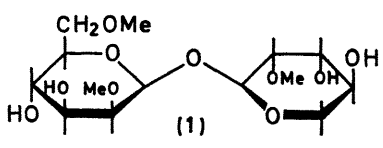
A Synthesis of 2-O-Methyl-L-lyxose: a Component of Everninomicin B and D

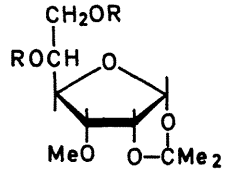
By J. S. BRIMACOMBE* and A. M. MOFTI
(*Chemistry Department, The University, Dundee* DD1 4HN)

Summary 2-*O*-Methyl-L-lyxose was prepared by oxidative degradation of 3-*O*-methyl-L-talose with manganese dioxide; entry into the L-talose series was gained by inverting the configuration of 1,2-*O*-isopropylidene-5,6-di-*O*-methanesulphonyl-3-*O*-methyl-α-D-allofuranose at C-5 by means of a benzoate-exchange reaction.

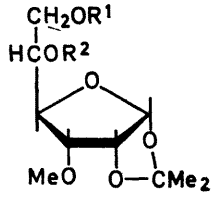
EVERNINOSE, a non-reducing disaccharide recovered from acid hydrolysates of everninomicin B and D, has the structure (**1**).[1] Prolonged hydrolysis of (**1**) gave the constituent monosaccharides which were identified[1] as 2,6-di-*O*-methyl-D-mannose (curamicose[2]) and 2-*O*-methyl-L-lyxose {m.p. 122°, $[\alpha]_D$ + 6·2° (*final*, water)}. Syntheses of 2,6-di-*O*-methyl-D-mannose are available[3] and we have recently described[4] a synthesis of 2-*O*-methyl-D-lyxose by partial oxidation of 3-*O*-methyl-D-galactopyranose with sodium periodate. This route is unlikely to be of use in synthesizing the natural L-sugar (**10**) because of the inaccessibility of the requisite L-galactose precursors. However, a synthesis of 2-*O*-methyl-L-lyxose could be approached equally well from 3-*O*-methyl-L-talose, since the asymmetry at C-2 is removed on descent of the series.

Entry into the L-talose series was gained by means of a benzoate-exchange reaction on the dimethanesulphonate (**3**),† m.p. 102—103°, $[\alpha]_D$ + 72° (*c* 1, $CHCl_3$), derived from 1,2-*O*-isopropylidene-3-*O*-methyl-α-D-allofuranose[5] (**2**). The two products isolated from this reaction by chromatography were identified as 5,6-di-*O*-benzoyl-1,2-*O*-isopropylidene-3-*O*-methyl-β-L-talofuranose (**4**) (71%), $[\alpha]_D$ + 10° (*c* 1, $CHCl_3$), and the corresponding 6-benzoate (**5**) (23%), m.p. 98—99°, $[\alpha]_D$ + 63° (*c* 1, $CHCl_3$). Debenzoylation of both (**4**) and (**5**) gave the diol (**6**), m.p. 54—56°, $[\alpha]_D$ + 103°

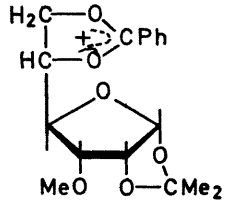




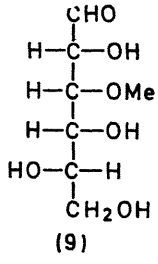
(**2**) R = H
(**3**) R = Ms



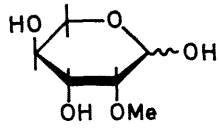
(**4**) $R^1 = R^2$ = Bz
(**5**) R^1 = Bz, R^2 = H
(**6**) $R^1 = R^2$ = H
(**7**) $R^1 = R^1$ = Ms



(**8**)



(**9**)



(**10**)

Ms = methanesulphonyl

† All crystalline compounds gave satisfactory elemental analyses and ^1H n.m.r. spectra were consistent with all the assigned structures.

(*c* 1, $CHCl_3$), which yielded a dimethanesulphonate (**7**), m.p. 149—150°, $[\alpha]_D$ + 32·5° (*c* 1, $CHCl_3$), that was clearly different from the original dimethanesulphonate (**3**). Hence, compounds (**4**)—(**7**) must possess the L-*talo*-configuration. Selective benzoylation of (**6**) gave a monoester indistinguishable from (**5**), thus demonstrating that the primary hydroxy-group of the latter was esterified. In view of recent findings,[6] it is tempting to suggest that (**4**) and (**5**) result from attack of benzoate ion and adventitious water, respectively, on an intermediate benzoxonium ion (**8**) arising from C-6 benzoyloxy-group participation in the displacement of the C-5 methanesulphonyloxy-group.

Acid hydrolysis of 1,2-*O*-isopropylidene-3-*O*-methyl-β-L-talofuranose (**6**) liberated syrupy 3-*O*-methyl-L-talose (**9**), $[\alpha]_D$ − 13·5 ± 1° (*c* 1, H_2O), which ^1H n.m.r. spectroscopy (D_2O) indicated to contain both the pyranose (major) and the furanose forms in tautomeric equilibrium. Since partial oxidation of the furanoid ring-form with periodate would lead to products other than the required pentose derivative, the series was descended by oxidative degradation of (**9**) with manganese dioxide[7–9]‡ in aqueous solution at *ca.* 100°. 2-*O*-Methyl-L-lyxose (**10**) (*ca.* 50%), m.p. 120—121°, $[\alpha]_D$ + 6° (*final*, *c* 1, H_2O), was isolated following chromatography, and its i.r. spectra and *X*-ray diffraction photograph were indistinguishable from those of the D-enantiomer[4] {m.p. 118—119°, $[\alpha]_D$ − 6·5° (*final c* 1·5, H_2O)}.

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‡ Foster *et al.*[8] have suggested that manganese dioxide might be especially applicable in degrading hexoses substituted at C-3, since further oxidation of the pentose products would be minimized by the absence of a C-2 hydroxy-group.

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