

THE SYNTHESIS OF METHYL 5-O-BENZOYL-2,3-DIDEOXY-
 β -D-GLYCERO-PENTOFURANOSIDE. PART IV. (1)
 (METHYL 5-O-BENZOYL-2,3-DIDEOXY- β -D-RIBOFURANOSIDE)

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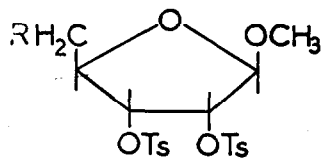
(Received 18 February 1967)

Recent interest in 2',3'-unsaturated, 2',3-dideoxy and 2',3',5'-trideoxy nucleosides (2) suggest, that the availability of methyl 5-O-benzoyl-2,3-dideoxy-2,3-dideoxy- β -D-glycero-pentofuranoside (III) and methyl 5-O-benzoyl-2,3-dideoxy- β -D-glycero-pentofuranoside (IV) might be of considerable chemical and biochemical interest.

We report in this communication the synthesis of the two furanoid systems (III and IV). The method also represents a potential route to the trideoxy-(IVa) and to a large variety of 5-substituted dideoxy pentofuranosides.

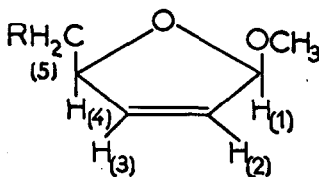
Selective displacement in furanoid *cis*-sulphonyloxy systems by nucleophiles such as iodide ion and azide ion have recently been reported (3a and 3b). It was of interest to examine, whether this type of displacement could be extended to a system such as (II), in which the substituents at C-1 and C-4 are *trans* - to both sulphonyloxy groups.

When methyl 2,3,5-tri-O-tosyl- β -D-ribofuranoside (4)(I) was heated with sodium benzoate in *N,N*-dimethylformamide at 120° for 0.5 hour, crystalline methyl 5-O-benzoyl-2,3-di-O-tosyl- β -D-ribofuranoside (II) was isolated (85%), m. p. 104.5-106°, $\alpha_D^{28} +53$ (c 0.79; CHCl₃); (found: C 56.25; H 4.92; S 11.31 C₂₇H₂₈O₁₀S₂; requires C 56.25; H 4.85; S 11.11).

