

Table 2. R_F -values of sugars.

Rhamnose	1.13
Ribose	1.00
Xylose	0.72
Arabinose	0.57
Fructose	0.52
Sedoheptulose	0.52
Mannose	0.50
Glucose	0.39
Mannoheptulose	0.39
Galactose	0.32
Lactose	0.09

Table 3. R_F -values of acids.

Fumaric acid	0.88
Aconitic acid	0.85
Succinic acid	0.83
Pyruvic acid	0.72
Lactic acid	0.72
α -Ketoglutaric acid	0.65
Malic acid	0.54
Isocitric acid	0.52
Citric acid	0.49
Glyceric acid	0.37
Tartaric acid	0.29
Oxalic acid	0.12

by using a simple desalting apparatus, illustrated in Fig. 2. The sample is applied along a line 5 cm from one end of a paper strip, 21 \times 5 cm, pointed at the other end. The strip is placed between two glass sheets, 16 \times 6 cm, in such a way that the pointed end is 1 cm outside the sheets. The other end is immersed in a mixture of acetone, water and ammonia in the proportions 7:3:0.4. After about 8 h all the amino acids have travelled to the pointed end of the strip, leaving most of the salts behind. The end is cut off and eluted with water. The eluate is concentrated and applied for chromatography. The application can, more conveniently, be made automatically by allowing the pointed end of the paper strip to touch the starting-line of

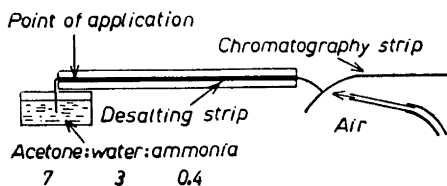


Fig. 2. Desalting apparatus.

the chromatography strip. A blast of air, directed from underneath this strip, accelerates the evaporation and prevents the spot from becoming too big.

About 20 cm has been found to be enough for the desalting strip in the case of *Neurospora*. Other materials may require greater length and time of desalting.

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The Reflection Spectra of Anhydrous Nickel(II) Chlorides and Bromides and Their Double Salts with Monovalent Cations

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It is generally assumed that the nickel ions in anhydrous NiCl_2 , NiBr_2 and their double salts MeNiCl_3 and MeNiBr_3 have the coordination number six. The magnetic properties of the double salts have previously been measured by Asmussen and Soling¹. The reflection spectra of ten solid compounds are given in Fig. 1 and in Table 1. The excited levels corresponding to the absorption maxima agree with the ligand field theory for d^8 -systems in fields of the cubic-octahedral symmetry O_h . Thus a ligand field parameter Δ (also denoted by $(E_1 - E_2)$ or $10Dq$) can be found for each compound. Further the Slater-Condon-Shortley integrals F^k seem to be decreased² in the complexes relative to the Ni^{2+} .

Fig. 1 shows that the ten absorption spectra are remarkably similar. However, the values of Δ given in Table 1 vary within a range of 6 800–7 600 K. Δ decreases with increasing radius of the anion (Cl^- , Br^-) and with increasing radius of the cation (Rb^+ , Cs^+ , $\text{C}_6\text{H}_5\text{NH}^+$). It has previously been discussed³ whether this behaviour can be explained by an electrostatic model. However, it is very probable that partly covalent bonding, *i. e.* intermixing of the partly filled 3d-shell with the orbitals of the ligands, occurs. The latter

Table 1. Spin-allowed bands of nickel(II) complexes and the parameters Δ and $15 B$. Parentheses indicate the shoulders caused by intermixing with the singlet level ${}^1A_1(D)$.

	${}^3\Gamma_4(F)$	${}^3\Gamma_4(P)$	Δ	$15 B$
Ni^{+2}	0	16 900	0	16 900
α -NiCl ₂	(11 600), 12 900	22 100	7 600	11 300
β -NiCl ₂	(11 600), 12 900	22 100	7 600	11 300
RbNiCl ₃	(11 500), (12 700)	21 600	7 200	11 700
CsNiCl ₃	(11 300), (12 500)	21 500	7 100	11 600
C ₅ H ₅ NHNiCl ₃	11 200, (12 500)	21 300	7 000	11 900
α -NiBr ₂	(10 300), 12 100	20 700	7 300	10 900
β -NiBr ₂	(10 300), 12 100	20 700	7 300	10 900
RbNiBr ₃	(10 400), 11 500	20 200	7 000	11 500
CsNiBr ₃	(10 300), 11 300	20 000	6 900	11 600
C ₅ H ₅ NHNiBr ₃	(10 300), 11 200	19 900	6 800	11 700
Ni(OH ₂) ₆ ⁺²	13 500, (15 400)	25 300	8 500	14 100
Nien ₃ ⁺²	18 350	29 000	11 600	12 500

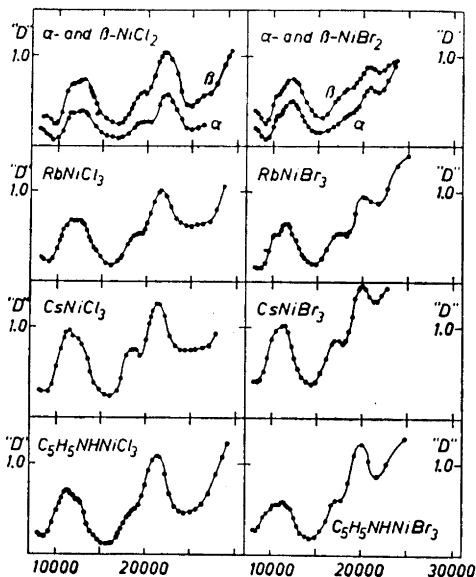


Fig. 1. Reflection spectra of nickel(II) halides measured by means of a Beckman DU spectrophotometer. (The optical density "D" is only a relative measure for the light absorbed).

possibility is supported by the fact that the values of a linear combination of F^k -integrals, viz. $15 B$, is relatively more decreased among our examples, when Δ is large. For comparison with nickel(II) complexes with neutral ligands the values of Δ and $15 B$ for Ni(OH₂)₆⁺² and Nien₃⁺²

are also given in Table 1. Even though the partly covalent bonding (as implied from decreased F^k -values) might seem rather important in nickel(II) halides compared with other nickel(II) complexes, it must be noted that similar or even stronger effects are observed in halide complexes of chromium(III) and rhodium(III)².

Further Fig. 1 shows that the wavenumbers of the absorption bands are identical for the α - and β -modifications of NiCl₂ and NiBr₂. Mr. P. Andersen⁴ has demonstrated that α -NiCl₂ and α -NiBr₂ has more disordered structure than the high-temperature β -forms. Generally the distribution of atoms, which are not directly coordinated to the transition group ion, has very small influence on the d^n -levels⁵. The nickel(II) halides, which do not contain monovalent cations, seem to be most tightly bound, i. e. Δ is large and $15 B$ much decreased.

Experimental. Preparation and analysis of the double halides are given elsewhere¹. α - and β -NiCl₂ and α - and β -NiBr₂ were kindly supplied by Mr. P. Andersen⁴.

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