	21	51.97

Effect of Bitumen Emulsion Dosage on Stabilisation

2 % Resin A, Bitumen emulsion added (dry)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.5	0	60	886.5	824	6.95	0.051	2142.70	92	254.45
7	4.5	1	55	966	905	6.31	0.055	2167.49	101	259.03
7	4.47	2	50	969	915	5.57	0.055	2174.22	93	238.51
7	4.55	3	45	975	923	5.33	0.054	2228.20	102	266.44
7	4.56	5	35	976	921	5.64	0.057	2113.09	96	237.57

2 % Resin A, Bitumen emulsion (wet 1 h)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.55	0	60	978	908	7.16	Broke	~	0.059	2045.64	0	0.00
7	4.5	1	55	944	878	6.99	946	7.74	0.056	2080.30	120	302.26
7	4.46	2	50	970	912	5.98	973	6.69	0.055	2176.47	95	243.64
7	4.47	3	45	972	926	4.73	954	3.02	0.054	2221.34	102	266.44
7	4.53	5	35	973	924	5.04	954	3.25	0.057	2106.59	103	254.89

2 % Resin A, Bitumen emulsion (wet 24 h)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.52	0	60	978	904	7.57	Broke	~	0.059	2045.64	0	0.00
7	4.5	1	55	975	912	6.46	957.5	4.99	0.058	2074.53	20	48.64
7	4.5	2	50	977	921	5.73	960	4.23	0.059	2043.55	10	23.91
7	4.55	3	45	978	928	5.11	975	5.06	0.058	2080.91	60	145.92
7	4.54	5	35	977	934	4.40	960	2.78	0.059	2043.55	68	162.57

2 % Resin A, Bitumen emulsion (wet 48 h)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.55	0	60	978	903	7.67	Broke	~	0.059	2045.64	0	0.00
7	4.5	1	55	972	906	6.79	975	7.62	0.058	2068.15	19	46.21
7	4.46	2	50	977	919	5.94	986	7.29	0.059	2043.55	20	47.82
7	4.47	3	45	977	928	5.02	958	3.23	0.058	2078.78	45	109.44
7	4.53	5	35	980	934	4.69	959	2.68	0.058	2085.17	80	194.56

21 days drying:

2 % Resin A, Bitumen emulsion (dry)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.56	2	50	981	911	7.68	0.056	2161.84	142	357.68
21	4.44	3	45	967	900	7.44	0.058	2057.51	144	350.21
21	4.55	5	35	968	905	6.84	0.058	2059.64	136	330.75

2 % Resin A, Bitumen emulsion (wet)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.55	2	50	970	901.8	7.56	985.00	9.23	0.056	2137.60	47	118.39
21	4.52	3	45	986	923	6.83	998	8.13	0.05	2028.00	78	183.37
21	4.5	5	35	965	904	6.75	968	7.08	0.059	2018.45	85	203.22

2 % Resin B, Bitumen emulsion (dry)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.56	2	50	970	904	6.80	0.056	2137.600954	122	307.30
21	4.44	3	45	968	907	6.73	0.058	2059.64	130	316.16
21	4.55	5	35	971	914	6.24	0.058	2066.02	131	318.59

2 % Resin B, Bitumen emulsion (wet)

Time dried (days)	pH	Bitumen added (%)	Water added (g)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	4.43	2	50	976	909	6.86	987	8.58	0.056	2150.82	16	40.30
21	4.48	3	45	965	907	6.39	980	8.05	0.058	2053.25	25	63.23
21	4.6	5	35	972	914	6.35	972	6.35	0.059	2033.09	27	64.55

Influence of pH on Stabilisation

2 % Resin A, no Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	4.38	975	920	5.64	0.058	2074.53	130	316.16
7	5.41	971	918	5.46	0.058	2066.02	118.5	288.19
7	6.85	972	907	6.69	0.058	2068.15	112.3	273.11

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	7.33	885.5	830	6.27	0.055	1986.87	108	276.98
7	6.38	966	907	6.11	0.055	2167.49	110	282.11
7	5.28	969	917	5.37	0.055	2174.22	114	292.37
7	4.5	975	923	5.33	0.055	2187.69	140	359.05
7	4.16	976	927	5.02	0.055	2189.93	150	384.70

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	7.33	968	904	6.61	0.055	2171.98	93	238.51
7	6.38	944	878	6.99	0.055	2118.13	95	243.64
7	5.28	970	919	5.26	0.055	2176.47	109	279.55
7	4.5	972	923	5.04	0.055	2180.95	122	312.89
7	4.16	973	921	5.34	0.055	2183.20	132	338.53

