

A ONE-STEP PREPARATION OF 2,3-ANHYDRO-4,6-O-BENZYLIDENE-
 α -D-ALLOPYRANOSIDE AND -GULOPYRANOSIDE¹⁾

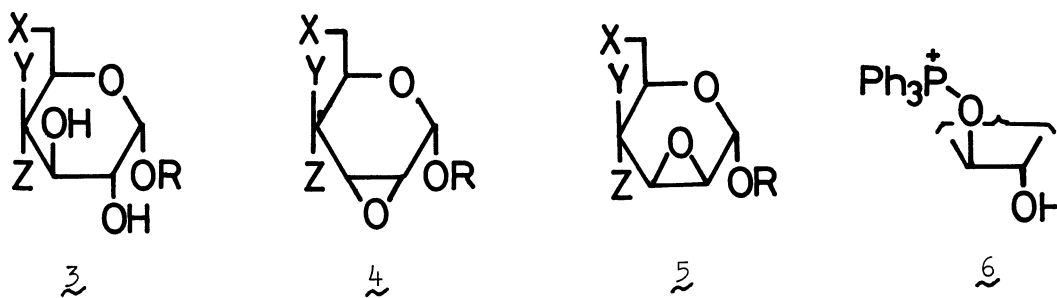
Oyo MITSUNOBU, Takashi KUDO, Mitsuru NISHIDA, and Nobuo TSUDA
 Department of Chemistry, College of Science and Engineering,
 Aoyama Gakuin University, Chitosedai, Setagayaku, Tokyo 157

Methyl 4,6-O-benzylidene- α -D-glucopyranoside reacted with diethyl azodicarboxylate and triphenylphosphine to give methyl 2,3-anhydro-4,6-O-benzylidene- α -D-allopyranoside and -mannopyranoside with the former predominant, while allyl 4,6-O-benzylidene- α -D-galactopyranoside selectively afforded the corresponding 2,3-anhydroguloside.

2,3-Anhydro sugars have been extensively utilized as chiral intermediates in synthetic organic chemistry.²⁾ They are most often prepared by two-step procedure.³⁾ Thus, methyl 2,3-anhydro-4,6-O-benzylidene- α -D-allopyranoside is prepared by ditosylation of methyl 4,6-O-benzylidene- α -D-glucopyranoside followed by treatment with sodium methoxide.⁴⁾ By the same procedure, however, methyl 4,6-O-benzylidene- α -D-galactopyranoside gave a mixture of anhydroguloside and anhydrotaloside.⁵⁾

We wish to report in this communication a convenient one-step preparation of 2,3-anhydro- α -D-hexopyranosides from trans-2,3-dihydroxy- α -D-hexopyranosides.

Methyl 4,6-dideoxy- α -D-glucopyranoside (3a; 4 mmol)⁶⁾ reacted smoothly with diethyl azodicarboxylate (1; 6.2 mmol) and triphenylphosphine (2; 6 mmol) in benzene under reflux to give the corresponding 2,3-anhydroallopyranoside (4a) in a 75% yield. Thin layer chromatography (tlc) of the crude reaction mixture indicated the presence of a trace of 2,3-anhydromannopyranoside (5a). On the other hand, no anhydro bond formation virtually took place as indicated by tlc, when methyl 4,6-O-benzylidene- α -D-glucopyranoside (3b)⁴⁾ and allyl 4,6-O-benzylidene- α -D-galactopyranoside (3c)⁷⁾ were treated with 1 and 2 under the same conditions.



a; X = Y = Z = H, R = CH₃

b; X, Z = $\text{PhC} \begin{array}{l} \diagup \text{O} \\ \diagdown \text{O} \end{array}$, Y = H, R = CH₃

c; X, Y = $\text{PhC} \begin{array}{l} \diagup \text{O} \\ \diagdown \text{O} \end{array}$, Z = H, R = CH₂=CH-CH₂

It would be reasonable to assume that the difficulty in effecting the 2,3-anhydro bond formation in 3b and 3c might result in rigidity imposed on the pyranose ring by 4,6-O-benzylidene group. Restricted conformational mobility could interfere the intramolecular displacement of trans- β -hydroxy phosphonium salt intermediate (6).

In order to facilitate the anhydro bond formation, the mixture resulted from the reaction of 3b (1 mmol) with 1 (3 mmol) and 2 (3 mmol) in benzene (2 ml) at room temperature was heated to remove the solvent. The residue was stirred for additional 2.5 h at 105-110 °C (bath temperature), methyl 2,3-anhydro-4,6-O-benzylidene- α -D-allopyranoside (4b) being isolated in a 65% yield along with anhydromannopyranoside (5b; 28%). By the same procedure (105-110 °C, 15 h), 3c gave the corresponding 2,3-anhydroguloside (4c) in a 64% yield without any detectable formation of anhydrotaloside (5c).^{8, 9)}

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References and Notes

- 1) Part IV of "Stereospecific and Stereoselective Reactions". For the preparation of cyclic ethers by the reaction of simple diols with 1 and 2, see Part III; O. Mitsunobu, J. Kimura, K. Iizumi, and N. Yanagida, Bull. Chem. Soc. Jpn., 49, 510 (1976). See also J. T. Carlock and M. P. Mack, Tetrahedron Lett., 1978, 5153. Recently Guthrie et al. have reported the conversion of fructofuranosides into the corresponding anhydrosugars by the similar system; R. D. Guthrie, I. D. Jenkins, and R. Yamasaki, J. Chem. Soc., Chem. Commun., 1980, 784.
- 2) S. Hanessian, Acc. Chem. Res., 12, 159 (1979), and references cited therein.
- 3) Hicks and Fraser-Reid reported a one-step preparation of 5b from 3b; D. R. Hicks and B. Fraser-Reid, Synthesis, 1974, 203.
- 4) N. K. Richtmyer in "Methods in Carbohydrate Chemistry," eds. R. L. Whistler and M. L. Wolfrom, Academic Press, New York, 1962, Vol. I, 203.
- 5) F. Reber and T. Reichstein, Helv. Chim. Acta, 28, 1164 (1945); A. Zobacova, V. Hermankova, and J. Jary, Coll. Czech. Chem. Commun., 36, 1860 (1971).
- 6) H. Paulsen, B. Sumfleth, and H. Redlich, Chem. Ber., 109, 1362 (1976).
- 7) R. Gigg and C. D. Warren, J. Chem. Soc. (C), 1968, 1903.
- 8) A small amount of an unidentified product derived from 3c was also formed.
- 9) All the products except for 4a were isolated by preparative layer chromatography. Physical constants of products were as follows. 5a and 5c were prepared by the reaction of 2-O-tosylates of the parent pyranosides with sodium methoxide.

Compound	mp°C (bp°C/mmHg)*	Solvent	60 MHz-PMR (δ)		
			1-H	2-H	3-H
<u>4a</u>	(80-120/22)	CCl ₄	4.92(d)	3.2-3.5(m)	
<u>5a</u>	(85-110/15)	CDCl ₃	4.91(s)	2.98(d)	3.40(m)
<u>4b</u>	202-203	CDCl ₃	4.83(d)	3.4-3.5(m)	
<u>5b</u>	144-145	CDCl ₃	4.87(s)	3.15(d)	3.2-3.4(m)
<u>4c</u>	141-142	CDCl ₃	5.17	3.3-3.5(m)	
<u>5c</u>	185-186	CDCl ₃	5.14(s)	3.07(d)	3.55(m)

* Oven temperature.

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