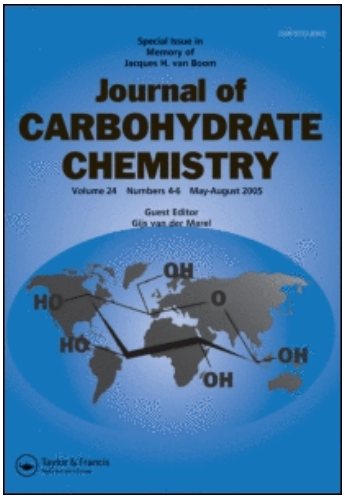


Journal of Carbohydrate Chemistry

Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713617200

Glycosylation Using a Thioglycoside and Methyl Trifluoro-Methanesulfonate. A New and Efficient Method for CIS and Trans Glycoside Formation

Hans Lönn[ab]

[a] Department of Organic Chemistry, Arrhenius Laboratory, University of Stockholm, Stockholm, Sweden [b] Organic Synthesis Department, BioCarb AB, Lund, Sweden

To cite this Article Lönn, Hans(1987) 'Glycosylation Using a Thioglycoside and Methyl Trifluoro-Methanesulfonate. A New and Efficient Method for CIS and Trans Glycoside Formation', Journal of Carbohydrate Chemistry, 6: 2, 301 — 306
To link to this Article: DOI: 10.1080/07328308708058879
URL: http://dx.doi.org/10.1080/07328308708058879

J. CARBOHYDRATE CHEMISTRY, 6(2), 301-306 (1987)

COMMUNICATION

GLYCOSYLATION USING A THIOGLYCOSIDE AND METHYL TRIFLUOROMETHANESULFONATE. A NEW AND EFFICIENT METHOD FOR CIS AND TRANS GLYCOSIDE FORMATION

Hans Lönn*

Department of Organic Chemistry,
Arrhenius Laboratory,
University of Stockholm,
S-106 91 Stockholm (Sweden)

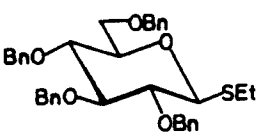
Received September 1, 1986 - Final Form October 27, 1986

For the synthesis of large oligosaccharides and biologically active oligosaccharide derivatives it is often desirable to use a block synthesis, that is to link an oligosaccharide residue to another or to a non-carbohydrate aglycon. It is sometimes difficult to prepare glycosyl halide derivatives of the oligosaccharides in good yields, and there is a need for glycosylating agents which can be prepared under mild conditions and in good yields.

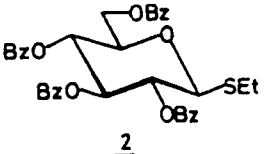
*Present address: Organic Synthesis Department, BioCarb AB, S-223 70 Lund (Sweden)

We recently showed[1,2] that ethyl thioglycoside derivatives of oligosaccharides, containing 2-deoxy-2-phtalimidoglucose residues as the "reducing" sugar became efficient glycosylating agents after S-methylation with methyl trifluoromethanesulfonate (methyl triflate).

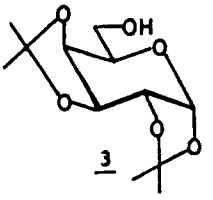
We now report on a more systematic study of this reaction, using ethyl 2,3,4,6-tetra-O-benzyl-1-thio-β-D-glucopyranoside[3] (1) and ethyl 2,3,4,6-tetra-O-benzoyl-1-thio-β-D-glucopyranoside[3] 2 as glycosylating agents. Equimolar amount of 1,2 ;3,4-di-O-isopropylidene-α-D-galactopyranose[4] (3) and methyl 2-O-acetyl-4,6-O-benzylidene-α-D-glucopyranoside[5] (4) were used as aglycons and the reactions were performed in different solvents.



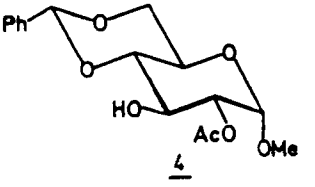
1



2



3



4

The following disaccharide derivatives were prepared: 6-O-(Tetra-O-benzyl-α-D-glucopyranosyl) 1,2:3,4-di-O-isopropylidene-α-D-galactopyranose[6] (5) and its corresponding β-linked analogue[7] (6), methyl-3-O-(tetra-O-benzyl--α-D-glucopyranosyl)-2-O-acetyl-4,6-O-benzylidene-α-D-glucopyranoside (7) and its corresponding β-linked analogue

(8), 6-O-(tetra-O-benzoyl-β-D-glucopyranosyl)-1,2:3,4-di--O-isopropylidene-α-D-galactopyranose[8] (9), and methyl-3-O-(tetra-O-benzoyl-β-D-glucopyranosyl)--2-O-acetyl-4,6-O-benzylidene-α-D-glucopyranoside (10).

