II EXPERIMENTAL

RESINFIED LIGANDS

II EXPERIMENTAL

II.1. RESINIFIED OXIME - ANIL : Attempted preparation :

1(a). Preparation of oxime ketone :

(2,3-Dioxobutyranilide-2-oxime)

It was prepared by the method of Talati(164). Acetoacetanilide (10g) and sodium nitrite (5.0g) were dissolved in dilute sodium hydroxide solution and the solution was added dropwise to the dilute sulfuric acid solution (2N) which was kept cool by ice. The solution was well stirred during the reaction and stirring was continued for half an hour more after the addition of alkaline solution was completed. The precipitates were filtered, washed with water and dried. The product was recrystallized from dilute alcohol as yellow crystals melting at 99-100°C.

1(b). Preparation of oxime anil (Schiff base):

(Imines of 2,3-dioxobutyranilide-2-oxime).

These were prepared by the method of Shah(158). Oxime ketone (2,3-dioxobutyranilide-2-oxime)

dissolved in ether was mixed with an amine - namely methyl amine, ethyl amine, n-butyl amine, hexamethylene diamine, decamethylenediamine or cyclohexyl amine. The mixture was cooled and stirred for several hours when the precipitation took place. The mass was kept for two hours more and then filtered, washed with ether and dried. The product was recrystallized from chloroform and petroleum ether mixture.

1(c). Resinification of oxime-imines :

Attempts were made to resinify these oxime-imines by treating them with (i) formaldehyde under acidic conditions and (ii) formaldehyde under basic conditions. In all these attempts gummy, intractable mass was obtained which could not be worked out further and small quantities of products were obtained which did not exhibit the characteristics of oximes or oxime-anils. Hence the work was discontinued.

II.2. RESINIFICATION OF 8-HYDROXY QUINOLINE USING PHENOL AND FORMALDEHYDE :

Resinified co-polyoxines were prepared as follows(165).

8-hydroxy quinoline was taken in a 250 ml flat bottom flask fitted with condenser and was dissolved by gradual addition of sodium hydroxide solution with constant stirring. 37% solution of formaldehyde was added to it. The solution turned deep red in a short time. After about an hour, the phenolic derivative, (resorcinol, m-amino phenol, m-cresol or bis phenol A) dissolved in sodium hydroxide solution, was added to the coloured mixture. The reaction mixture was heated under reflux till gel formation took place. The gel was removed from the reaction vessel and was cured in an oven at 105-110°C. The product was ground and particles having 35-100 BSS mesh size were washed thoroughly with hot water, sodium hydroxide solution, hydrochloric acid solution and finally with water and were used for further investigations. Data regarding proportions of reactants used and gelation and curing times are given in Table II 1(a).

Table II 1(a)

Preparation of resins based on 8-hydroxy quinoline

(8Q series)

No.	resin	8-hydroxy quinoline (g)	phenolic compound and its wt (g)	formaldehyde (37%) (ml)	gel period (hr)	cure period (hr)
1	8QR	14.5	resorcinol : 11.0	45	3/4	24
2	8QM	14.5	m-aminophenol : 10.9	45	6	24
3	8QC	14.5	m-cresol : 10.8	45	24	24
4	8QB	14.5	bis-phenol A : 22.2	45	24	24

II.3 RESINIFIED SALICYLALDEHYDE USING PHENOL AND FORMALDEHYDE :

Salicylaldehyde was taken in a 250 ml flat bottom flask fitted with a condensor and was treated with sodium hydroxide solution with constant stirring so that clear solution was obtained. 37% solution of formaldehyde was added to it and the mixture was warmed on water bath for sometime. The phenolic derivative (resorcinol, m-amino phenol or bis phenol A) dissolved in sodium hydroxide solution was added to the above mixture. The reaction mixture was heated under reflux until the reaction mixture gelled. The gel was removed from the reaction vessel and was cured in an oven at 105-110°C. The product was ground and particles having 35-100 BSS mesh size were washed with water, alkali solution, acid solution and again with water and were used for further investigations. Data regarding proportions of reactants used and gelation and curing times are given in Table II 1(b).

Table II 1(b)

Preparation of resins based on salicylaldehyde

(S series)

No.	resin	salicyl-aldehyde (g)	phenolic compound and its wt (g)	formaldehyde (37%) (ml)	gel period (hr)	cure period (hr)
1	SR	12.2	resorcinol : 11.0	45	2½	24
2	SM	12.2	m-aminophenol : 10.9	45	6	24
3	SB	12.2	bis-phenol A : 22.2	45	24	24

II.4 RESINIFICATION OF SALICYLALDEHYDE USING MELAMINE AND ALDEHYDE :

Melamine dissolved in hydrochloric acid was taken in a 500 ml flask fitted with reflux condensor and salicylaldehyde was added to it. Comdensing agent (formaldehyde, n-butyraldehyde or glyoxal) was then added to it. After shaking the flask for 10 minutes, alkali solution was added to it to make the mixture alkaline. It was refluxed on water bath till gelation took place. The product was taken out and cured in an oven at 105-10°C. It was powdered and washed with water. The product was dried in air and particles of 35-100 BSS mesh size were used for subsequent work.

The amounts of the reactants used, gel period, cure period, etc are presented in Table II 1(c).

II.5 RESINIFICATION OF LIGANDS USING POLYVINYL ALCOHOL AND FORMALDEHYDE :

(i) Oxine dissolved in hydrochloric acid was mixed with polyvinyl alcohol dissolved in water.

Table II 1(c)

Preparation of resins using melamine, salicylaldehyde and condensing agent (basic condition)

(A series)

No.	resin	melamine (g)	salicyl-aldehyde (ml)	condensing agent and its volume (ml)	gel period (hr)	cure period (hr)
1	MSF	4.2	6	formaldehyde : 20	2.5	72
2	MSB	4.2	6	n-butyraldehyde : 4	12	24
3	MSG	4.2	6	glyoxal : 6	4	48

The mixture was taken in 500 ml flask, formaldehyde was added to it and the mixture was made alkaline. It was refluxed for 30 minutes. The mixture was then made acidic and refluxed further till gelation took place. The gel was taken out and cured at 105-10°C.

(ii) Polyvinyl alcohol dissolved in water was taken in 500 ml flask. Salicylaldehyde was added to it and the mass was agitated after making the solution acidic with hydrochloric acid. The mass was refluxed till gelation took place. The gel was taken out and cured at 105-10°C.

(iii) A paste of starch and polyvinyl alcohol in water was prepared. It was mixed with oxine in hydrochloric acid and their reaction with formaldehyde was carried out as suggested in (i).

(iv) A paste of starch and polyvinyl alcohol was prepared in water, salicylaldehyde was added to it and the reaction was carried out as suggested in (ii).

The cured mass in each case was powdered, washed with water and dried in air. The particles of 35-100 BSS mesh size were used for subsequent investigations. The amounts of the reactants used, gel period, cure period, etc are presented in Table II 1(d).

II.6 COPOLYMERS OF PHENOLS :

Copolymers of phenols were prepared for comparative studies by the method of Sheth(161), using the following reactant systems :

(i) Resorcinol - m-cresol- formaldehyde,
(ii) m-Amino phenol - formaldehyde,
(iii) H-acid-thiourea - formaldehyde,
(iv) Bis-phenol A - thiourea - formaldehyde,
(v) m-Amino phenol - furfural.

