255. *The Synthesis of* 2 : 3 : 6-*Tribenzoyl α-Methylglucoside.*

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The importance of sugar derivatives substituted in positions 2, 3, and 6 by acyl groups is well known, but there is no recorded synthesis of α-glucosides of this type. Such a synthesis is now described, and the constitution of the product established.

Several workers have utilised the greater activity of primary than of secondary alcoholic groups in a sugar towards acylating agents in order to introduce substituents into position 6 only (see Ohle and Dickhäuser, *Ber.*, 1925, **58**, 2593; Oldham and Rutherford, *J. Amer. Chem. Soc.*, 1932, **54**, 366; Levene and Raymond, *J. Biol. Chem.*, 1932, **97**, 763). In the present instance 2 : 3-dibenzoyl α-methylglucoside was treated with 1·2 mols. of benzoyl chloride in pyridine, and crystalline 2 : 3 : 6-*tribenzoyl α-methylglucoside* obtained in fair yield, its constitution being established through the following considerations :

(i) Oldham and Rutherford (*loc. cit.*) have shown that, under specified conditions, a toluenesulphonyl group in acylated and methylated glucoses can be replaced by iodine only when it occupies position 6. The new tribenzoate yielded a crystalline p-*toluenesulphonate* which did not react in this way, whereas 2 : 3 : 4-tribenzoyl 6-*p*-toluenesulphonyl α-methylglucoside (Helferich and Becker, *Annalen*, 1924, **440**, 1) gave quantitative replacement.

(ii) 2 : 3-*Dibenzoyl* 4 : 6-*di*-p-*toluenesulphonyl* α-*methylglucoside* was prepared and converted successively through the 6-*iodo*-4-*toluenesulphonyl* and 4-*toluenesulphonyl* derivative into 2 : 3 : 6-*tribenzoyl* 4-p-*toluenesulphonyl* α-*methylglucoside*, identical with the toluenesulphonate of the new tribenzoate.

EXPERIMENTAL.

(Unless otherwise stated, solvents were removed under reduced pressure. Polarimetric observations were made in 2-dm. tubes.)

2 : 3-*Dibenzoyl* α-*Methylglucoside* (I).—Three separate preparations showed, in chloroform, $[\alpha]_D^{19°}$ + 165·6°, and in alcohol, + 157·0° (Mathers and Robertson, J., 1933, 1076, give 102·5° and 154·4° respectively) (Found: OMe, 7·6; C_6H_5·CO, 52·0. Calc. for $C_{21}H_{22}O_8$: OMe, 7·7; C_6H_5·CO, 52·2%).

2 : 3-*Dibenzoyl* 4 : 6-*Diacetyl* α-*Methylglucoside* (II).—2·00 G. of (I) were acetylated with acetic anhydride and sodium acetate; yield, 2·25 g. (93%); needles, from alcohol, m. p. 125—126°; $[\alpha]_D^{17°}$ (chloroform) + 138·1°. Brigl and Grüner (*Annalen*, 1932, **495**, 60) give $[\alpha]_D$ + 141·6° (Found: C, 61·5; H, 5·1. Calc. for $C_{25}H_{26}O_{10}$: C, 61·7; H, 5·4%).

2 : 3 : 6-*Tribenzoyl* α-*Methylglucoside* (III).—1 Mol. of (I) was dissolved in the minimum of dry pyridine, and 1·2 mols. of benzoyl chloride added with cooling. The whole was kept at room temperature for 24 hours, water was then added, and after an hour the product was extracted with benzene in the usual way. The dried benzene solution was concentrated to a thick syrup, and light petroleum added, an oil being precipitated. Further treatment of the oil with light petroleum gave a friable solid, which crystallised on standing in contact with 75% spirit. The crude crystals were dissolved in chloroform (1 vol.) and ether (2 vols.), and light petroleum was added to turbidity; large prisms separated, m. p. 126—132°; yield 60—65%. Recrystallisation from methyl alcohol containing a little water raised the m. p. to 132—133°; $[\alpha]_D^{18°}$ (chloroform) + 141·1° (c = 3·480), + 141·05° (c = 4·263) (Found: OMe, 6·2; C_6H_5·CO, 62·1; C, 66·0; H, 5·3. $C_{28}H_{26}O_9$ requires OMe, 6·2; C_6H_5·CO, 62·3; C, 66·4; H, 5·1%).

