Tetrahedron Letters,Vol.23,No.4,pp 409-412,1982 0040-4039/82/040409-04$03.00/0
Printed in Great Britain

C-GLYCOSIDES FROM O-GLYCOSYL TRICHLOROACETIMIDATES [1)]

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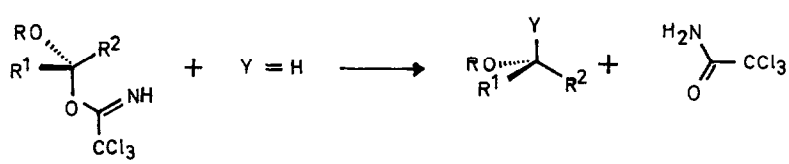
Abstract: *From O-glycosyl trichloroacetimidates 2, 9, and 13 and activated benzene derivatives C-aryl glycosides were obtained by mild Lewis acid catalysis. In most cases only one stereoisomer was formed, however, the α-alkoxyalkyl transfer took place not always by inversion of configuration at the anomeric center.*

O-Glycosyl trichloroacetimidates were obtained directly in high chemical and stereochemical yield from 1-O-unprotected carbohydrates and trichloroacetonitrile under base catalysis [2-5)]. These activated species afforded - with different alcohols and under acidic catalysis - O-glycosides, di-, tri-, and tetrasaccharides mainly by inversion of configuration at the anomeric center [2-6)]. Without the addition of any further catalyst a highly stereoselective glycosyl transfer to acids was obtained [2,5,6)]. The observed high reactivity of these O-α-alkoxyalkyl trichloroacetimidates should admit a stereoselective α-alkoxyalkyl transfer also to other nucleophiles (Scheme 1).

Scheme 1



The glycosyl transfer to activated benzene derivatives in a Friedel-Crafts type reaction reported here [7)] is of interest for the synthesis of C-glycosyl flavonoids [8,9)]. Earlier Friedel-Crafts reactions with glycosyl halides gave frequently both anomers and unsatisfactory results because of low reactivity [9)].

The O-glycosyl trichloroacetimidates 2 [2)], 9 [10)], and 13 [10)] were obtained from the 1-O-unprotected carbohydrates 1, 8, and 12 and trichloroacetonitrile with sodium hydride as base in practically quantitative yield. The O-α-D-glucopyranosyl imidate 2 gave with 1.3-dimethoxy benzene, 1.3-bis-trimethylsilyloxy benzene, and 1.3.5-trimethoxy benzene and borontrifluoride