Amounts of the reactants used, gel period, cure period, etc are presented in Table II 1(e).

Table II 1(d)

Preparation of resins using polyvinyl alcohol

(V series)

No.	resin	poly-vinyl alcohol (g)	8-hydroxy quinoline (g)	salicyl-aldehyde (ml)	formal-dehyde (37%) (ml)	condition (as desc-ribed in II 5)	gel period (hr)	cure period (hr)
1	8QV	3	0.5	-	1	5(i)	2	16
2	SV	3	-	2	-	5(ii)	6	12
3	8QVs	3	0.5	-	1	5(iii)	2	24
4	SVs	3	-	2	-	5(iv)	2.5	12

Table II 1(e)

Preparation of resins based on phenolic compounds
(vide ref. 161)
(P series)

No.	resin	reactants I, II and III and their wt. or vol.			gel period (hr)	cure period (hr)
		I	II			
1	FCR	m-cresol : 4.4 g	resorcinol : 4.4 g	formaldehyde : 36 ml	0.5	5.4
2	FA	m-amino-phenol : 4.4 g	-	formaldehyde : 36 ml	1.5	4.0
3	FBHa	bisphenol-A :11.0 g	H-acid : 6.4 g	formaldehyde : 45 ml	1.5	5.0
4	FTB	thiourea : 2.8 g	bisphenol-A : 8.8 g	formaldehyde : 36 ml	1.0	4.5
5	FuA	m-amino-phenol : 4.4 g	-	furfural : 36 ml	0.75	4.0

II.7 CONVERSION OF RESIN :

7(a) Acid form resin :

About 5.0 g of the resin were taken in 500 ml glass stoppered bottle and 500 ml 1N hydrochloric acid solution was added to it. The mixture was kept for 24 hours with occassional shaking. The resin was filtered, washed to neutrality with distilled water and dried in air.

7(b) Base form resin :

About 5.0 g of the resin were taken in a 250 ml glass stoppered bottle and about 250 ml 1.5 N sodium hydroxide solution were added to it. The mixture was kept for 24 hours with occassional shaking. The resin was filtered, washed to neutrality with water and dried in air.

7(c) NH_4 for resin :

About 5.0 g of the resin were taken in a 500 ml glass stoppered bottle and 500 ml 0.1 N ammonium

hydroxide solution were added to it. The mass was kept for 24 hours with occassional shaking. It was filtered, washed with water and dried in air.

II.8 NITROGEN ANALYSIS :

Nitrogen analysis of some of the resins in acid form and NH_4 form was obtained from the results of micro-analysis. The results together with the calculated values and the probable formulae of the repeat unit of the resins are presented in Table II.2.

II.9 SOLUBILITY OF RESINS :

A small quantity of the resin was taken in a test tube, solvent was added to it and the solubility of the resin in the solvent was observed at room temperature and on heating. The results are presented in Table II.3.

Table II 2(a)

Analysis of resins

(8Q series)

No.	resin	formula repeat unit of resin (acid form)	analysis of resin (%N)			
			resin (acid form)		resin (NH_4 form)	
			%N found	%N calc	% found	%N calc
1	8QR	$C_{77.5}H_{61}NO_{19}$	1.02	1.07	2.39	2.14
2	8QC	$C_{78}H_{71}NO_9$	1.19	1.20	2.38	2.40
3	8QB	$C_{61}H_{55}NO_7$	1.51	1.53	2.46	3.07

Table II 2(b)

Analysis of resins
(S series)

No.	resin	formula of repeat unit of resin (NH_4 form)	analysis of resin (NH_4 form)	
			%N found	%N calc
1	SR	$C_{60.5}H_{51}NO_{16}$	1.30	1.34
2	SB	$C_{76}H_{73}NO_{10}$	1.29	1.21

Table II 3(a)

Colour and solubility of resins (acid form)

(8Q series)

No.	resin	colour	solubility in								
			water	3N.HCl	3N.NaOH	alcohol	acetone	benzene	carbon tetrachloride	n-heptane	dimethyl formamide
1	8QR	black	I	I	I	I	I	I	I	I	I
2	8QC	black	I	I	PS	I	I	I	I	I	PS
3	8QB	brown	I	I	I	I	I	I	I	I	I
4	8QM	brown	I	I	I	I	I	I	I	I	I

I : insoluble

PS : partly soluble

Table II 3(b)

Colour and solubility of resins (acid form)

(S series)

No.	resin	colour	solubility in								
			water	3N HCl	3N NaOH	alcohol	acetone	benzene	carbon tetrachloride	n-heptane	dimethyl formamide
1	SR	black	I	I	I	I	I	I	I	I	I
2	SB	black	I	I	PS	I	I	I	I	I	PS
3	SM	reddish brown	I	I	I	I	I	I	I	I	I

I : insoluble

PS : partly soluble

Table II 3(c)

Colour and solubility of resins (acid form)

(A series)

No.	resin	colour	solubility in						
			water	3N HCl	3N NaOH	alcohol	acetone	benzene	chloroform
1	MSF	yellow	I	I	I	I	I	I	I
2	MSB	brown	I	I	PS	I	I	I	I
3	MSG	brown	I	I	I	I	I	I	I

I : insoluble

PS : partly soluble

Table II 3(d)

Colour and solubility of resins (acid form)

(V series)

No.	resin	colour	solubility in						
			water	3N HCl	3N NaOH	alcohol	acetone	benzene	chloroform
1	8QV	yellow	I	PS	PS	I	I	I	I
2	SV	pink	I	PS	PS	I	I	I	I
3	8QVs	yellow	I	PS	PS	I	I	I	I
4	SVs	pink	I	PS	PS	I	I	I	I

I : insoluble

PS : partly soluble

Table II 3(e)

Colour and solubility of resins (acid form)

(P series)

No.	resin	colour	solubility in						
			water	3N HCl	3N NaOH	alcohol	acetone	benzene	chloroform
1	FCR	brown	I	I	I	I	I	I	I
2	FA	brown	I	I	I	I	I	I	I
3	FBHa	brown	I	I	I	I	I	I	I
4	FTB	brown	I	I	I	I	I	I	I
5	FuA	brown	I	I	I	I	I	I	I

I : insoluble

II.10. MOISTURE CONTENT :

Moisture content or water content of the resin was determined by drying an exactly weighed sample (acid-form or base-form) of the resin in an oven at 105-110°C for 24 hours and reweighing it after cooling it in a desiccator. The calculation is

$$\frac{\text{weight of oven dried sample x 100}}{\text{weight of resin before drying}} = \% \text{ solid}$$

100 - % solid = % moisture = % water content

The values of % water content are presented in Table II.4. Water content was determined for each set of exchange reactions simultaneously.

II.11 DENSITY OF RESINS :

11(a) Density of resins using water or n-heptane :

Density of the resin (acid form or base form) was determined by the specific gravity bottle method.