2 : 3-*Dibenzoyl* 4 : 6-*Di*-p-*toluenesulphonyl* α-*Methylglucoside* (IV).—2·00 G. of (I) were dissolved in the minimum of dry pyridine, a 50% excess of *p*-toluenesulphonyl chloride added, and the whole kept at 30° for 5 days. After the usual procedure, the crude product was obtained as a colourless glass which crystallised on trituration with alcohol–acetone (equal parts); needles, m. p. 122—124°; yield, 3·50 g. (85%); $[\alpha]_D^{16°}$ (chloroform) + 94·58° (c = 4·100) (Found: OMe, 4·8; C, 58·97; H, 4·9. $C_{35}H_{34}O_{12}S_2$ requires OMe, 4·4; C, 59·15; H, 4·8%).

6-*Iodo*-2 : 3-*dibenzoyl* 4-p-*Toluenesulphonyl* α-*Methylglucoside* (V).—This *compound* was prepared from (IV) by Oldham and Rutherford's sodium iodide–acetone method in theoretical yield. The crude product was a colourless glass which crystallised in contact with a mixture of equal parts of acetone and alcohol; needles, m. p. 136°, not raised by recrystallisation; $[\alpha]_D^{19°}$ (chloroform) + 90·9° (c = 2·24) (Found: OMe, 4·7; I, 18·9. $C_{28}H_{27}O_9SI$ requires OMe, 4·9; I, 19·0%).

2 : 3-*Dibenzoyl* 4-p-*Toluenesulphonyl* α-*Methylglucoside* (VI).—This was obtained from (V) by treatment with silver nitrate in acetonitrile (Oldham and Rutherford), a mixture of nitrate and hydroxy-derivative being obtained. The mixture was converted directly into the pure hydroxy-compound by reduction with zinc and iron in glacial acetic acid. The over-all yield was 89·4% of needles (from alcohol), m. p. 179—180°, $[\alpha]_D^{16°}$ (chloroform) + 106·3° (Found OMe, 5·5; S, 5·8. $C_{28}H_{28}O_{10}S$ requires OMe, 5·6; S, 5·8%).

2 : 3 : 6-*Tribenzoyl* 4-*Toluenesulphonyl* α-*Methylglucoside* (VII).—(*a*) *From* (VI). 2·00 G. of (VI) were benzoylated in pyridine, two treatments at 30° for 4 days being necessary. The crude product (1·95 g.; 82%), needles, m. p. 155°, was recrystallised from alcohol–acetone (5 : 1), and then had m. p. 158—160°; $[\alpha]_D^{18°}$ (chloroform) + 104·2° (Found: OMe, 4·8; S, 4·7; C, 63·0; H, 5·1. $C_{35}H_{32}O_{11}S$ requires OMe, 4·7; S, 4·8; C, 63·6; H, 4·8%).

(*b*) *From* (III). 0·2695 G. of (III) was treated exactly as in (*a*) but with *p*-toluenesulphonyl chloride. The final yield of pure crystals was 0·2674 g. (76·5%), m. p. 158·5—169°; $[\alpha]_D^{18°}$ (chloroform) + 104·2° (Found: OMe, 4·8%). The mixed m. p. of (*a*) and (*b*) showed no depression. The preparations were unaffected by sodium iodide in acetone at 100° during 2 hours, indicating that the toluenesulphonyl group did not occupy position 6.

The m. p. was depressed to 135—140° on admixture with 2 : 3 : 4-tribenzoyl 6-*p*-toluenesulphonyl α-methylglucoside (VIII), m. p. 164° (Helferich and Becker, *loc. cit.*, give 166°, corr.); $[\alpha]_D^{16^\circ}$ (chloroform) 64·48° (c = 2·980).

6-*Iodo*-2 : 3 : 4-*tribenzoyl* α-*Methylglucoside* (IX).—This substance was obtained in theoretical yield from (VIII) by the sodium iodide reaction; it crystallised from alcohol and ether in needles, m. p. 99—100·5°, $[\alpha]_D^{16^\circ}$ (chloroform) + 42·29° (c = 4·102) (Found : OMe, 4·9; I, 20·5. Calc. for $C_{27}H_{33}O_8I$: OMe, 5·0; I, 20·7%).

2 : 3 : 4-Tribenzoyl α-methylglucoside was obtained as a yellow glass (0·785 g.) when 1·004 g. of (IX) were treated as described for (VI); it was induced to crystallise by the method employed for (III). Recrystallisation from methyl alcohol containing a little water gave needles, m. p. 140—142°; mixed m. p. with (III), 104—125°; $[\alpha]_D^{17^\circ}$ (chloroform) + 54·8° (c = 3·442); (pyridine) + 131·4° (c = 3·147). Helferich and Becker (*loc. cit.*) give $[\alpha]_D$ (pyridine) + 131·4°, but do not record an m. p.

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