SCHEME 2

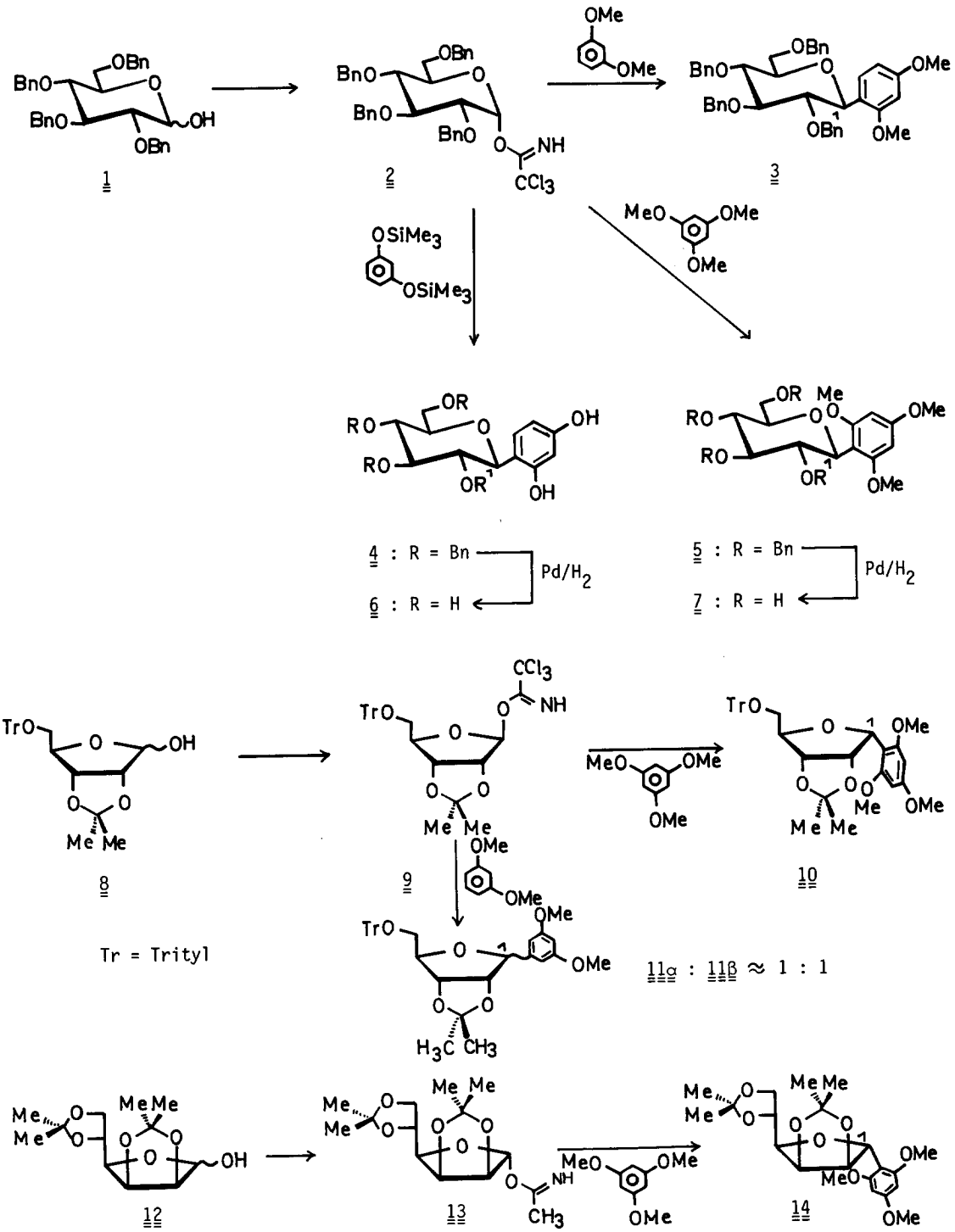

1
2
3
4 : R = Bn
6 : R = H
Pd/H2
5 : R = Bn
7 : R = H
Pd/H2
8
Tr = Trityl
9
10
11α : 11β ≈ 1 : 1
12
13
14

Table 1: C-Glycosides from trichloroacetimidates 2, 9, and 13 [a]

Compound [b]	yield [c]	$[\alpha]_{578}^{20}$ ($CHCl_3$, c=1)	mp. [°C]	^1H - NMR data [d] 1-H	$J_{1,2}$ [Hz]	other protons
3	75	+15.6	176-8	4.75(d)	10	7.4-7.12 (m, 20 H, $4C_6H_5$); 6.92, 6.52, 6.46 (dd, 1H; dd, 1H; d, 1H; C_6H_3); 3.83, 3.75 (2s, 2 OMe)
4	75	- 1.3	oil	[e]		6.65-6.48 (m, 3H, C_6H_3).
5	77	+ 5.4	oil	[e]		6.17, 6.20 (2s, 2H, C_6H_2); 3.95 (s, 6H, 2 OMe); 3.73 (s, 3H, OMe)
6	88	[e]	oil	4.85(d)	8	6.50-6.80 (m, 3H, C_6H_3).
7 [f]	85	[e]	105	4.60(d)	10	6.27 (s, 2H, C_6H_2); 3.81 (s, 6H, 2 OMe); 3.77 (s, 3H, OMe).
10	53	+ 1.0	oil	5.60(d)		6.40 (s, 2H, C_6H_2); 3.83 (s, 3H, OMe); 3.57 (s, 6H, 2 OMe).
11α	65	[e]	oil	5.73(d)	4	1.60, 1.32 (2s, 6H, $2CH_3$).
				5.29(d)	1.5	1.40, 1.26 (2s, 6H, $2CH_3$).
14	63	+24.5	134-6	5.60(s)	-	6.11 (s, 2H, C_2H_2); 3.82 (s, 3H, OMe); 3.79 (s, 6H, 2 OMe).