Table II 4(a)

Water content and density of resins (acid form)
and water content of resins (base form)

(8Q series)

No.	resin	water content of resins (acid form) (% W_a)	density of resin (acid form)			water content of resins (base form) (% W_b)
			using water (D_w)	using n-heptane (D_h)	column (D_c)	
1	8QR	18.4	1.52	1.80	0.60	10.0
2	8QM	8.2	1.24	2.20	0.47	5.2
3	8QC	7.0	1.43	1.25	0.55	14.0
4	8QB	15.5	1.12	1.85	0.40	7.1

Table II 4(b)

Water content and density of resins (acid form)

(S series)

No.	resin	water content (% W_a)	density		
			using water (D_w)	using n-heptane (D_h)	column (D_c)
1	SR	15.5	1.40	1.54	0.66
2	SM	25.5	1.57	2.04	0.63
3	SB	11.5	1.14	2.08	0.37

Table II 4(c)

Water content of resins (acid form)

(A series)

No.	resin	water content (% W_a)	density of resin using water (D_W)
1	MSF	8.0	1.41
2	MSB	9.0	1.19
3	MSG	9.0	1.27

Table II 4(d)

Water content and density of resins (acid form)
(vide ref. 161)

(P series)

No.	resin	water content (% W_a)	density using water (D_w)	column density (D_c)
1	FCR	10.8	1.69	0.55
2	FA	10.2	1.40	0.34
3	FBHa	10.0	1.28	0.54
4	FTB	14.0	1.72	0.85
5	FuA	12.4	1.30	0.60

A definite amount of the resin was taken in a specific gravity bottle whose weight was determined previously and weighed. Then it was filled with water or n-heptane in presence or absence of resin sample and weighed. Hence the density (D_w or D_h) was determined as follows :

$$D = \frac{W_r - W}{(W_s - W_{rs}) + (W_r - W)}$$

where W = weight of the specific gravity bottle

W_r = weight of the specific gravity bottle containing resin

W_s = weight of the specific gravity bottle containing liquid (water or n-heptane)

W_{rs} = weight of the specific gravity bottle containing resin and liquid

D_w = density using water

D_h = density using n-heptane.

The values obtained for the resins in acid and base forms are presented in Table II.4.

11(b) Apparent density of resins :

Apparent or column density of the resin was determined as follows :

A definite amount of the resin was suspended in water and the suspension was introduced into a graduated glass column which was plugged at the lower end. Resin was allowed to settle as water gradually flowed through the plug. Further quantities of water were introduced into the column and allowed to flow through. At the end when all excess water flowed out, the volume of the column was read. The resin was then taken out and allowed to dry at room temperature till constant weight. Hence the column density (D_c) was determined as follows :

$$D_c = \frac{\text{weight of resin}}{\text{volume of resin bed}}$$

The values of D_c obtained for the resins are presented in Table II.4.

II.12 pH TITRATION :

0.1 g (exactly weighed) samples of the resins (acid form) were taken in different 150 ml dry bottles. Solutions of different concentrations were prepared by diluting different quantities of 0.1 N sodium hydroxide in 1.0 N sodium chloride solution to the calculated volume with 1.0 N sodium chloride solution. 100 ml of such a solution were added to the bottle containing resin (alkali solution to the acid form resin). The bottles were shaken at intervals and pH of the solution was measured until constant pH value was obtained, (Usually 24 hours were required). pH of the solution was then exactly measured. 10 ml aliquots of the supernatant liquid were titrated against standard acid solution.

Titration reading at zero time was obtained by mixing 100 ml of each dilute solution with 0.1 g resin, shaking and titrating 10 ml of the solution against standard acid solution.

Similarly resins (base form) were treated with 0.1 N hydrochloric acid in 1.0 N sodium chloride solution and titrated against standard alkali solution.

The ion uptake by the resin was calculated as follows :

$$\text{ion uptake} = \frac{(10z - 10y) \times (\text{N of titrant})}{\text{sample weight} \times \%\text{solid}/100}$$

where z = titration reading at zero time

y = titration reading after 24 hours or more as required.

The values of equilibrium pH of the solution and of the ion uptake by the resin for the alkali or acid taken per g of the dry resin are presented in Table II.5.

II.13 ALKALI ION UPTAKE :

Alkali ion uptake by the resins in acid form was determined for Na and NH_4 ions as follows :

Table II 5(a)

pH titration of resins (acid form)

(8Q series)

(concentration of NaCl : 1N)

No.	resin	alkali taken (meg/g dry resin)	pH of solution at equilibrium	ion uptake (meg/g dry resin)
1	2	3	4	5
1	8QR	(i) 0.00	7.36	0.00
		(ii) 22.16	9.65	0.25
		(iii) 10.29	10.46	1.47
		(iv) 21.57	11.10	2.94
		(v) 32.84	11.12	4.90
		(vi) 43.43	11.17	6.37
		(vii) 54.41	11.24	8.82
		(viii) 66.17	11.33	10.29
		(ix) 76.47	11.39	11.27
		(x) 88.23	11.45	12.74
		(xi) 98.53	11.52	14.70

Table II 5(a)(contd.)

1	2	3	4	5
2	8Q0	(i) 0.00	7.38	0.00
		(ii) 11.89	9.62	0.21
		(iii) 9.03	10.51	1.29
		(iv) 18.92	11.05	3.01
		(v) 28.82	11.11	3.87
		(vi) 38.28	11.16	5.59
		(vii) 47.74	11.22	8.17
		(viii) 58.06	11.34	9.46
		(ix) 67.10	11.39	10.32
		(x) 77.42	11.45	12.04
		(xi) 86.45	11.46	15.05

Table II 5(a)(contd)

1	2		3	4	5
3	8QM	(i)	0.00	7.31	0.00
		(ii)	1.92	9.60	0.22
		(iii)	9.17	10.40	0.87
		(iv)	19.21	11.00	1.75
		(v)	29.26	11.12	3.39
		(vi)	38.86	11.15	5.24
		(vii)	48.47	11.23	7.86
		(viii)	58.95	11.32	8.73
		(ix)	68.12	11.37	9.61
		(x)	78.60	11.44	11.35
		(xi)	87.77	11.49	13.10

Table II 5(a)(contd)

1	2		3	4	5
4	8QB	(i)	0.00	7.31	0.00
		(ii)	2.08	9.58	0.23
		(iii)	9.94	10.39	1.89
		(iv)	20.82	11.02	2.84
		(v)	31.72	11.09	4.73
		(vi)	42.13	11.15	5.68
		(vii)	52.54	11.23	8.05
		(viii)	63.90	11.31	9.94
		(ix)	73.85	11.37	11.36
		(x)	85.21	11.45	12.78
		(xi)	95.15	11.50	15.62

Table II 5(b)

pH titration of resins (acid form)

(S series)

(concentration of NaCl : 1N)

No.	resin	alkali taken (meg/g dry resin)	pH of solution at equilibrium	ion uptake (meg/g dry resin)
1	2	3	4	5
1	SR	(i) 0.00	7.25	0.00
		(ii) 2.08	9.70	0.23
		(iii) 9.94	10.42	1.42
		(iv) 20.82	10.98	3.31
		(v) 31.72	11.10	4.26
		(vi) 42.13	11.16	6.15
		(vii) 52.54	11.23	8.52
		(viii) 63.90	11.32	10.41
		(ix) 73.85	11.38	11.12
		(x) 85.21	11.43	11.36
		(xi) 95.15	11.50	16.57

Table II 5(b)(contd)

1	2		3	4	5
2	SM	(i)	0.00	7.21	0.00
		(ii)	2.36	9.67	0.27
		(iii)	11.27	10.29	1.07
		(iv)	23.62	10.97	2.68
		(v)	35.97	11.08	5.37
		(vi)	47.78	11.17	6.44
		(vii)	59.60	11.24	9.13
		(viii)	72.48	11.30	10.74
		(ix)	83.76	11.37	12.88
		(x)	96.64	11.43	13.96
		(xi)	107.92	11.47	18.26

