40. 3 : 6-*Dimethyl Glucose.*

By D. J. Bell.

An addition compound of glucose with two molecules of metaboric acid has been utilised by Brigl and Grüner (*Annalen*, 1932, **495**, 60) for the preparation of 2 : 6-dibenzoylglucose. The possibility occurred to the author that similar treatment of the α- and the β-methylglucoside might produce 2 : 6-derivatives. The reactions indeed led to the formation of substances, having the composition of methylglucoside dimetaboric acid, which, when methylated in dry acetone, yielded about 50% of the original methylglucosides as the dimethyl derivatives. As these would not crystallise, they were benzoylated (compare Oldham, *J. Amer. Chem. Soc.*, 1934, **56**, 1360). The α-compound yielded no crystalline derivative and was not further investigated. A crystalline derivative obtained from the dimethyl β-methylglucoside (the yield, however, indicated that the original dimethyl derivative was a mixture of isomerides) was identified as 2 : 4-dibenzoyl 3 : 6-dimethyl β-methylglucoside by conversion into the 2 : 4-di-*p*-toluenesulphonate recently synthesised by Oldham (unpublished work). Debenzoylation of the crystalline dibenzoate gave a syrupy 3 : 6-*dimethyl* β-*methylglucoside*, and hydrolysis of the glucosidic methoxyl group yielded crystalline 3 : 6-*dimethyl glucose.* This compound shows downward mutarotation in water and therefore has the α-configuration.

That the 2 : 6-derivative was present in the mixture of dimethyl β-methylglucosides was shown in the following manner. Debenzoylation, followed by toluenesulphonation, of the syrupy residues after the crystallisation of 2 : 4-dibenzoyl 3 : 6-dimethyl β-methylglucoside gave a crystalline product, from which on fractionation 3 : 4-di-*p*-toluenesulphonyl 2 : 6-dimethyl β-methylglucoside, identical with the synthetic product of Oldham and Rutherford (*J. Amer. Chem. Soc.*, 1932, **54**, 1086), was isolated.

The above results show that the dimetaboric acid complexes are not homogeneous with respect to structure. It was also observed that only one molecule of the acid could be titrated with alkali in the presence of glycerol.

Experimental.

Condensation of α- and β-Methylglucoside with Metaboric Acid.—10 G. of the glucoside and 4·8 g. (2 mols.) of metaboric acid (both finely powdered and dried in a vacuum over phosphoric oxide) were boiled on the water-bath for 3 hours with 100 ml. of dry acetone : only a trace remained undissolved. When dry benzene was added to the filtered liquid, a crystalline precipitate formed; this was washed with dry benzene and dry acetone and dried in a vacuum desiccator. The *α-derivative* had $[\alpha]_D^{16^\circ}$ + 84·4°, and the *β-derivative* − 60·4°, in acetone (*c*, 3·2) [Found for the α-derivative : OMe, 10·9; HBO_2 (by titration), 16·1. Found for the β-derivative : OMe, 10·7; HBO_2, 16·0. $C_7H_{14}O_6,2HBO_2$ requires OMe, 11·0; HBO_2, 31·2%].

Methylation of the β-Derivative.—This could be carried out either on the isolated boric acid derivative or with the original reaction mixture. The proportions employed, per mol. of the β-derivative, were acetone, 16 mols., silver oxide, 4 mols., methyl iodide, 6 mols., and the duration of heating at 35° was 6 hours. (Modification of these conditions, or further methylation of the isolated product, did not improve the yield.) After methylation, the solution was filtered and evaporated to dryness, the residue dissolved in potassium carbonate solution, and the dimethyl methylglucoside separated from higher and lower homologues by the author's usual procedure (*Biochem. J.*, 1932, **26**, 590). The yield was one-half to one-third of the weight of the β-derivative (only very small amounts of mono- and tri-methyl glucosides were formed). The product had the composition of a dimethyl methylhexoside, distilled at 150°/0·4 mm. without residue, but would not crystallise.