[a] Reaction conditions: CH_2Cl_2, room temperature, 3 h, catalyst (2, 13): 1 equivalent $BF_3 \cdot OEt_2$; (9): 1 equivalent $ZnCl_2$.

[b] All compounds gave correct elemental analyses.

[c] Isolated yields.

[d] 80 MHz-spectra in $CDCl_3$ (3-5, 10, 11α,β, 14) and D_6-DMSO (6, 7), internal TMS, δ-values.

[e] Not assigned.

[f] 7 was synthesized independently, see ref. 9; the ^1H-NMR spectral assignments and the mp. are in accordance.

etherate as catalyst only the C-β-D-glucopyranosides 3, 4, and 5 (Scheme 2). The ^1H-NMR structural assignment of 4 and 5 was possible after hydrogenolytic deprotection (Pd/H_2), which afforded 6 and 7 [9].

Tritylated O-β-D-ribofuranosyl imidate 9 was partly detritylated with borontrifluoride etherate as catalyst; therefore dry $ZnCl_2$ was used as catalyst. However, only with the more reactive 1.3.5-trimethoxybenzene the inverted α-D-ribofuranosylated compound 10 was obtained; 1.3-dime-

thoxybenzene gave a 1:1-mixture of both anomers 11α and 11b. The O-α-D-mannofuranosyl imidate 13 led with 1.3.5-trimethoxybenzene and borontrifluoride etherate catalysis exclusively to the α-product 14. Presumably intermediate ion pair formation and at least partial equilibration are responsible for the observed retention of configuration in the products 11β and 14. Anomerisation of the obtained C-glycosides was not observed under the applied reaction conditions [11]. The structural assignments are based on the ^{1}H-NMR data (Table 1).

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1) Glycosylimidates, Part 5. This work was supported by the DEUTSCHE FORSCHUNGSGEMEINSCHAFT and the FONDS DER CHEMISCHEN INDUSTRIE. - Part 4: see ref. 5.

2) R.R. Schmidt and M. Michel, Angew.Chem. 92, 763 (1980); Angew.Chem.Int.Ed.Engl. 19, 731 (1980).

3) R.R. Schmidt and G. Grundler, Synthesis 1981, in press.

4) R.R. Schmidt and J. Michel, Angew.Chem., in press.

5) R.R. Schmidt, Lecture, IX^0 Journees sur la Chimie et la Biochimie des Glucides, Aussois, January 1981; Lecture, 1st European Symposium on Carbohydrates and Glycoconjugates, Vienna, September 1981.

6) R.R. Schmidt and M. Stumpp. Tetrahedron Lett. preceding paper.

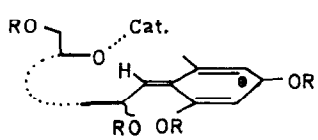
7) M. Hoffmann, Diplomarbeit, Universität Konstanz, 1981.

8) P.A. Ramaiah, L.R. Row, D.S. Reddy, A.S.R. Anjaneyulu, R.S. Ward, and A. Pelter, J.C.S. Perkin I, 1979, 2313; J. Lutowski, K. Szpunar, and E. Segiet, Pharm.i.u.Z. 10, 45 (1981) and ref.

9) R.A. Eade and H.-P. Pham, Aust.J.Chem. 32, 2483 (1979) and ref.; compound 7 was synthesized by a modified Koenigs-Knorr procedure.

10) ^{1}H-NMR data (80 MHz spectra in $CDCl_3$, internal TMS, δ-values); 9: 6.22 (s,1H,1-H); 8.41 (s,1H,NH); 1.51(s,3H,CH_3; 1.32(s,3H,CH_3). 13: 6.28(s,1H,1-H); 8.63(s,1H,NH). $[\alpha]_{578}^{20}$ ($CHCl_3$, c=1.0): 9: - 0.42^0; 13: +49.0^0. Mp. 9: 140-142^{0}C; 13: 103-106^{0}C.

11) Anomerisation was not expected under the applied reaction conditions; however, anomerisation of C-aryl glycosides having electron releasing substituents should be possible via the following intermediate:



(Received in Germany 23 October 1981)