Table II 5(b)(contd)

1	2		3	4	5
3	SB	(i)	0.00	7.23	0.00
		(ii)	1.99	9.61	0.23
		(iii)	9.49	9.98	1.81
		(iv)	19.89	10.95	2.71
		(v)	30.28	11.07	4.52
		(vi)	40.22	11.14	5.42
		(vii)	50.17	11.22	8.13
		(viii)	61.01	11.30	9.49
		(ix)	70.51	11.36	10.39
		(x)	81.36	11.41	12.20
		(xi)	90.85	11.45	13.56

Table II 5(c)

pH titration of resins (base form)

(8Q series)

(concentration of NaCl : 1N)

No.	resin	acid taken (meg/g dry resin)	pH of solution at equilibrium	ion uptake (meg/g dry resin)
1	2	3	4	5
1	8QR	(i) 2.20	2.80	0.20
		(ii) 11.04	1.97	0.82
		(iii) 22.08	1.64	1.64
		(iv) 33.12	1.56	2.49
		(v) 44.57	1.40	3.68
		(vi) 56.02	1.18	4.50
		(vii) 67.06	1.01	5.72
		(viii) 77.28	0.93	6.95
		(ix) 89.14	0.86	8.12
		(x) 99.36	0.79	9.40

Table II 5(c)(contd)

1	2		3	4	5
3	8QM	(i)	2.09	2.75	0.19
		(ii)	10.46	1.99	0.77
		(iii)	20.92	1.66	1.59
		(iv)	31.38	1.55	2.36
		(v)	42.23	1.41	3.29
		(vi)	53.07	1.21	4.26
		(vii)	63.53	1.00	5.62
		(viii)	73.22	0.92	6.59
		(ix)	84.45	0.85	7.74
		(x)	94.14	0.80	8.52

Table II 5(c)(contd)

1	2		3	4	5
4	8QB	(i)	2.14	2.81	0.20
		(ii)	10.68	1.99	0.79
		(iii)	21.37	1.65	1.58
		(iv)	32.05	1.53	2.41
		(v)	43.13	1.42	3.56
		(vi)	54.21	1.19	4.75
		(vii)	64.89	1.01	5.94
		(viii)	74.79	0.92	7.12
		(ix)	86.26	0.84	8.51
		(x)	96.16	0.80	9.10

13(a) Na ion uptake :

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To this were added 100 ml N/40 sodium hydroxide solution. The mixture was kept for 24 hours with shaking at intervals. After 24 hours, 10 ml aliquots of the supernatant liquid were titrated against standard acid solution. Na- ion uptake was calculated as follows :

$$\text{Na- ion uptake} = \frac{100 \times \text{N of alkali} - 10(\text{ml} \times \text{N of titrant})}{\text{sample wt} \times (\% \text{ solid}/100)}$$

13(b) NH_4- ion uptake :

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To this were added 100 ml 0.1 N ammonium hydroxide solution. The mixture were kept for 24 hours with shaking at intervals. After 24 hours , 10 ml aliquots of the supernatant liquid were titrated against standard sulphuric acid solution

(A blank reading without using resin was also taken). NH_4- ion uptake was calculated as follows :

$$\text{NH}_4 \text{ ion up-take} = \frac{10(\text{blank reading} - \text{titre}) \times N \text{ of titrant}}{\text{sample wt} \times (\% \text{ solid}/100)}$$

The results are presented in Table II 5/1.

II.14 COPPER ION EXCHANGE :

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To this sample in the bottle were added 100 ml of (M/20) copper ammonium sulphate in ammonium hydroxide solution (pH 8.8). The mixture was kept for 24 hours (or 48 hours or 72 hours) and bottles were shaken at intervals. After 24 hours (or 48 or 72 hours). 10.0 ml aliquots of the supernatant liquid were titrated against standard sodium thiosulphate solution. The copper ion uptake was calculated as follows :

Table II 5/1(a)

Alkali ion uptake by the resins (acid form)

(8Q series)

No.	resin	ion uptake by the resin (meq/g)	
		Na-ion	NH_4-ion
1	8QR	4.90	3.68
2	8QC	3.87	3.22
3	8QM	3.93	4.31
4	8QB	4.73	3.55

Table II 5/1(b)

Alkali ion uptake by the resins (acid form)

(S series)

No.	resin	ion uptake by the resin (meq/g)	
		Na-ion	NH_4-ion
1	SR	4.26	3.51
2	SM	5.37	4.83
3	SB	4.52	3.85

Table II 5/1(c)

Alkali ion uptake by the resins (acid form)

(P series)

No.	resin	ion uptake the resin (meq/g)	
		Na-ion	NH_4-ion
1	FCR	4.25	3.62
2	FA	4.83	4.14
3	FBHa	3.77	4.09
4	FTB	2.49	2.98
5	FuA	3.38	3.67

Cu(II) ion

$$\text{uptake} = \frac{100(\text{M. copper ion}) - 10(\text{ml titrant x M titrant})}{\text{sample wt x (\% solid/100)}}$$

The results are presented in Table II.6.

II.15 NICKEL ION EXCHANGE :

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of (~M/20) nickel ammonium sulphate in ammonium hydroxide solution (pH~8.8). The mixture was kept for 24 hours (or 48 hours or 72 hours) with occasional shaking. 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using murexide as the indicator.

The nickel ion uptake was calculated as follows :

Ni(II) ion uptake

$$= \frac{100(\text{M Nickel ion}) - 10(\text{ml titrant x M titrant})}{\text{sample wt x (\% solid/100)}}$$

The results are presented in Table II.7.

Table II 6(a)

Copper ion uptake by resins

(8Q series)

(initial concentration of Cu(II) in solution: 0.0475M)

No.	resin	amount of copper ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	55.76	2.45	55.76	2.45
2	8QM	46.93	4.82	46.30	5.45
3	8QC	48.92	2.15	48.92	2.15
4	8QB	53.25	2.96	53.25	2.96

Table II 6(b)

Copper ion uptake by resins

(S series)

(initial concentration of Cu(II) in solution: 0.0475M)

No.	resin	amount of copper ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SR	53.85	2.37	53.85	2.37
2	SM	59.73	4.03	59.73	4.03
3	SB	50.85	2.82	49.72	3.95

Table II 6(c)

Copper ion uptake by resins

(A series)

(initial concentration of Cu(II) in solution: 0.05M)

No.	resin	amount of copper ion (m mole/g dry resin)			
		after 48 hrs		after 72 hrs	
		in solution (C'_{SR})	in resin (C'_{RR})	in solution (C''_{SR})	in resin (C''_{RR})
1	MSF	47.83	6.52	47.83	6.52
2	MSB	47.80	7.14	47.80	7.14
3	MSG	47.80	7.14	47.80	7.14

Table II 6(d)

Copper ion uptake by resins (P series)
(vide ref. 161)

(initial concentration of Cu(II) in solution: 0.05M)

No.	resin	amount of copper ion (m mole/g dry resin) after 24 hrs	
		in solution (C_{SR})	in resin (C_{RR})
1	FA	14.02	1.38
2	FBHa	12.36	2.54
3	FTB	14.79	0.31
4	FuA	14.67	0.93

Table II 7(a)

Nickel ion uptake by resins

(8Q series)

(initial concentration of Ni(II) in solution: 0.0475M)

