NOTES

Ionic Radii of the Histadyl and Pyrilamine Cations

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Recent studies of the physical chemistry of the antihistamines[2] have been valuable in the correlation of the pharmacological properties of such compounds with certain of their physical properties. It is thought that the ionic radius of an antihistamine may be important in its biological efficiency. This paper describes two techniques which were used to determine the ionic radius of the Histadyl and Pyrilamine cations. The radii obtained by the two methods for Histadyl are in close agreement; however no satisfactory radius could be obtained by the apparent molal volume method for Pyrilamine.

Experimental

Materials.—Histadyl (N,N-dimethyl-N′,2-thenyl-N′-α-pyridylethylenediamine hydrochloride), which was furnished by Eli Lilly and Co., carried the manufacturers specifications of HCl: 12.1-12.4%, Histadyl base: 87.0-87.5%. Pyrilamine (N-*p*-methoxybenzyl-N′,N′-dimethyl-N-α-pyridylethylenediamine maleate), which was furnished by Merck and Co., carried the manufacturers ultraviolet Assay of 99.8% Pyrilamine. The materials were used without further purification since conductance studies[3] of recrystallized products showed no deviation from the original material received.

Methods. I. Ionic Radii from Ionic Conductances.—An equation based on Stokes law[4] permits the calculation of ionic radii from a knowledge of the limiting ionic conductance, $l°$, viscosity of solvent, η, and the valence of the ion, Z. The simplified equation has the form

$$l°\eta = \frac{0.8147 \times 10^{-8}\,|Z|}{r}$$

where r is the ionic radius in centimeters. The values for $l°$ for the Histadyl and Pyrilamine cations have been previously reported.[3] The viscosity of water was taken as 8.949 millipoises at 25°.[5] Substituting these values into the equation gives 3.96×10^{-8} cm. and 3.75×10^{-8} cm. as the radii of the Histadyl and Pyrilamine cations, respectively.

II. Ionic Radii from Apparent Molal Volumes.—The apparent molal volumes of cesium and rubidium chlorides, bromides and iodides may be represented to a close approximation by the equation,[6] $\phi = 6.47\ (r^{3+} + r^{3-})$ where ϕ is the apparent molal volume and r is the crystallographic radius. It was assumed that this equation might be applied to Histadyl since large ions are involved in both cases. The apparent molal volume for Histadyl was evaluated from the relation[7]

$$\phi = \frac{1000}{c} - \frac{1}{d'}\left(\frac{1000d}{c} - M\right)$$

where M is the molecular weight of the solute, d' and d are the densities of the solvent and solution, respectively, and c is the concentration of solute in moles per liter.

Table I gives the apparent molal volumes of various concentrations of Histadyl. The densities shown were determined with a Weld pycnometer.

Table I

Apparent Molal Volumes of Histadyl

c	Density	ϕ (ml.)
0.13198	1.00426	243.7
.23003	1.00972	243.7
.30377	1.01397	242.8
.40761	1.01966	242.9

Using the value 243 ml. for the apparent molal volume and the crystallographic radius of the chloride ion as 1.81×10^{-8} cm.[4] the value for the ionic radius of Histadyl is 3.84×10^{-8} cm. which agrees closely with the value obtained from ionic conductances.

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[1] Abstracted in part from the Ph.D. Thesis of H. B. Johnson, Kansas State College, 1952.

[2] A. V. Tolstoouhov, *Trans. N. Y. Acad. Sci.*, **14**, 260 (1952).

[3] A. C. Andrews and H. B. Johnson, *Trans. Kans. Acad. Sci.*, **56**, 449 (1953).

[4] H. S. Harned and B. B. Owen, "The Physical Chemistry of Electrolytic Solutions," Reinhold Publ. Corp., New York, N. Y., 1950.

[5] "International Critical Tables," Vol. 3, McGraw-Hill Book Co., New York, N. Y., 1929, p. 10.

[6] R. H. Stokes and R. A. Robinson, This Journal, **70**, 1870 (1948).

[7] E. M. Baker, *ibid.*, **71**, 3336 (1949).

The Chemical State of F^{18} from the Fast Neutron Irradiation of Fluorobenzene

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Experimental

We have irradiated fluorobenzene with fast neutrons obtained by bombardment of beryllium with 26 Mev. deuterons in the Philips synchrocyclotron. The fluorobenzene was prepared from $C_6H_5N_2BF_4$ and had been purified by simple distillation. Before the start of the experiment the liquid had been treated with a concentrated solution of hydrofluoric acid to introduce a carrier for the inorganic radiofluorine. (The quantity of hydrofluoric acid dissolved in this way amounts to much less than 1% of the organic fluorine.)

The fluorobenzene was irradiated in a brass cylinder, which was gold-plated on the inside. It was closed by means of a disc of polyvinyl chloride with a screwed-on top on the outside and a thin gold foil on the inside. To separate the inorganic radiofluorine from the organic fraction the contents of the cylinder were poured into a brass tube which was gold-plated on the inside and mixed with a solution of sodium hydroxide and sodium fluoride. The mixing was done by means of a gold-plated silver vibrating stirrer. The liquid was then separated in a separating funnel and the two fractions collected in glass tubes. The original cylinder was rinsed with hydrogen fluoride and this liquid collected in the gold-plated tube which had served for the first separation.

All fractions were measured in their glass or brass tubes in a Philips hollow liquid γ-counter (No. 18508), which is eminently suitable for this purpose. We made sure that the sensitivity for the radiation of F^{18} was the same for all tubes. The activity found in the wash liquid and on the wall of the gold-plated tube, which at most amounted to about 10% of the total, was added to that of the inorganic fraction. The correct half-life for F^{18} was observed in all cases. We found 0.64 of the activity in the inorganic fraction with a probable error of a few per cent. (In the final series individual experiments gave the figures: 0.68, 0.64, 0.62, 0.67, 0.59 and 0.63.)

The main uncertainty lay in the danger that the radiofluorine atoms might react with the gold-plated walls. We were unable to prove that this complication did not occur, as the brass cylinder became so active that we would not have been able to recognize the F^{18} in its decay curve. We did, however, carry out some irradiations in which a very