The mixture of anomeric disaccharide derivatives obtained was isolated by silica gel chromatography and the ratio of the anomers was assessed from the heights of pertinent peaks in the ^{13}C-n.m.r. spectra. The results are summarized in the Table.

As seen from the Table, the total yield of α-and β-glycosides was consistently good. With a participating group in the 2-position, as in 2, the β-glycoside was exclusively formed. The same result was obtained with a phthalimide in the 2-position[1,2]. With a non-participating group in this position, as in 1, a mixture of α- and β-glycosides was formed, the proportions of α-glycoside being highest in the diethyl ether. The α:β-ratio was lower in toluene or ethyl ether-isooctane (1:4). The total yield was also highest in diethyl ether.

The use of methyl triflate as an activating agent for thioglycosides in glycoside syntheses has been summarized[9]. Since that time, others have successfully used this system in oligosaccharide syntheses[1,2,10,11].
Recently Fügedi and Garegg[12] introduced dimethyl (methylthio) sulfonium triflate (DMTST) as an activator of thioglycoside donors.

General methods. - Methyl triflate (1 mmol) was added to a solution of the thioglycoside (0.2 mmol) and the aglycon (0.2 mmol) in the solvent (5 mL) which contained powdered 4Å molecular sieves (0.5 g). The mixture was stirred at the temperature indicated in the Table. When

TABLE 1

Thio-glucoside	Aglycone	Solvent	Reaction time (h) and temperature (°C)	α:β-ratio	Total yield (%)
1	3	diethyl ether	18, 22	3.5:1	87
1	3	dichloromethane	18, 22	0.9:1	80
1	3	acetonitrile	2, 22	1:5	75
1	4	diethyl ether	18, 22	6.7:1	96
1	4	dichloromethane	18, 22	3.6:1	85
1	4	acetonitrile	2, 22	0.9:1	72
2	3	toluene	0.5, 50	0:1	89
2	4	toluene	1.0, 50	0:1	76

the reaction was complete (t.l.c.), triethylamine (2 mmol) was added and stirring continued for 10 min. The reaction mixture was filtered through a layer of Celite, concentrated, and the α,β-mixture of oligosaccharide derivatives isolated by chomatography on a silica gel column. ^{13}C-n.m.r. demonstrated the absence of other components in this mixture and gave the ratio between the anomers.

Analytical data.

Disaccharide	Selected n.m.r parameters	References
5	C-1 96.2, C-1′ 97.0	6
6	C-1 96.2, C-1′ 104.3	7
7	C-1 97.9, C-1′ 96.4	-
8	C-1 97.6, C-1′ 101.9	-
9	C-1 96.2, C-1′ 101.2	8
10	C-1 97.3, C-1′,benzylidene 101.1, 101.5	-

ACKNOWLEDGMENTS

I thank Dr. Jörgen Lönngren, Professor Per J. Garegg and Professor Bengt Lindberg for their interest. This work was supported by a grant from the Swedish Natural Science Research Council.

REFERENCES

1. H. Lönn, Carbohydr. Res., 139, 105 (1985).

2. H. Lönn, Carbohydr. Res., 139, 115 (1985).

3. F. Weygand and H. Ziemann, Liebigs Ann. Chem., 657, 179 (1962).

4. C. E. Ballou and H. O. L. Fischer, J. Am. Chem. Soc., 76,3188 (1954).

5. R. W. Jeanloz and D. A. Jeanloz, J. Am. Chem. Soc., 79, 2579 (1957).

6. R.V. Lemieux, K.B. Hendriks, K.B. Stick and K.J. James, J. Am. Chem. Soc., 97, 4056 (1975).

7. P.J. Garegg, C. Ortega and B. Samuelsson, Acta Chem. Scand. Ser. B 35 , 631 (1981).

8. P.J. Garegg and T.Norberg, Acta Chem. Scand. Ser. B 33 , 116 (1979).

9. H. Lönn Chem. Commun. Stockholm University , No 2 (1984).

10. K. Leontein, M. Nilsson and T. Norberg, Carbohydr. Res., 144, 231 (1985).

11. T. Norberg, S. Oscarsson and M. Szönyi, Carbohydr. Res., 152, 301 (1986).

12. P. Fügedi and P.J. Garegg, Carbohydr. Res., 149, C9-C12 (1986).