No.	resin	amount of nickel ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	56.37	1.84	56.37	1.84
2	8QM	50.65	1.09	49.56	2.17
3	8QC	50.00	1.07	50.00	1.07
4	8QB	55.03	1.18	53.85	2.36

Table II 7(b)

Nickel ion uptake by resins

(S series)

(initial concentration of Ni(II) in solution: 0.0475M)

No.	resin	amount of nickel ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SR	55.03	1.18	55.03	1.18
2	SM	63.09	0.67	61.75	2.01
3	SB	51.98	1.69	51.98	1.69

Table II 7(c)

Nickel ion uptake by resins

(A series)

(initial concentration of Ni(II) in solution:0.052M)

No.	resin	amount of nickel ion (m mole/g dry resin)			
		after 48 hrs		after 72 hrs	
		in solution (C'_{SR})	in resin (C'_{RR})	in solution (C''_{SR})	in resin (C''_{RR})
1	MSF	53.26	3.80	53.26	3.80
2	MSB	52.75	4.94	52.75	4.94
3	MSG	52.75	4.94	52.75	4.94

II.16 ZINC ION EXCHANGE :

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of (~ M/20) zinc ammonium sulphate in ammonium hydroxide solution (pH~ 8.8). The mixture was kept for 24 hours (or 48 hours or 72 hours) with occassional shaking. 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using Eriochrome Black T as indicator.

The zinc ion exchange was calculated as follows :

$$\text{Zn(II) ion uptake} = \frac{100(\text{M Zinc ion}) - 10(\text{ml titrant} \times \text{M titrant})}{\text{sample wt} \times (\% \text{ solid}/100)}$$

The results are presented in Table II.8.

II.17 MAGNESIUM ION EXCHANGE :

About 0.1 g (exactly weighed) acid form of the

Table II 8(a)

Zinc ion uptake by resins

(8Q series)

(initial concentration of Zn(II) in solution : 0.076M)

No.	resin	amount of zinc ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	88.25	4.90	88.25	4.90
2	8QM	77.30	5.45	77.30	5.45
3	8QC	75.30	6.45	75.30	6.45
4	8QB	85.22	4.73	85.22	4.73

Table II 8(b)

Zinc ion uptake by resins

(S series)

(initial concentration of Zn(II) in solution : 0.076M)

No.	resin	amount of zinc ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SM	96.02	6.03	95.34	6.71
2	SR	85.22	4.73	85.22	4.73
3	SB	80.20	5.65	80.20	5.65

Table II 8(c)

Zinc ion uptake by resins

(A series)

(initial concentration of Zn(II) in solution : 0.05M)

No.	resin	amount of zinc ion (m mole/g dry resin)			
		after 48 hrs		after 72 hrs	
		in solution (C'_{SR})	in resin (C'_{RR})	in solution (C''_{SR})	in resin (C''_{RR})
1	MSF	48.91	5.43	48.91	5.43
2	MSB	50.55	4.39	50.55	4.39
3	MSG	50.55	4.39	50.55	4.39

resin was taken in a dry 250 ml bottle with a stopper. To this sample in the bottle were added 100 ml of (~ M/20) magnesium sulphate solution. pH of the solution was adjusted to 6.0 - 6.5 . The mixture was kept for 24 hours (or 48 hours) with occassional shaking. 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using Eriochrome Black T as the indicator.

The magnesium ion exchange was calculated as follows :

$$\text{Mg(II) ion uptake} = \frac{100(\text{M magnesium ion}) - 10(\text{ml titrant} \times \text{M titrant})}{\text{sample wt} \times (\% \text{ solid}/100)}$$

The results are presented in Table II.9.

II.18 COPPER ION EXCHANGE :

(dilute solution)

Copper ion exchange by the resin from a dilute

Table II 9

Magnesium ion uptake by resins

(8Q series)

(initial concentration of Mg(II) in solution: 0.058M)

No.	resin	amount of magnesium ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	insolution (C'_{SR})	in resin (C'_{RR})
1	8QR	68.63	2.45	68.63	2.45
2	8QC	61.29	1.07	60.21	2.15
3	8QB	66.27	2.37	66.27	2.37
4	8QM	62.09	1.09	61.00	2.18

solution of copper ammonium sulphate (~M/200) in ammonium hydroxide solution (pH~8.8) was determined as follows :

About 0.1 g (exactly weighed) acid form of the resin was taken in a 250 ml bottle with a stopper and 100 ml of Cu(II) solution were added to it. It was kept for 24 hours (or 48 hours) with shaking at intervals. 10 ml aliquots of the supernatant solution were then titrated against sodium thiosulphate solution. Cu(II) ion uptake was calculated as shown in II.14. The results are presented in Table II.10.

II.19 NICKEL ION EXCHANGE :

(dilute solution)

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of (~M/200) nickel ammonium sulphate in

Table II 10(a)

Copper ion uptake by resins

(8Q series)

(initial concentration of Cu(II) in solution: 0.00445 M)

No.	resin	amount of copper ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	5.08	0.37	5.08	0.37
2	8QM	4.41	0.44	4.31	0.55
3	8QC	4.52	0.27	4.52	0.27
4	8QB	3.85	1.42	3.85	1.42

Table II 10(b)

Copper ion uptake by resins

(S series)

(initial concentration of Cu(II) in solution: 0.00445M)

No.	resin	amount of copper ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SR	4.56	0.71	4.56	0.71
2	SM	5.43	0.54	5.37	0.60
3	SB	3.78	1.24	3.72	1.30

ammonium hydroxide solution (pH~8.8). The mixture was kept for 24 hours (or 48 hours) with occasional shaking. 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using murexide as the indicator.

The nickel ion uptake was calculated as shown in II.15. The results are presented in Table II.11.

II.20 ZINC ION EXCHANGE : (dilute solution)

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of (~ M/200) zinc ammonium sulphate in ammonium hydroxide solution (pH~8.8). The mixture was kept for 24 hours with occassional shaking. 10 ml aliquots of the supernatant liquid were

Table II 11(a)

Nickel ion uptake by resins

(8Q series)

(initial concentration of Ni(II) in solution : 0.0053M)

No.	resin	amount of nickel ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	6.31	0.18	5.88	0.62
2	8QM	5.44	0.33	4.95	0.82
3	8QC	5.43	0.27	5.05	0.65
4	8QB	5.92	0.36	5.38	0.89

Table II 11(b)

Nickel ion uptake by resins

(S series)

(initial concentration of Ni(II) in solution : 0.0053M)

No.	resin	amount of nickel ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SR	5.92	0.36	5.32	0.95
2	SM	6.84	0.27	6.64	0.47
3	SB	5.65	0.34	5.08	0.90

titrated against standard E.D.T.A. solution using Eriochrome Black T as indicator.

The zinc ion uptake was calculated as shown in II.16. The results are presented in Table II.12.

II.21 MAGNESIUM ION EXCHANGE : (dilute solution)

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of (~ M/200) magnesium sulphate solution. pH of the solution was adjusted to 6.0 - 6.5 . The mixture was kept for 24 (or 48) hours with occassional shaking . 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using Eriochrome Black T as the indicator.

The magnesium ion uptake was calculated as shown in II.17. The results are presented in Table II.13.