2 : 4-*Dibenzoyl* 3 : 6-*Dimethyl β-Methylglucoside.*—The mixed glucosides described above were benzoylated in pyridine for 24 hours (100% excess of benzoyl chloride gave the best yield). The product was washed and dried (over sodium sulphate) in ether, and light petroleum (b. p. 40—60°) added until a permanent turbidity was produced. Hard needles were deposited on scratching, and the filtrate gave a second crop on repetition of this treatment. Recrystallisation from methyl alcohol raised the m. p. to 155—156°. Yield, 25%, $[\alpha]_D^{19^\circ}$ (chloroform) − 11·65° (l = 2, c = 3·0) (Found : C, 64·3; H, 6·1; OMe, 21·85. Calc. for $C_{23}H_{26}O_8$: C, 64·2; H, 6·05; OMe, 21·65%).

3 : 6-*Dimethyl β-Methylglucoside.*—2·0 G. of the preceding compound, debenzoylated by Oldham's method (*loc. cit.*), gave 0·9 g. (yield, 90%) of a colourless syrup having $[\alpha]_D^{18^\circ}$ + 55·4° in methyl alcohol and + 62·9° in chloroform (c = 3·5, l = 2) (Found : OMe, 41·8. $C_9H_{18}O_6$ requires OMe, 41·9%).

2 : 4-*Di*-p-*toluenesulphonyl* 3 : 6-*Dimethyl β-Methylglucoside.*—3 : 6-Dimethyl β-methylglucoside (0·67 g.) was treated with *p*-toluenesulphonyl chloride (1·54 g.; 4 mols.) in the minimum of pyridine for 3 days at 25°. After the usual procedure a crystalline residue was obtained from the evaporated benzene solution. Recrystallised from ethyl alcohol (yield, 93%), the crystals melted at 158—160°, had $[\alpha]_D^{15^\circ}$ (chloroform) − 22·8° (c = 4·5, l = 2), and did not depress the m. p. of synthetic 2 : 4-di-*p*-toluenesulphonyl 3 : 6-dimethyl β-methylglucoside (m. p. 158—160°, $[\alpha]_D^{15^\circ}$ − 22·8°).

3 : 6-*Dimethyl α-Glucose.*—The preceding glucoside, in 5% concentration, was heated at 100° in 5% hydrochloric acid until the rotation attained a constant value (4 hours). After neutralisation of the acid with silver carbonate, removal of colloidal silver with norite, and evaporation of the solution to dryness in a vacuum, the sugar was obtained as a straw-coloured glass. The dried product was dissolved in pure ethyl acetate and decolorised with a little norite; from the solution, concentrated somewhat, the sugar was deposited in hard lumps of stout needles, m. p. 113—116° (Found : C, 46·0; H, 7·6; OMe, 30·1. $C_8H_{16}O_6$ requires C, 46·2; H, 7·7; OMe, 29·8%). $[\alpha]_D^{18^\circ}$ in water : initial value + 102·5°, falling to + 61·52°.

In water (c = 3·316, l = 2).

Time (mins.) ...	0	5	15	30	45	17 (hrs.)
$\alpha_D^{18^\circ}$	+ 6·88° (by extrapolation)	6·23°	5·54°	4·92°	4·65°	4·08° (const.)

Isolation of the Toluenesulphonyl Derivative of 2 : 6-*Dimethyl β-Methylglucoside.*—The syrupy residues remaining from the crystallisation of 2 : 4-dibenzoyl 3 : 6-dimethyl β-methylglucoside were debenzoylated and treated with *p*-toluenesulphonyl chloride in the usual manner. The crude crystalline product, m. p. 135—141°, on fractional crystallisation from ethyl alcohol, gave a middle fraction, m. p. 156—158°, which melted at 156—158° when mixed with authentic ditoluenesulphonyl 2 : 6-dimethyl β-methylglucoside, but at 140—152° in admixture with the 3 : 6-dimethyl derivative.

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