Reaction of diisopropylcadmium with terebic acid chloride. An ether solution (47.5 cc.) of isopropylmagnesium bromide (0.065 mole[16]) was cooled to 0°, and 10 g. (0.037 mole) of powdered anhydrous cadmium bromide was added in several portions during about 5 min. The solution was stirred under ice-cooling until a negative Gilman test for Grignard reagent was obtained (usually in about 30 min.). A solution of 5.5 g. (0.031 mole) of terebic acid chloride in 20 ml. of benzene was added during about 5 min. After stirring has been continued for 4 hr. under ice-cooling and for 2 hr. at room temperature, the reaction vessel was kept air-tight and allowed to stand for a week. After addition of ice and 6*N* hydrochloric acid and extraction of the aqueous layer with ether, the total ether solution was successively washed once with water, twice with 5% sodium carbonate solution, and three times with sodium chloride solution; then it was dried. There remained 3.8 g. of a neutral product C; $\nu_{\max}^{CCl_4}$ 1780 cm.$^{-1}$ (lactone), 1730 cm.$^{-1}$ (ester), 1710 cm.$^{-1}$ (ketone). Distillation gave 2.8 g. of colorless liquid, b.p. 138–141° (8 mm.). Upon seeding, it formed colorless crystals (2 g.; 32%), which were identified with isopropyl terebate by mixed melting point determination. When the oily portion of the distillate was allowed to stand for a long time (about 1 month) with Brady reagent in ethanol, a 2,4-dinitrophenylhydrazone (1.2 g.; 10.6% based on terebic acid chloride) was obtained. A sample for analysis was prepared by recrystallization from methanol; it formed orange needles, m.p. 175–176.5°.

Anal. Calcd. for $C_{16}H_{20}O_6N_4$: C, 52.74; H, 5.53. Found: C, 52.80; H, 5.67.

Reaction of the ketone (II) *with Blaise reagent.* The above mixture C (900 mg.; prepared in another run) containing the ketone (II) and isopropyl terebate was dissolved in 2 ml. of dry benzene. The solution was added with stirring under cooling with ice to 7.5 ml. of isopropylzinc iodide-benzene solution which contained 0.002 mole of the reagent. After the stirring was continued for 2 hr., the reaction mixture was allowed to stand at room temperature for 8 days. The reaction mixture was hydrolyzed with ice and 6*N* sulfuric acid; the separated organic layer and ether extracts were combined and washed successively with water, 5% sodium bicarbonate, and saturated sodium chloride aqueous solution. After having been dried with anhydrous sodium sulfate, the solvent was removed under reduced pressure. A pale orange-red oily residue (750 mg.) was obtained. The residue was negative to Baeyer reagent to which pyrocin is positive. On treatment with Brady's Reagent, the residue afforded dinitrophenyl hydrazone of the ketone (II). The NMR spectrum of the residue was reproduced in Fig. 1.

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[16] Analysed by Gilman's method; *cf.* ref. 13.

The Preparation of Acetylated Aldonic Acids

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The fully acetylated aldonic acids are important as intermediates in the synthesis of ketones[1] and some aldoses.[2] However, attempts to acetylate the aldonic acids or their salts have demonstrated that the yield of the desired product not only depends upon the stereochemistry of the acid but, with any given acid, varies markedly with the particular salt employed.[3]

The most generally applicable method for the preparation of acetylated aldonic acids involves formation of the amide, followed by acetylation, and then regeneration of the free acid from the amide,[4] although in some instances the use of this procedure has proved difficult.[5]

This report describes a method for the preparation of acetylated aldonic acids in good yields from the salts of the acids. The yields obtained are virtually independent of the salt used.

EXPERIMENTAL

A solution prepared at room temperature of 1.75 g. (12.9 mmoles) of fused zinc chloride in 25 ml. of acetic anhydride was cooled to −5° and 5 g. (24.3 mmoles) of finely divided potassium arabinonate was added. The suspension was then saturated with dry hydrogen chloride, care being taken to maintain a reaction temperature of less than 5°. When saturated, the mixture was set at room temperature and protected from atmospheric moisture by a calcium chloride tube. After standing at room temperature for periods varying from 5 to 18 hr. the reaction mixture was chilled in an ice bath and small portions of chipped ice were added cautiously to destroy the excess acetic anhydride. To ensure complete destruction of the anhydride, the reaction mixture was left at 0° for 1 hr., then diluted to approximately 100 ml. with water, and extracted six to eight times with 30-ml. portions of chloroform or dichloromethane. The extracts were dried over sodium sulfate, filtered from the drying agent, and concentrated *in vacuo* at 40° to a yellow sirup. This sirup was twice concentrated *in vacuo* with 40-ml. portions of toluene, then dissolved in 25 ml. of warm toluene, and the solution cooled. Crystallization occurred spontaneously within a few hours. The yield varied from 6.0 to 6.8 g. (74–84%) and the material melted at 135–136°, with $[\alpha]_D^{25}$ +32.0° (*c* 4.0, chloroform).

The yields of acetylated aldonic acids and their physical constants are listed in Table I. All of the acetates were prepared in a similar fashion to that described above except that the ammonium salts were allowed to react for a longer time because of their slower solubilization in the reaction mixture.

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