21 days drying:

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	6.18	961	887	7.70	0.055	2156.27	84	215.43
21	4.55	981	915	6.73	0.056	2161.84	120	302.26
21	3.85	970	903	6.91	0.055	2176.47	147	377.00

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	6.18	975	903	7.38	0.055	2187.69	77	197.48
21	4.55	970	906	6.60	0.057	2100.10	95	235.09
21	3.85	972	907	6.69	0.055	2180.95	108	276.98

2 % Resin B, 2 % Bitumen emulsion (dry)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	6.2	978	907	7.26	0.056	2155.23	97	244.33
21	4.55	971	907	6.59	0.056	2139.80	107	269.52
21	3.9	970	910	6.19	0.058	2063.89	131	318.59

2 % Resin B, 2 % Bitumen emulsion (wet)

Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	6.2	970	901	7.11	0.056	2137.60	7	17.63
21	4.55	976	915	6.25	0.056	2150.82	18	45.34
21	3.9	971	904	6.90	0.055	2178.71	21	53.86

Influence of Urea to Formaldehyde Ratio on Stabilisation

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	Molar ratio (F:U)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	1	973	923	5.14	0.057	2106.59	80	197.97
7	1.5	978	917	6.24	0.055	2194.42	86	220.56
7	2	978	921	5.83	0.055	2194.42	90	230.82
7	3	976	918	5.94	0.058	2076.66	78	189.69
7	4	974.5	904	7.23	0.056	2147.52	72	181.36

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	Molar ratio (F:U)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	1	979	921.00	5.92	958.5	4.07	0.059	2047.73	18	43.03
7	1.5	978	919.00	6.03	952	3.59	0.056	2155.23	26	65.49
7	2	980.5	920.00	6.17	956	3.91	0.056	2160.74	33	83.12
7	3	977.5	917.00	6.19	972	6.00	0.058	2079.85	18	43.78
7	4	975.5	907.00	7.02	986	8.71	0.055	2188.81	12	30.78

21 days drying:

2 % Resin A, 2 % Bitumen emulsion (dry)

Time dried (days)	Molar ratio (F:U)	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	1	961	903	6.04	0.056	2117.77	108	272.04
21	2	970	904	6.80	0.058	2063.89	133	323.45
21	4	970	902	7.01	0.059	2028.91	83	198.43

2 % Resin A, 2 % Bitumen emulsion (wet)

Time dried (days)	Molar ratio (F:U)	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
21	1	976	913	6.45	980	7.34	0.059	2041.46	35	86.07
21	2	965	900	6.74	968	7.56	0.059	2018.45	74	176.92
21	4	967	900	6.93	972	8.00	0.059	2022.63	17	40.64

Influence of the Type of Bitumen Emulsion on the Effectiveness of the Resin

2 % Resin A, 2 % Bitumen emulsion (dry)

Type of Bitumen	Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
SS 60	21	4.55	981	915	6.73	0.056	2161.84	142	357.68
KMS 60	21	4.35	973	911	6.37	0.057	2106.59	109	269.74
KRS 60	21	4.31	977	911	6.76	0.057	2115.25	128	316.76

2 % Resin A, 2 % Bitumen emulsion (wet)

Type of Bitumen	Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
SS 60	21	4.55	970	908	6.83	985	8.48	0.056	2137.60	87	219.14
KMS 60	21	4.35	969	909	6.60	992	9.13	0.057	2097.93	4	9.90
KRS 60	21	4.31	971	908	6.94	Broke	~	0.057	2102.26	0	0.00

2 % Resin B, 2 % Bitumen emulsion (dry)

Type of Bitumen	Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
SS 60	21	4.61	973	909	6.58	0.056	2144.21	94	236.77
KMS 60	21	4.45	973	907	6.78	0.055	2183.20	110	282.11
KRS 60	21	4.32	975	910	6.67	0.057	2110.92	102	252.41

2 % Resin B, 2 % Bitumen emulsion (wet)

Type of Bitumen	Time dried (days)	pH	Mass (g)	Dry mass (g)	Water lost (%)	Wet mass (g)	Water in (%)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
SS 60	21	4.61	976	909	6.86	982	8.03	0.057	2113.09	16	39.59
KMS 60	21	4.45	977	911	6.76	Broke	~	0.057	2115.25	0	0.00
KRS 60	21	4.32	973	913	6.17	Broke	~	0.057	2106.59	0	0.00

Influence of Cement on the Soil Strength when Combined with Resin

0 % Resin A with Cement, Standard Method (dry)

