A New Method for the Protection of *trans*-Diequatorial Amino and Hydroxyl Groups in Aminosugars and Aminocyclitols

Sumio UMEZAWA, Tsutomu TSUCHIYA and Yasushi TAKAGI

Department of Applied Chemistry, Faculty of Engineering, Keio University, Koganei-shi Tokyo

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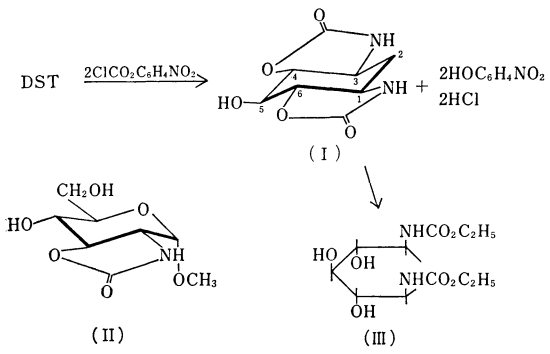
The combined protection of vicinally situated *trans*-diequatorial amino and hydroxyl groups of pyranoside type aminosugars or inosamines is sometimes necessary in preparing their derivatives. However, contrary to the case of *cis* amino and hydroxyl groups, this kind of protection has not been achieved satisfactorily. Very recently, Miyai and Gross[1] prepared the 2,3-carbamate derivative of benzyl 2-amino-4,6-*O*-benzylidene-2-deoxy-β-D-glucopyranoside with the use of *N,N'*-carbonyldiimidazole in absolute tetrahydrofuran.

We wish to report that the protection was successfully performed by utilizing *p*-nitrophenoxycarbonyl chloride; a characteristic feature of this method is that the products are prepared by a one-step procedure in good yields and the reaction proceeds in a medium containing water, which is necessary in dealing with water-soluble compounds. As an example, the preparation of 2-deoxystreptamine 1,6;3,4-dicarbamate (I) and methyl 2-amino-2-deoxy-α-D-glucopyranoside 2,3-carbamate (II) is described.

To an aqueous solution of 2-deoxystreptamine (DST), Dowex 1×2 resin (OH form) was added, and an excess *p*-nitrophenoxycarbonyl chloride in acetone was added with stirring. A cyclic dicarbamate I was obtained in 73% yield; mp >285°C; IR spectrum: 1760 and 1735 cm^{-1} (C=O); no peak near 1550 cm^{-1} (amide II) was observed indicating I to be a cyclic amide. The 5-*O*-acetyl derivative of I was prepared from I with pyridine-acetic anhydride; mp 276°C (decomp.); molecular weight: 256 (mass spectrum); IR spectrum: 3300 (NH), 1770, 1735 cm^{-1}; NMR (dimethyl sulfoxide-d_6): τ: 4.45 (1-proton triplet, J 9.4 Hz, H-5), 5.91 (2-proton quartet, $J_{4,5}=J_{5,6}$ 9.4 Hz, $J_{3,4}=J_{1,6}$ 11.2 Hz, H-4,6), 6.30 (2-proton double triplets, $J_{3,4}=J_{1,6}$ $J_{1,2_a}=J_{3,2_a}$ 11.2 Hz, $J_{1,2_e}=J_{3,2_e}$ 3.2 Hz, H-1,3), 7.85 (1-proton double triplets, J 3.2 and 11 Hz, H-2_e), 8.40 (1-proton quartet, J 11 Hz, H-2_a). The results support the structure for I.

On alkaline hydrolysis I gave DST, and on ethanolysis in the presence of sodium ethoxide, I gave *N,N'*-diethoxycarbonyldeoxystreptamine (III); mp 225°C (decomp.); IR spectrum: 1695 (NH*COO*), 1545 (amide II) cm^{-1}.

Methyl 2-amino-2-deoxy-α-D-glucopyranoside was treated similarly to give the corresponding 2,3-carbamate derivative (II) in 70% yield; hygroscopic solid, $[\alpha]_D^{21}$ +110° (*c* 0.5, water); IR spectrum: 1760 cm^{-1} (C=O); NMR (deuterium oxide): τ: 4.86 (1-proton doublet, $J_{1,2}$ 3 Hz, H-1), 5.40 (1-proton quartet, $J_{2,3}$ 12 Hz, $J_{3,4}$ 9.3 Hz, H-3), 5.93 (1-proton triplet, $J\sim9$ Hz, H-4), 6.22 (1-proton quartet, J 3 and 12 Hz, H-2), 6.5 (3-proton singlet, OMe). A similar acetylation of II gave the 4,6-di-*O*-acetyl derivative; amorphous solid, $[\alpha]_D^{21}$ +94° (*c* 0.5, chloroform); NMR (deuteriochloroform): τ: 4.67 (1-proton quartet, $J_{4,5}$ 9.2, $J_{3,4}$ 10 Hz, H-4), 4.96 (1-proton doublet, $J_{1,2}$ 3 Hz, H-1), 5.33 (1-proton quartet, $J_{3,4}$ 10, $J_{2,3}$ 11.8 Hz, H-3), 6.5 (3-proton singlet, OMe), 7.88 and 7.90 (each 3-proton singlet, OAc). These results indicate the CI conformation of II.



1) K. Miyai and P. H. Gross, *J. Org. Chem.*, **34**, 1638 (1969).