Short Communications

Ion Exchange of Quaternary Salts

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It is well known that organic ions of a high molecular weight are difficult to elute once they are taken up by a cation exchange resin containing a "normal" network. The ion exchange process seems not to be totally reversible (e.g. Refs.¹⁻⁴). Lately, several authors have used cation exchange resins with a low percentage of crosslinking, (e.g. Refs.⁵⁻⁷). They could elute tertiary alkaloidal cations from the resins with alcoholic ammonia. Büchi and Furrer⁸ also tried 10 % hydrochloric acid for the elution of quinine, but very large eluates were necessary.

We have repeated their experiments, using Dowex 50-X1, a cation exchange resin with 1 % crosslinking. 200–300 mg of quinine sulphate was applied to a column (10 × 150 mm). All the quinine was taken up and could be quantitatively eluted with 25 ml of 10 % ammonia in 60 % alcohol. However, a full recovery was also obtained with 75 ml of 2 N hydrochloric acid in 70 % alcohol.

On account of this very interesting result we tried to elute quaternary cations from Dowex 50-X1 with alcoholic media.

Method. Suitable quantities, usually 1–2 mg, of the compounds dissolved in water or alcohol of various strengths were run through a column, 4 × 30 mm, of Dowex 50-X1 (200–400 mesh) in its hydrogen form. The column was washed with the solvent. The bases were completely adsorbed. After elution, usually with 25 ml of the elutriant, the bases were determined by means of their ultraviolet spectra. Benzethonium chloride was titrated by Carkhuff and Boyd's method⁹.

Results: 9-(4-Dimethylaminobenzylidene)-fluorene ethyltosylate. Aqueous mineral acids up to 2 N were without effect. 50 % alcoholic solution of mineral

acids gave total yields if the acid was 1–2 N. Further, at this alcohol level there is a difference between perchloric, hydrochloric, and sulphuric acids as 0.2 N perchloric acid gave a full yield in contrast to hydrochloric which gave 60 % and sulphuric acid 20 % yields. 70 % alcoholic solution of mineral acids gave total yields if the acid was 0.5–2 N.

Experiments with aqueous and alcoholic potassium hydroxide were unsuccessful. 5 % sodium bromide in 70 % alcohol gave 95 % yield in 50 ml eluate.

Hyoscyne methylnitrate. Of this alkaloid 10–15 mg was taken and was quantitatively eluted by 20 ml of 1 N hydrochloric acid in 50 % alcohol.

Codeine ethyliodide. The positive ion was eluted to 85–95 % by aqueous 1 N hydrochloric acid and totally by the same acid in 50 % alcohol. 0.5 N potassium hydroxide in 70 % alcohol gave 100 % recovery.

Papaverine ethyltosylate. 15–25 ml of 1 N hydrochloric acid in 50 % alcohol gave 100 % recovery.

Berberine sulphate. 1 N hydrochloric acid in 70 % alcohol gave a quantitative yield.

Strychnine ethyliodide. 1 N hydrochloric acid in water gave 75–80 %, in 50 % alcohol 85 %, and in 90 % alcohol 100 % recovery.

Benzethonium chloride. 100 % recovery was obtained with 10 ml of 1 N sulphuric acid in 90 % alcohol.

A full report will be given in a later publication.

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Mass Spectrometric Determination of the Structure of Phthiocerol

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The position of the methoxyl group in phthiocerol previously inferred from mass-spectrometric and X-ray data¹ has now been confirmed by a mass-spectrometric study of synthetic 3-methoxy-4-methylheptene-6. The spectrum of this molecule, like that of phthiocerol, shows an intense peak at $m/e = 73$, arising from cleavage between carbon atoms 3 and 4.

A similar study of the parent hydrocarbon, phthiocerane², definitely settles the structure of this hydrocarbon in favour of 4-methyltetratriacontane and not 4-methyltrtriacontane, which previously appeared more likely³⁻⁵. The mass-spectrum shows a small parent peak at $m/e = 492$ corresponding to $C_{35}H_{72}^+$ (ionized unfragmented molecule), and very strong peaks at $m/e = 449$ and $m/e = 421$ corresponding to $C_{33}H_{65}^+$ and $C_{30}H_{41}^+$, respectively, arising from cleavage on both sides of the tertiary carbon atom in position 4.

Parts of the mass-spectra of phthiocerol, 16,17-dihydroxydotriacontane, and 2,4-dihydroxyeicosane are shown in Fig. 1. A comparison between the spectrum of phthiocerol and those of the two synthetic glycols shows that phthiocerol is an 1,3-glycol as previously demonstrated by Demarteau-Ginsburg and Lederer⁶ and excludes the possibility that phthiocerol is an 1,2-glycol. In the spectrum of 17,19-dihydroxyeicosane (2,4-dihydroxyeicosane) the C_{15} -alkene peaks $C_{15}H_{30}^+$ and $C_{15}H_{28}^+$ are considerably stronger than the corresponding peaks in the C_{14} - and C_{16} -groups. In the phthiocerol spectrum the $C_{20}H_{40}^+$ and $C_{20}H_{38}^+$ peaks are similarly increased, indicating the presence of a hydroxyl group in position 22. In phthiocerol the C_{27} - and C_{28} -groups of peaks are very weak, but a comparison with 17,19-dihydroxyeicosane is of course not possible as this molecule is too short. A comparison with the spectrum of 16,17-dihydroxydotriacontane, where the C_{20} - and C_{21} -groups of peaks are weak, does indicate, however, that phthiocerol has no hydroxyl group in position 25 or 26 from the normal chain end of the molecule.

Through the kind co-operation of Professor E. Lederer we have been able to make mass-spectrometric and monolayer studies of the acidic long-chain product obtained by Mme Demarteau-Ginsburg by oxidation of phthiocerol. The sample was found to consist of a mixture of about equal amounts of n - C_{32} - and n - C_{34} -acid together with smaller amounts of n - C_{31} - and n - C_{33} -acid. The presence of behenic acid supports the conclusion that phthiocerol has a hydroxyl group in position 22.

The presence of n -tetracosanoic acid appears more difficult to explain. This acid might arise from elimination of the hydroxyl group in position 22 before cleavage of the chain between the 24th and 25th carbon atom. It is hoped to settle this question by the study of oxidation products of a suitable synthetic 1,3-glycol.

Phthiocerol would thus have the empirical formula $C_{35}H_{69}(OH)_2OCH_3$ and be one of the sixteen theoretically possible stereoisomers of 3-methoxy-4-methyl-11,13-dihydroxytetratriacontane.

The mass-spectra of phthiocerol preparations from a virulent human strain of