cis-2,6-*p*-Dioxanedimethanol

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During a study of derivatives of *p*-dioxane, *cis*-2,6-*p*-dioxanedimethanol (I) and some of its derivatives have been prepared. Structures and configurations of these compounds were proved by relating them to 2,6-derivatives of *p*-dioxane whose configurations were proved by Summerbell and Stephens.[1]

Allyl ether was converted to 2,6-bis(iodomethyl)-*p*-dioxane (II) and the cis form was isolated by fractional crystallization.[1,2] Under mild conditions *cis*-II is converted by silver acetate to *cis*-2-acetoxymethyl-6-iodomethyl-*p*-dioxane (III) and under more severe conditions to *cis*-2,6-bis-(acetoxymethyl)-*p*-dioxane (IV), paralleling the observations of Summerbell and Stephens[3] on the corresponding 2,5-isomers. As would be expected III can also be converted to IV. Transesterification by the procedure of Summerbell and Stephens[3] gave *cis*-2,6-*p*-dioxanedimethanol (I) from IV.

The configurations of I, III, and IV were shown to be *cis* by oxidizing them to *cis*-2-6-*p*-dioxanedicarboxylic acid (V) with nitric acid.[1] Mixed melting points of the oxidation products with authentic V showed no depression.

EXPERIMENTAL

All melting points are uncorrected. No effort was made to investigate the conditions required for obtaining optimum yields, since the amounts obtained the first time were sufficient for the purposes for which the compounds were prepared.

cis-2-Acetoxymethyl-6-iodomethyl-p-dioxane (III). A solution of 200 g. of *cis*-2,6-bis(iodomethyl)-*p*-dioxane (m.p. 93–95°) in 300 ml. of benzene was refluxed with 210 g. of freshly prepared silver acetate for 43 hr. The mixture was filtered and the filtrate was concentrated by distilling the solvent. Addition of ethanol precipitated some II which was filtered off. An equal volume of methanol was added to the filtrate, and chilling gave 57 g. of solid, m.p. 40–42°. Fractional crystallization first from water and then from a mixture of petroleum ether and ethyl ether yielded III, m.p. 43.5–44.5°.

Anal. Calcd. for $C_8H_{13}IO_4$: C, 32.01; H, 4.37; I, 42.30. Found: C, 32.12, 31.89; H, 4.55, 4.50; I, 42.31, 42.18.

Some starting material (II) and a mixture of m.p. 38° were obtained by further work up of the solutions. Only 16 g. of purified III was obtained, but quantitative recovery was not attempted. However, infrared examination of the impure fractions and recovery of starting material indicated about 50% conversion and 70% yield. Oxidation of III with nitric acid gave V, m.p. and mixed m.p. with authentic V, 179–180°.

cis-2,6-bis(Acetoxymethyl)-p-dioxane (IV). Using a suspending medium of higher boiling point and a greater excess of silver acetate than in the preparation of III, a xylene-toluene solution of 107 g. of II was refluxed for 24 hr. with 330 g. of silver acetate. The silver salts were removed and the filtrate was freed of solvent by distillation, leaving 88 g. of residue. This was distilled at the full vacuum of the pump (about 0.5 mm.) giving 72 g. of distillate in the boiling range 115–117° and a small liquid residue. The distillate contained 33.1% iodine, and on standing in the refrigerator it partially crystallized. The crystals were filtered off, purified, and further separated into two components identified as III and a small amount of II. The oily liquid filtrate, 41 g., completely solidified at 0° and melted from about 10° to 27°. It was believed to be a mixture of II, III, and IV.

This 41 g. of liquid was again treated with excess silver acetate (93 g.), this time in 750 ml. of glacial acetic acid, and the mixture was heated and stirred for 48 hr. just below reflux temperature. The mixture was cooled and filtered, and 32 g. of silver iodide was recovered by treating the filter cake with dilute nitric acid to remove the excess silver acetate. After distilling the acetic acid from the filtrate, the product was rapidly distilled and the fraction boiling around 120° (0.5 mm.) was collected. The distillate gave a negative test for iodine, solidified in the refrigerator, and did not remelt at room temperature. Recrystallization from benzene-petroleum ether and ethyl ether–petroleum ether mixtures gave 21 g. of pure IV, m.p. 44–45°.

Anal. Calcd. for $C_{10}H_{16}O_6$: C, 51.72; H, 6.94. Found: C, 51.81, 51.71; H, 7.02, 6.90.

The infrared spectrum showed strong acetate bands and negligible hydroxyl content. Oxidation with nitric acid[1] gave V, m.p. 178–179°; mixed m.p. with authentic V was the same.

cis-2,6-p-Dioxanedimethanol (I). Transesterification was conducted according to Summerbell and Stephens,[3] refluxing 15 g. of IV in 100 ml. of 3.5% methanolic hydrogen chloride for 1 hr. The solvent was removed *in vacuo* and small amounts of a mixture of benzene and isopropyl alcohol were added and distilled off until the vapors no longer gave an acid reaction with moist indicator paper. The residue was rapidly distilled, boiling at 115° (about 0.5 mm.), yield 8 g. Seed crystals were prepared in a small sample and they caused the distillate to solidify to colorless, very hygroscopic crystals. The material was recrystallized from a mixture of benzene, isopropyl alcohol, and a little petroleum ether, taking care to exclude moisture. The analytical and melting point samples were carefully dried *in vacuo* over phosphorus pentoxide and sealed off under dry air. The *cis*-2,6-*p*-dioxanedimethanol thus obtained melted at 57–58°.

Anal. Calcd. for $C_6H_{12}O_4$: C, 48.65; H, 8.16; mol. wt., 148. Found: C, 48.55, 48.49; H, 8.38, 8.28; mol. wt., 143. The carbon content and molecular weight values indicate a water content of 0.5%. In the mass spectrometer the highest mass number found was 148.

Nitric acid oxidation of I gave a solid which was recrystallized from water and then from a mixture of benzene-dioxane-petroleum ether. The crystals from water are apparently a hydrate, melting and resolidifying after some boiling at about 110°, then remelting at 180°. The carefully dried analytical sample melted at 180° (lit.[1] for *cis*-2,6-*p*-dioxanedicarboxylic acid, m.p. 177–178°, 179°).

Anal. Calcd. for $C_6H_8O_6$: C, 40.91; H, 4.58; neut. equiv., 88.1. Found: C, 40.86, 41.02; H, 4.48, 4.68; neut. equiv. 86.6, 87.9.

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(1) R. K. Summerbell and J. R. Stephens, *J. Am. Chem. Soc.*, **76**, 731 (1954).

(2) A. N. Nesmeyanov and I. F. Lutsenko, *Bull. acad. sci. U.R.S.S., Classe sci. chim.*, 296 (1943).

(3) R. K. Summerbell and J. R. Stephens, *J. Am. Chem. Soc.*, **76**, 6401 (1954).