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Preliminary communication

Synthesis of a derivative of 2,5-anhydro-L-arabinitol having nitrogen in the ring

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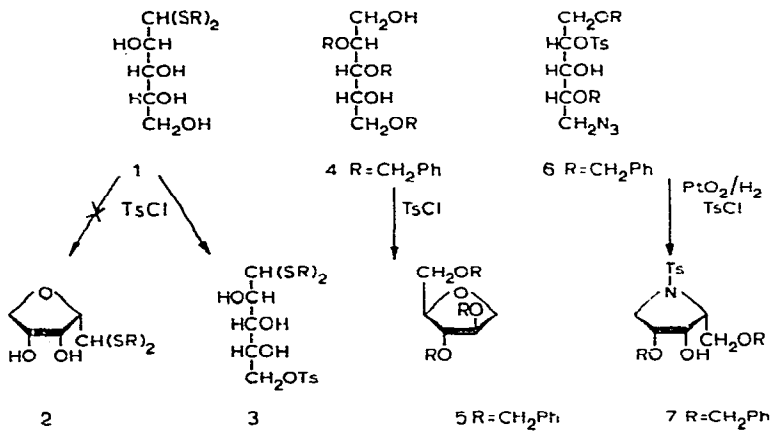
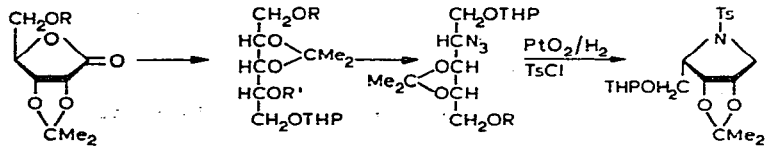
Attempted monosulphonylation of D-ribose and D-xylose dithioacetals has provided[1] excellent syntheses of the dithioacetals of 2,5-anhydro-D-ribose and 2,5-anhydro-D-xylose. The products, which arise by intramolecular displacement of an initially formed 5-toluene-*p*-sulphonyloxy group by HO-2, are valuable synthetic intermediates[2–5]. By contrast*, D-arabinose dithioacetals **1** can be selectively toluene-*p*-sulphonylated at the primary hydroxyl group, and the products **3** isolated in high yield[6].

Thus, it was of interest to ascertain whether analogues of 2,5-anhydroarabinitol having a nitrogen atom in the ring can be obtained by intramolecular cyclisation reactions. Recently[7], the conversion **6** → **7** has been described, and we now report on the related conversion **13** → **14**.



*Editorial note: since this manuscript was received, a rationalisation of these apparently anomalous reactions has been published: J. Defaye and D. Horton, *Carbohyd.Res.*, 14 (1970) 128.



8 R=H
9 R=THP

10 R=R'=H
11 R=Bz, R'=Ms

12 R=Bz
13 R=Ts

14 THP = tetrahydropyranyl

Treatment of 2,3-*O*-isopropylidene-D-ribono-1,4-lactone[8] (**8**) with dihydropyran in methylene chloride, in the presence of acid, yielded 85 % of 2,3-*O*-isopropylidene-5-*O*-tetrahydropyranyl-D-ribono-1,4-lactone (**9**), m.p. 75–80°★, $[\alpha]_D$ (*c* 1, chloroform). Reduction of **9** with sodium borohydride in propan-2-ol afforded 2,3-*O*-isopropylidene-5-*O*-tetrahydropyranyl-D-ribitol (**10**), which was converted, by monobenzoylation at C-1 and then methanesulphonylation, into the crystalline 1-*O*-benzoyl-2,3-*O*-isopropylidene-4-*O*-methanesulphonyl-5-*O*-tetrahydropyranyl-D-ribitol (**11**), m.p. 54–59°★, $[\alpha]_D$ −10° (*c* 1.34, chloroform), in high yield (90%). Treatment of **11** with sodium azide in *N*,*N*-dimethylformamide for 6 h at 140° gave 2-azido-5-*O*-benzoyl-2-deoxy-3,4-*O*-isopropylidene-1-*O*-tetrahydropyranyl-L-arabinitol (**12**) as a syrup, $[\alpha]_D$ +32.4° (*c* 1.11, chloroform). Catalytic debenzoylation of **12**, followed by toluene-*p*-sulphonylation, furnished the oily 2-azido-2-deoxy-3,4-*O*-isopropylidene-1-*O*-tetrahydropyranyl-5-*O*-toluene-*p*-sulphonyl-L-arabinitol (**13**), $[\alpha]_D$ +14° (*c* 0.92, chloroform).

Hydrogenation of the azide **13** over Adams' catalyst, followed by toluene-*p*-sulphonylation, gave 2,5-anhydro-2-deoxy-3,4-*O*-isopropylidene-1-*O*-tetrahydropyranyl-2-toluene-*p*-sulphonamido-L-arabinitol (**14**), m.p. 78–82°★, $[\alpha]_D$ +89° (*c* 1.05, chloroform), in a yield of 60%. Its elemental analyses, and mass spectral and n.m.r. data were entirely consistent with structure **14**.

The dominant factors in the above reactions appear to be the non-bonded interactions developed in the transition state. Thus, in the transition state leading to the derivatives of 2,5-anhydro-D-arabinose (**2** from **1**), the substituent groups on C-2, C-3, and C-4 are *cis*, and steric interaction would be maximal. In the transition state for the formation[9] of 1,4-anhydro-2,3,5-tri-*O*-benzyl-D-arabinitol (**5**) from **4**, all substituents are *trans*, and non-bonded interactions would be minimal. The greater nucleophilicity of the amino group, compared with the hydroxyl group, accounts for the ready intramolecular formation of *N*-analogues of 2,5-anhydro-D-arabinitol[7] (**7**) and -L-arabitinol (**14**), despite the unfavorable interactions between the substituents in the transition state.

Syntheses of the antibiotic Anisomycin[10] and related diastereoisomeric pyrrolidine derivatives from compounds **7** and **14** are in progress.

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★The new asymmetric centre introduced during tetrahydropyranylation is responsible for the wide range in melting point.

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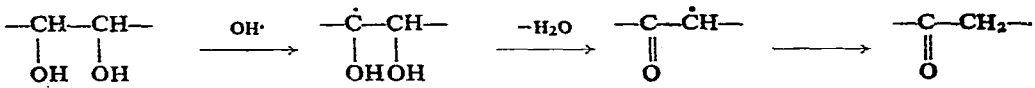
CORRIGENDUM

Carbohyd. Res., 14 (1970) page 418, scheme 1, should read:



Scheme 1