Time (days)	Dosage (%)	Mass (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	949	0.066	1774.46	15	32.06
7	4	950	0.066	1776.33	20	42.74
7	6	953	0.064	1837.62	45	99.18

0 % Resin A with Cement, Standard Method (wet)

Time (days)	Dosage (%)	Mass (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	961	0.065	1824.54	4	8.68
7	4	951	0.065	1805.55	15	32.55
7	6	966	0.065	1834.03	30	65.10

2 % Resin A with Cement, Standard Method (dry)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	960	1016	0.059	2007.99	4	9.56
7	4	969	1009	0.06	1993.04	30	70.53
7	6	963	1014	0.059	2014.27	120	286.89

2 % Resin A with Cement, Standard Method (wet)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	964	1023	0.059	2016.36	3	7.17
7	4	958	997	0.059	2003.81	25	59.77
7	6	967	1001	0.059	2022.63	52	124.32

2 % Resin A with Cement, Experimental Method (dry)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	970	920	0.06	1995.09	55	129.30
7	4	956	912	0.059	1999.63	122	291.67
7	6	969	929	0.06	1993.04	142	333.83

2 % Resin A with Cement, Experimental Method (wet)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	965	916	0.06	1986.87	15	35.26
7	4	958	915	0.059	2003.81	70	167.35
7	6	966	925	0.06	1986.87	98	230.39

The Influence of Lime on Resin

0 % Resin A with Lime, Standard Method (dry)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	961	997	0.061	1944.18	3	6.94
7	4	894	931	0.056	1970.12	3	7.56
7	6	950	987	0.06	1953.96	2	4.70

0 % Resin A with Lime, Standard Method (wet)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	968	998	0.061	1958.34	6	13.87
7	4	955	988	0.06	1964.24	4	9.40
7	6	956	998	0.06	1966.30	4	9.40

2 % Resin A with Lime, Experimental Method (dry)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	952	898	0.06	1958.07	43	101.09
7	4	959	906	0.06	1972.47	40	94.04
7	6	970	919	0.061	1962.39	45	104.06

2 % Resin A with Lime, Experimental Method (wet)

Time (days)	Dosage (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	2	957	904	0.059	2001.72	16	38.25
7	4	969	917	0.06	1993.04	13	30.56
7	6	960	909	0.06	1974.53	13	30.56

The Influence of Organic Substances on the Resin

0 % Resin A with plain soil, Humic acids added

Time (days)	HA added (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3	ITS (gauge)	ITS (kPa)
7	1	6	1002	934	0.06	2060.91	60	141.06
7	3	4	1010	947	0.06	2077.37	63	148.11
7	5	2	1024	960	0.06	2106.16	70	164.56

2 % Resin A with plain soil, Humic acids added

Time (days)	HA Dosage (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3	ITS (gauge)	ITS (kPa)
7	1	4	1025	963	0.062	2040.21	107	243.43
7	3	2	1023	988	0.061	2069.61	100	231.24
7	5	0	1022	970	0.061	2067.59	98	226.61

Resin A with plain soil, 5 % lignosulphonates added

Time (days)	Ecotec Dosage	Water added	Mass (g)	M end (g)	Height (m)	Density (kg/m3	ITS (gauge)	ITS (kPa)
7	0	2	1023	984	0.063	2003.91	74	165.68
7	2	0	1033	1000	0.066	1931.52	85	181.66

0 % Resin A with washed soil, Humic acids added

Time (days)	HA added (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	1	6	1002	934	0.06	2060.91	0	0.00
7	3	4	1010	947	0.06	2077.37	0	0.00
7	5	2	1024	960	0.06	2106.16	5	11.75

2 % Resin A with washed soil, Humic acids added

Time (days)	HA Dosage (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	1	4	848	800	0.05	2093.00	10	28.21
7	3	2	1003	950	0.055	2250.51	20	51.29
7	5	0	1004	945	0.063	1966.69	25	55.97

2 % Resin A with washed soil, 2 % Bitumen emulsion, Humic acids added

Time (days)	HA added (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	0	5	952	898	0.065	1807.45	15	32.55
7	5	0	1031	974	0.06	2120.56	65	152.81

2 % Resin A with washed sand, Humic acids added

Time (days)	HA added (%)	water added (%)	Mass (g)	M end (g)	Height (m)	Density (kg/m3)	ITS (gauge)	ITS (kPa)
7	0	3	1002	934	0.06	2060.91	0	0.00
7	1	2	1010	947	0.06	2077.37	60	141.06
7	2	1	1024	960	0.04	3159.24	75	264.48