Table II 12(a)

Zinc ion uptake by resins

(8Q series)

(initial concentration of Zn(II) in solution:0.0086M)

No.	resin	amount of zinc ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	9.90	0.61	9.90	0.61
2	8QM	8.87	0.49	8.82	0.54
3	8QC	8.93	0.32	8.82	0.43
4	8QB	9.68	0.49	9.58	0.59

Table II 12(b)

Zinc ion uptake by resins

(S series)

(initial concentration of Zn(II) in solution: 0.0086M)

No.	resin	amount of zinc ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	SR	9.82	0.36	9.58	0.59
2	SM	11.14	0.40	10.87	0.67
3	SB	9.15	0.56	9.15	0.56

Table II 13

Magnesium ion uptake by resins

(8Q series)

(initial concentration of Mg(II) in solution: 0.0063M)

No.	resin	amount of magnesium ion (m mole/g dry resin)			
		after 24 hrs		after 48 hrs	
		in solution (C_{SR})	in resin (C_{RR})	in solution (C'_{SR})	in resin (C'_{RR})
1	8QR	7.60	0.12	7.35	0.37
2	8QM	6.75	0.11	6.64	0.22
3	8QC	6.61	0.16	6.56	0.21
4	8QB	7.28	0.18	7.28	0.18

II.22 COPPER ION EXCHANGE :

(in presence of excess NH_4 ions)

Solutions of different concentrations of copper sulphate in ammonium hydroxide in presence of excess of ammonium ions (0.2M) (pH ~8.8) were prepared.

About 0.1 g (exactly weighed) acid form of the resin was taken in a 250 ml bottle with a stopper and 100 ml of one of the above copper (II) solutions were added to it. It was kept for 24 hours with shaking at intervals. 10 ml aliquots of the supernatant solution were then titrated against standard sodium thiosulphate solution. Cu(II) ion uptake was calculated as shown in II.14. The results are presented in Table II.14.

II.23 NICKEL ION EXCHANGE :

(in presence of excess NH_4 ions)

Solutions of different concentrations of

Table II 14(a)

Copper ion uptake by resins

(8Q series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of copper ion (m mole/g dry resin)					
				after 24 hrs			
				(i)	(ii)	(iii)	(iv)
1	8QR	in resin	C_{RRA}	8.84	7.94	4.90	2.45
		in solution	C_{SRA}	17.07	13.91	8.27	3.98
2	8QM	in resin	C_{RRA}	5.99	6.53	2.72	0.27
		in solution	C_{SRA}	17.15	11.16	8.98	5.4
3	8QC	in resin	C_{RRA}	7.53	6.45	2.68	0.27
		in solution	C_{SRA}	15.33	11.02	8.84	5.40
4	8QB	in resin	C_{RRA}	10.04	8.28	4.44	1.48
		in solution	C_{SRA}	15.06	10.94	8.29	4.74

Table II 14(b)

Copper ion uptake by resins

(S series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of copper ion (m mole/g dry resin)					
				after 24 hrs			
				(i)	(ii)	(iii)	(iv)
1	SR	in resin	C_{RRA}	7.02	6.64	3.47	0.87
		in solution	C_{SRA}	17.84	12.12	8.96	5.22
2	SM	in resin	C_{RRA}	8.06	8.34	2.35	1.34
		in solution	C_{SRA}	20.48	13.34	12.08	5.69
3	SB	in resin	C_{RRA}	10.12	7.06	3.67	2.02
		in solution	C_{SRA}	13.77	11.29	8.47	4.04

Table II 14(c)

Copper ion uptake by resins
(P series)
(concentration of ammonium ions = 0.2M)

No.	resin	amount of copper ion (m mole/g dry resin)				
				after 24 hrs (i)	(ii)	(iii)
1	FCR	in resin	C_{RRA}	4.13	1.65	0.83
		in solution	C_{SRA}	21.20	17.60	5.53
2	FA	in resin	C_{RRA}	4.62	1.44	0.87
		in solution	C_{SRA}	21.94	18.72	5.80
3	FBHa	in resin	C_{RRA}	3.59	1.66	0.82
		in solution	C_{SRA}	21.82	17.71	5.47
4	FuA	in resin	C_{RRA}	3.27	1.78	0.89
		in solution	C_{SRA}	24.08	18.99	4.23
5	FTB	in resin	C_{RRA}	3.74	2.02	1.15
		in solution	C_{SRA}	22.73	18.18	5.46

nickel sulphate in ammonium hydroxide in presence of excess ammonium ions (0.2M) (pH~8.8) were prepared.

About 0.1 g (exactly weighed) acid form of the resin was taken in a dry 250 ml bottle with a stopper. To the sample in the bottle were added 100 ml of one of the above nickel (II) solutions. The mixture was kept for 24 hours with occassional shaking. 10 ml aliquots of the supernatant liquid were titrated against standard E.D.T.A. solution using murexide as the indicator.

The nickel ion uptake was calculated as shown in II.15. The results are presented in Table II.15.

II.24 ZINC ION EXCHANGE :

(in presence of excess NH_4 ions)

Solutions of different concentrations of zinc sulphate in ammonium hydroxide in presence of excess

Table II 15(a)

Nickel ion uptake by resins

(8Q series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of nickel ion (m mole/g dry resin)				
				after 24 hrs (i)	(ii)	(iii)
1	8QR	in resin	C_{RRA}	6.43	3.37	2.14
		in solution	C_{SRA}	25.72	15.32	7.64
2	8QM	in resin	C_{RRA}	5.45	3.54	1.91
		in solution	C_{SRA}	23.16	13.09	8.73
3	8QC	im resin	C_{RRA}	6.18	3.23	2.15
		in solution	C_{SRA}	22.03	13.19	6.45
4	8QB	in resin	C_{RRA}	7.10	3.85	2.66
		in solution	C_{SRA}	23.96	14.21	6.80

Table II 15(b)

Nickel ion uptake by resins

(S series)

(concentration of ammonium ions = 0.2M)

No.	resin			amount of nickel ion (m mole/g dry resin) after 24 hrs (i)	(ii)	(iii)
1	SR	in resin	C_{RRA}	6.50	2.96	1.77
		in solution	C_{SRA}	24.52	15.10	7.67
2	SM	in resin	C_{RRA}	7.05	3.67	2.01
		in solution	C_{SRA}	28.20	16.68	8.71
3	SB	in resin	C_{RRA}	7.34	3.67	2.26
		in solution	C_{SRA}	22.30	13.55	6.78

Table II 15(c)

Nickel ion uptake by resins

(P series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of nickel ion (m mole/g dry resin)				
				after 24 hrs (i)	(ii)	(iii)
1	2	3		4	5	6
1	FCR	in resin	C_{RRA}	3.86	3.12	1.84
		in solution	C_{SRA}	23.16	10.32	5.52
2	FA	in resin	C_{RRA}	6.06	1.93	0.83
		in solution	C_{SRA}	20.93	13.51	4.98

Table II 15(c)(contd.)