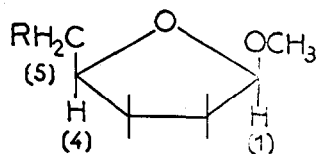


[I] R = OTs

[II] R ≠ OBz



[III] R = OBz



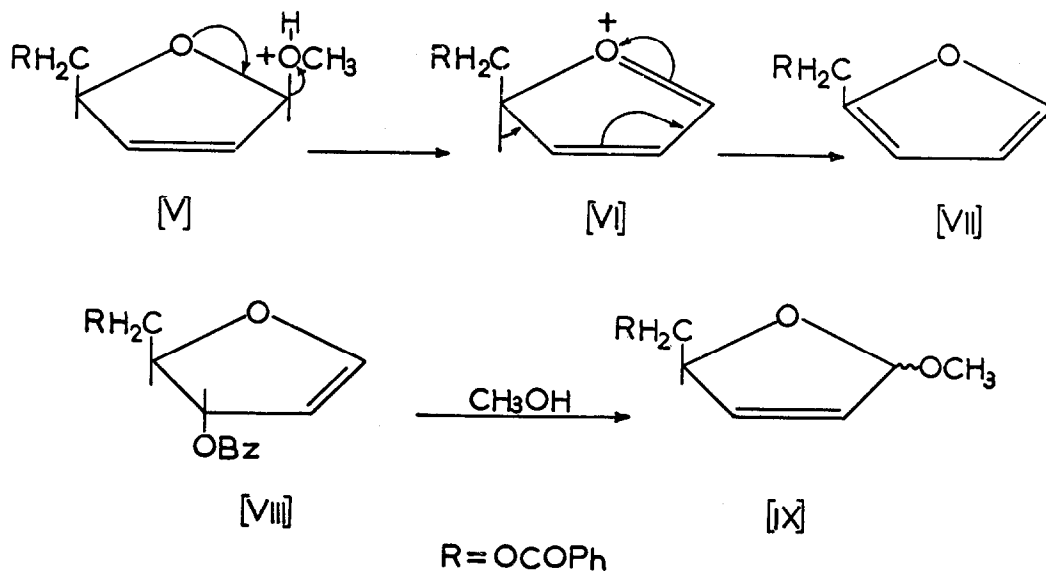
[V] R = OBz

[IVa] R = H

Treatment of the di-O-sulphonate (II) with the sodium iodide-N,N-dimethylformamide-zinc dust reagent (3a and 3c) at 170° for 1.5 hours gave a liquid (80%, (5)), formulated as methyl 5-O-benzoyl 2,3-dideoxy-2,3-didehydro- β -D-glycero-pentofuranoside (III), b.p. 72-74°/0.02 mm, $[\alpha]_D^{27} - 98$ (c 0.54; CHCl₃), (found: C 66.94; H 6.30 C₁₃H₁₄O₄; requires C 66.65; H 6.02). The distilled olefin crystallised overnight, m.p. 40-44°. N.M.R. spectrum of (III); OCH₃, 3.40 p.p.m. [3]; C-5, 4.37 and 4.46 [2]; C-4 5.1 [1]; C-3 and C-2, 5.9 [2]; C-1, 6.22 [1]; aromatic protons, 7.4-8.25 [5].

If the heating was continued, t.l.c. indicated the appearance of a new product and the disappearance of (III). The substance was found to be identical with authentic furfuryl benzoate (VII), probably formed via (V) by the path shown (V-VII). The presence of zinc iodide and the development of weak acidity during the reaction (at 170°) accounts for the decomposition of the olefin (III). When (III) was heated with aqueous acetic acid at 65° for 5 minutes, the olefin was completely converted into furfuryl benzoate (VII). However, when pure, the unsaturated compound (III) is reasonably stable at room temperature and can be used as a synthetic intermediate.

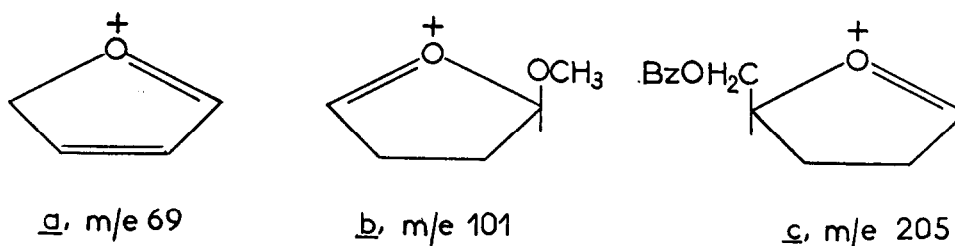
The olefin (III) has been reported previously from furanoid glycal benzoate (6) (VIII-IX). The stereochemistry at C-1 in (IX) was not assigned. Both the N.M.R. spectra and the optical rotation $[\alpha]_D - 98$ of the two substances (III and IX) are identical. Consequently the β -configuration is assigned to the product (IX).



Hydrogenation of (III) with palladium on charcoal (5%) gave the corresponding saturated system (IV), b.p. 80-82°/0.01 mm, $[\alpha]_D^{25} -73.3^\circ$ (c 0.52; CHCl_3), $n_D^{23} 1.5090$, (found: C 66.01; H 6.98 $\text{C}_{13}\text{H}_{16}\text{O}_4$, requires C 66.08; H 6.83). N.M.R. spectrum of (IV): C-2 and C-3, 1.99 and 2.03 p.p.m. [4]; OCH_3 , 3.49 [3]; C-5 and C-4, 4.38 [3]; C-1, 5.01 [1]; aromatic protons, 7.4-8.25 [5]. If Adam's catalyst was used for the reduction, the hydrogenation was accompanied by hydrogenolysis.

Compound (IV) exhibits in its mass spectrum the peaks at m/e 235 (M-1), m/e 69(a), m/e 101 (b) and m/e 205 (c). The presence of these significant fragment ion peaks, confirm unequivocally the assigned di-substituted structure (IV).

Despite, several previous attempts (7), this is the first synthesis of the biologically important 2,3-dideoxy-D-ribofuranoside (IV).



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Acknowledgments

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