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STEREOSELECTIVITY IN THE DEHYDRATIVE GLYCOSYLATION WITH HEPTA-O-BENZYL-GLUCOBIOSES

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Dehydrative glycosylation of benzyl 2,3,4-tri-O-benzyl-α-D-glucopyranoside with hepta-O-benzyl-kojibiose, -sophorose, -nigerose, -laminaribiose, -maltose, -cellobiose, -isomaltose, and -gentiobiose gave 16 linear trisaccharide derivatives. The reaction of α(1→2)-, β(1→3)-, α(1→4)-, and β(1→6)-linked biose derivatives shows the α-selectivity, while the reaction of the others does the β-selectivity.

Oligosaccharide synthesis is a long-standing subject in the carbohydrate chemistry.1) The glycosylation using oligosaccharide derivatives as glycosyl donor has often been used for synthesizing higher oligosaccharides.2) We have now prepared 8 glucobiose derivatives (2~9), with which benzyl 2,3,4-tri-O-benzyl-α-D-glucopyranoside (1) was then glycosylated to afford 16 linear glucotriose derivatives (10~25) through the one-stage glycosylation using p-nitrobenzenesulfonyl chloride, silver trifluoromethanesulfonate, and triethylamine (Reagent NST)3) in CH_2Cl_2. Table 1 shows the yields of trisaccharides and the stereoselectivities of the reaction.

Although the glycosyaltion with Reagent NST has been available for the β-glucosylation with 2,3,4,6-tetra-O-benzyl-α-D-glucopyranose (26),3) such selectivity was retained only for the glycosylation with hepta-O-benzyl sophorose (3), -cellobiose (7), and isomaltose (8). On the contrary, the preferential formation of the α-glycosides was found in the cases of hepta-O-benzyl-kojibiose (2), -laminaribiose (5), -maltose (6), and -gentiobiose (9). Especially, the (1→2)- and the (1→6)-linked glucobiose derivatives showed sufficient stereoselectivity for either of the anomers to be formed, while hepta-O-benzyl-nigerose (4) exhibited a poor selectivity.

Syntheses of glucobiose derivatives were carried out as follows:

1) Stereoselective β-glucosylation of allyl alcohol with 2-O-acetyl-3,4,6-tri-O-benzyl-D-glucopyranose in the presence of $MeSO_3H$ and $CoBr_2$ in CH_2Cl_2,4) followed by deacetylation, gave allyl 3,4,6-tri-O-benzyl-β-D-glucopyranoside, which was glucosylated with 26 and Reagent NST in CH_2Cl_2 to afford the equal amounts of allyl hepta-O-benzyl-kojibioside and -sophoroside. Deallylation of them furnished 2 and 3.

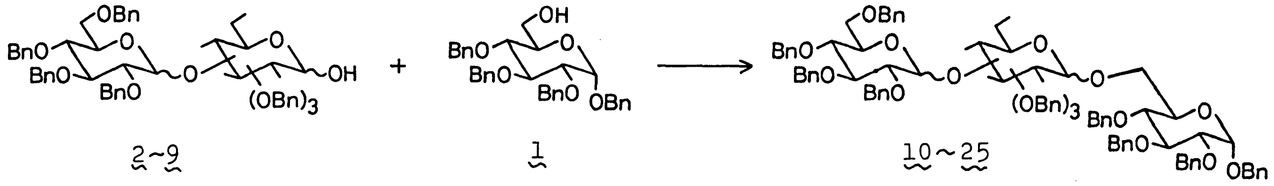
2) α-Glucosylation of allyl 2,4,6-tri-O-benzyl-α-D-glucopyranoside, prepared by the partial benzylation of allyl α-D-glucopyranoside, with 26 using p-nitrobenzenesulfonyl chloride, silver trifluoromethanesulfonate, N,N-dimethylacetamide, and tri-

ethylamine (Reagent NSDT)$^{5)}$ in CH_2Cl_2 gave allyl hepta-O-benzyl-α-nigeroside. This was then deallylated to afford 4.

3) Ethyl 2,3,4-tri-O-benzyl-1-thio-α-D-glucopyranoside$^{6)}$ was glucosylated with 26 and Reagent NSDT$^{5)}$ in CH_2Cl_2 to give ethyl hepta-O-benzyl-1-thio-α-isomaltoside, which was then treated with Br_2 in CCl_4, followed by hydrolysis, to yield 8.

4) Compounds 5, 6, 7, and 9, were prepared from the corresponding octaacetates of glucobioses via bromination with AcBr and H_2O in $CHCl_3$, alcoholysis with allyl alcohol, benzylation, and deallylation.

Glycosylation of 1 with a biose derivative (1.0 equiv.) and Reagent NST (1.2 equiv.) in CH_2Cl_2 at 0°C for 16 h, followed by chromatography (silica gel, toluene-butanone), to afford an anomeric pair of trisaccharide derivatives. The structures of the di- and the trisaccharide derivatives were determined by means of elemental analysis, optical rotation (Tables 1 and 2) and ^{13}C NMR.



2~9 1 10~25

Table 1 Glucobiose derivatives and results of glycosylation of 1 using them

Glucobiose derivatives	Type of inter-glycoside link	Mp(°C)	$[\alpha]_D^{20}$(c, $CHCl_3$)	Yield (%) of trisaccharides^1	α:β
2	α(1→2)	——	+60°(2.3)	51 (10+11)	77:23
3	β(1→2)	125-126	+28°(0.7)	44 (12+13)	17:83
4	α(1→3)	——	+54°(3.3)	67 (14+15)	46:54
5	β(1→3)	——	+40°(1.0)	62 (16+17)	61:39
6	α(1→4)	——	+38°(2.4)	58 (18+19)	66:34
7	β(1→4)	108-110	+20°(0.9)	65 (20+21)	25:75
8	α(1→6)	——	+53°(2.5)	72 (22+23)	15:85
9	β(1→6)	137-139	+26°(3.7)	63 (24+25)	83:17

[1] The products are shown in parentheses.

Table 2 Optical rotations of the totally benzylated trisaccharides

α-Anomer		β-Anomer	
Cpd	$[\alpha]_D^{20}$(c)^1	Cpd	$[\alpha]_D^{20}$(c)^1
10	+86°(3.5)	11	+67°(0.6)
12	+59°(0.5)	13	+34°(2.6)
14	+80°(3.9)	15	+56°(3.7)
16	+67°(2.9)	17	+42°(2.0)
18	+74°(1.0)	19	+51°(0.5)
20	+62°(1.7)	21^2	+48°(0.4)
22	+81°(1.0)	23	+58°(1.0)
24	+53°(2.3)	25	+38°(1.6)

[1] In $CHCl_3$. [2] Mp 122-123°C.

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