1	2	3	4	5	6
3	FBHa	in resin	C_{RRA} 8.04	2.87	1.15
		in solution	C_{SRA} 20.10	13.20	6.90
4	FuA	in resin	C_{RRA} 5.34	2.67	1.19
		in solution	C_{SRA} 23.73	13.74	9.92
.5	FTB	in resin	C_{RRA} 8.66	2.46	1.15
		in solution	C_{SRA} 21.03	13.89	6.90

Table II 16(a)

Zinc ion uptake by resins

(8Q series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of zinc ion (m mole/g dry resin)					
				after 24 hrs			
				(i)	(ii)	(iii)	(iv)
1	8QR	in resin	C_{RRA}	1.53	1.22	1.07	1.07
		in solution	C_{SRA}	30.33	22.98	15.16	7.20
2	8QM	in resin	C_{RRA}	1.36	0.95	0.95	0.82
		in solution	C_{SRA}	26.96	20.56	13.48	6.35
3	8QC	in resin	C_{RRA}	1.08	0.77	1.29	0.53
		in solution	C_{SRA}	27.00	19.50	12.38	6.62
4	8QB	in resin	C_{RRA}	1.41	1.17	1.06	1.03
		in solution	C_{SRA}	23.03	17.32	11.42	6.92

Table II 16(b)

Zinc ion uptake by resins

(S series)

(concentration of ammonium ions = 0.2M)

No.	resin	amount of zinc ion (m mole/g dry resin)				
			after 24 hrs			
			(i)	(ii)	(iii)	(iv)
1	SR	in resin C_{RRA}	2.96	1.77	1.18	0.89
		in solution C_{SRA}	27.82	21.54	14.45	7.12
2	SM	in resin C_{RRA}	2.01	1.67	1.51	1.17
		in solution C_{SRA}	32.83	24.72	16.27	7.85
3	SB	in resin C_{RRA}	2.54	1.69	1.11	0.85
		in solution C_{SRA}	26.81	20.56	13.60	6.80

Table II 16(c)

Zinc ion uptake by resins

(P series)

(concentration of ammonium ions = 0.2M)

No.	resin		amount of zinc ion (m mole/g dry resin)			
			after 24 hrs			
			(i)	(ii)	(iii)	(iv)
1	2	3	4	5	6	7
1	FCR	in resin C_{RRA}	1.65	1.38	1.24	0.10
		in solution C_{SRA}	26.95	20.42	13.36	0.67
2	FA	in resin C_{RRA}	1.51	1.30	0.10	0.08
		in solution C_{SRA}	27.04	21.52	1.41	0.64

Table II 16(c)(contd.)

1	2	3		4	5	6	7
3	FBHa	in resin	C_{RRA}	1.87	1.52	1.42	1.15
		in solution	C_{SRA}	28.04	20.31	17.28	6.61
4	FuA	in resin	C_{RRA}	1.78	1.48	1.19	1.04
		in solution	C_{SRA}	29.07	21.90	14.58	6.98
5	FTB	in resin	C_{RRA}	1.44	1.29	1.00	0.09
		in solution	C_{SRA}	28.51	21.31	14.14	0.72

to different bottles and kept for 24 hours with occassional shaking. The resins were filtered, dried and weighed. The solvent uptake (SU) was calculated as

$$SU = \frac{\text{final weight} - \text{initial weight}}{\text{initial weight}}$$

The results are presented in Table II.17.

II.26 MAGNETIC SUSCEPTIBILITY :

Copper (II) loaded resin 8QR was prepared by treating acid form resin with the solution of copper sulphate in ammonium hydroxide.

Magnetic susceptibility measurements were carried out using Gouy's magnetic balance at room temperature. Mass magnetic susceptibility was found to be 1.016×10^{-6}.

II.27 I. R. SPECTRA :

IR spectra of acid form, NH_4- form and copper-loaded form of the resin 8QR were obtained in KBr pellet form using Backman Model 4220. These spectra are presented in Fig.II.1.

Table II 17(a)

Solvent uptake by resins (acid form)

(8Q series)

No.	resin	solvent uptake (g/g dry resin)			
		water	methanol	acetone	benzene
		(SU)			
1	8QR	0.17	0.18	0.09	0.08
2	8QM	0.08	0.12	0.11	0.08
3	8QC	0.07	0.09	0.05	0.04
4	8QB	0.14	0.15	0.15	0.09

Table II 17(b)

Solvent uptake by resins (acid form)

(S series)

No.	resin	solvent uptake (g/g dry resin)			
		water	methanol	acetone	benzene
		(SU)			
1	SR	0.15	0.16	0.14	0.12
2	SM	0.24	0.25	0.20	0.16
3	SB	0.11	0.12	0.11	0.10

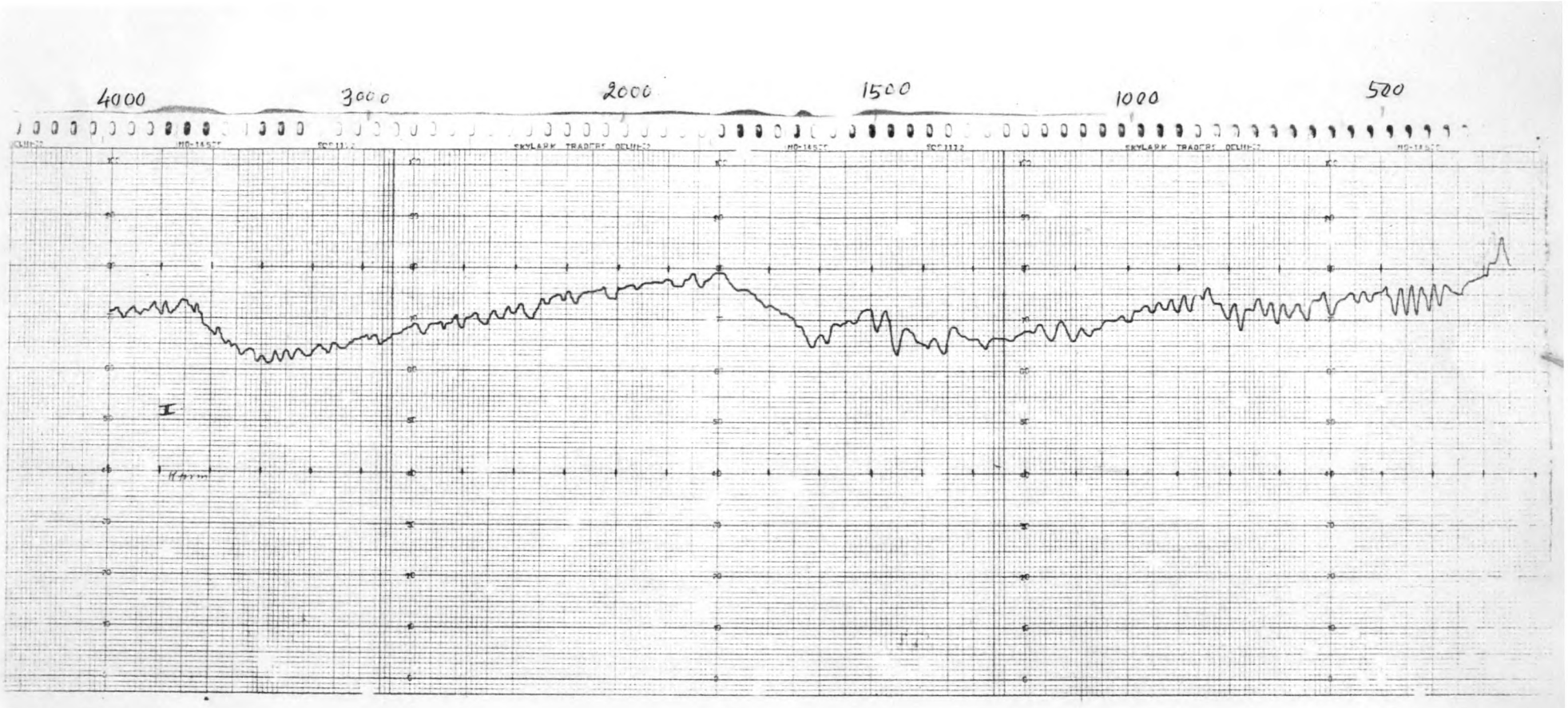

Fig.II.1(a) IR spectrum of 8QR (acid form)

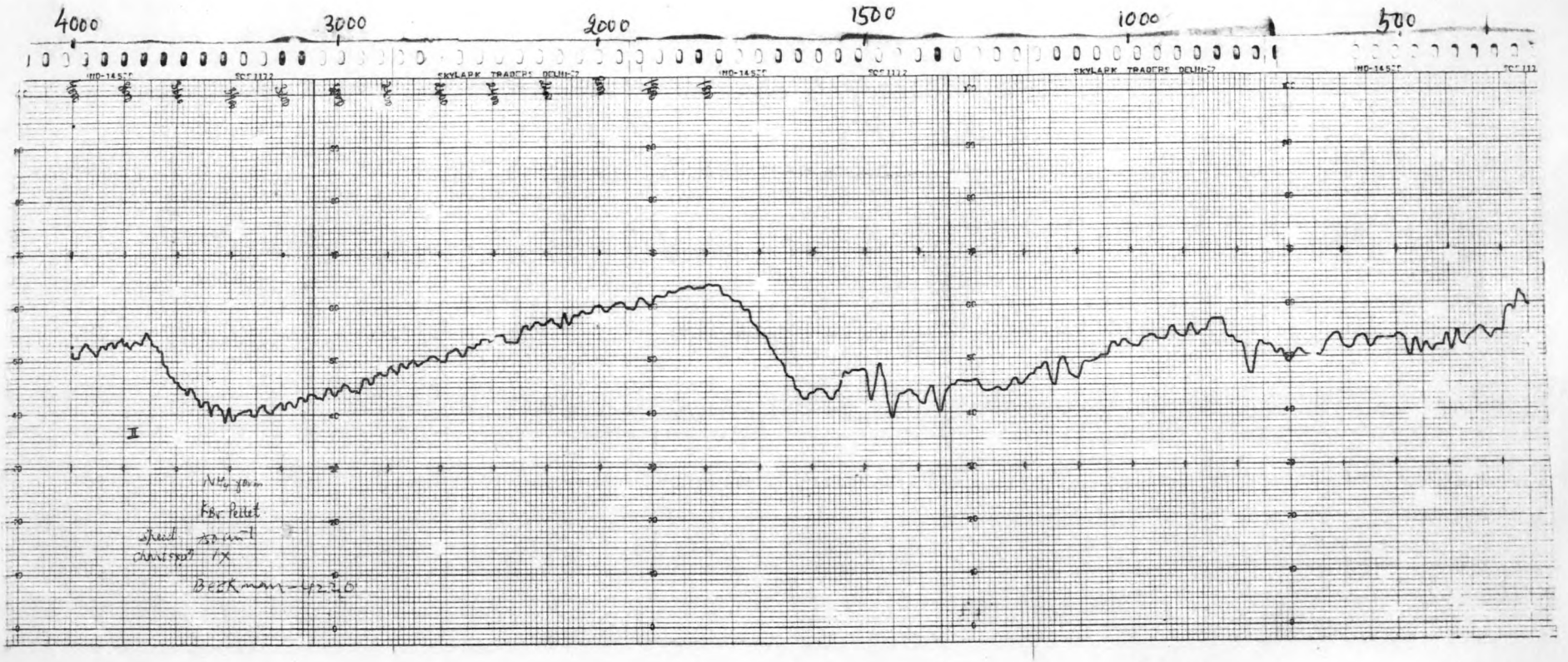

Fig.II.1(b) IR spectrum of 8QR (NH_4 form)

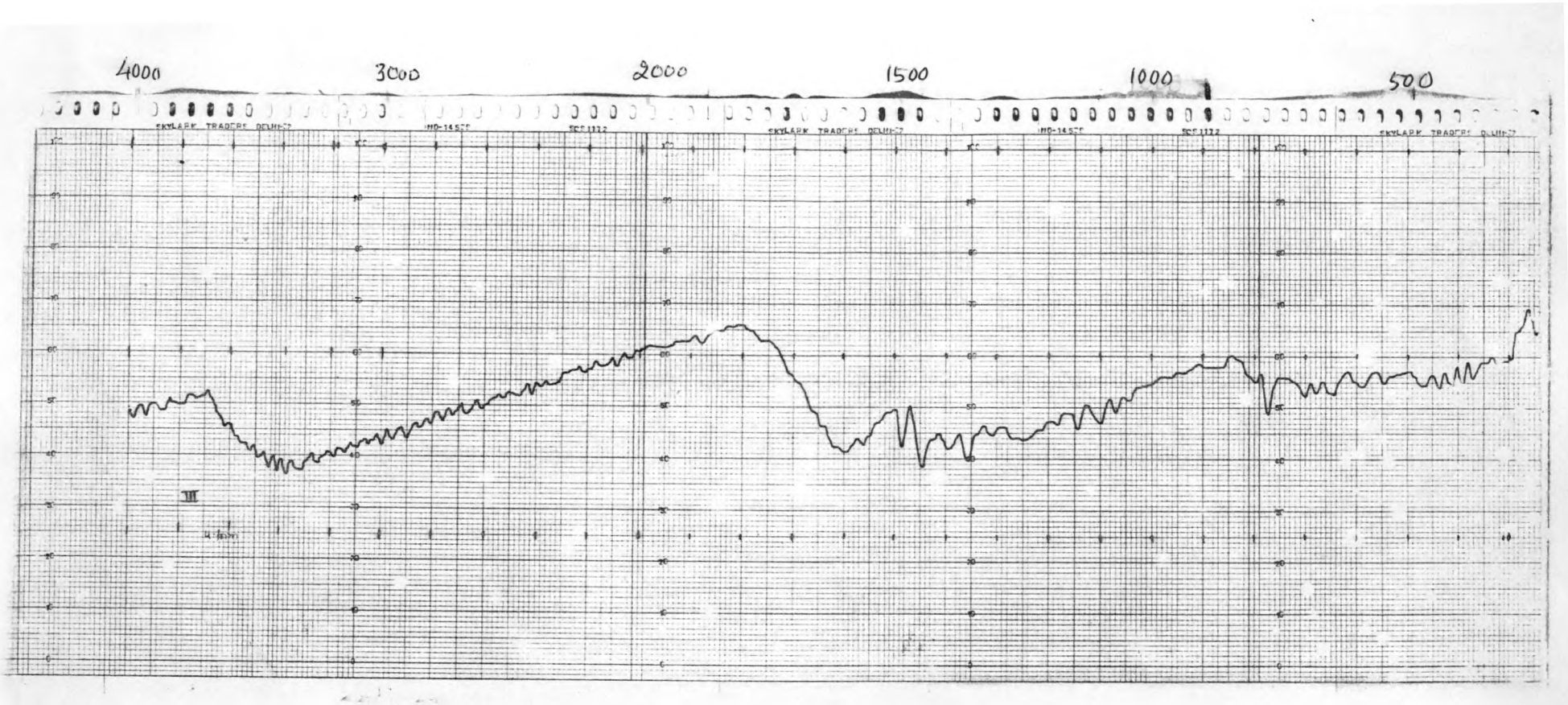

Fig.II.1(c) IR spectrum of 8QR (Cu form)