

Note

Novel glycosylation reagents: synthesis of disaccharides containing 2-deoxy-2-iodo- α -D-talopyranosyl groups

PER J. GAREGG, BERTIL SAMUELSSON,

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

PETER KONRADSSON, INGEMAR KVARNSTRÖM, AND STEFAN C. T. SVENSSON

Department of Chemistry, University of Linköping, S-581 83 Linköping (Sweden)

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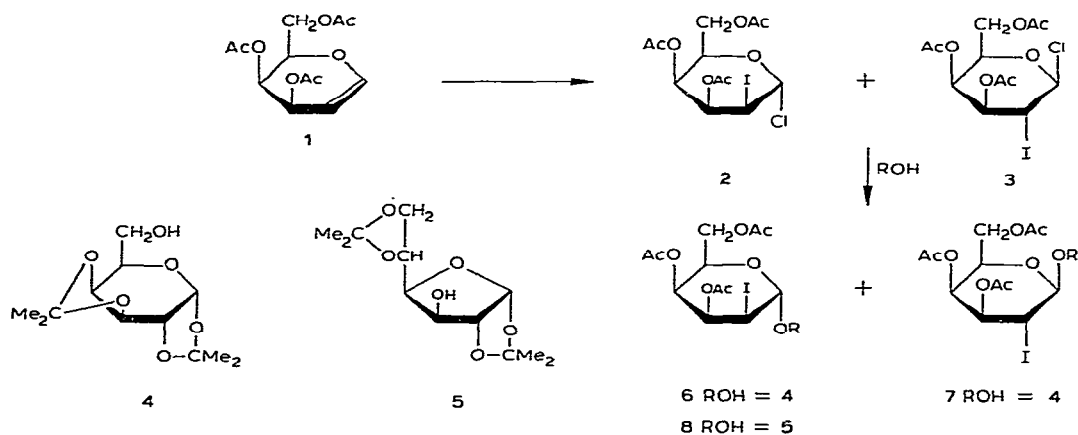
We have described a facile synthesis of disaccharides containing 2-deoxy-2-iodo- α -D-mannopyranosyl groups by using a novel glycosylating system¹. Potential uses of α -linked 2-deoxy-2-iodoglycosides include their reduction to the corresponding 2-deoxyglycosides^{2–4} as well as their conversion into the corresponding 2,3-dideoxyhex-2-enosides⁵. In view of current interest in the synthesis of disaccharide moieties of chromomycin A₃ and olivomycin A containing 2,6-dideoxy- α -D-*l*-xo-hexopyranosyl units⁶, we have now extended our glycosylating system into the *talo* series. The steric course of the reaction appears to be dominated by the *trans*-diaxial addition of iodine monochloride to the glycal double-bond. The course of the glycosylation step is directed by participation of the iodine substituent at C-2, giving 1,2-*trans* glycosides.

3,4,6-Tri-*O*-acetyl-D-galactal (**1**) was treated with silver imidazolate⁷, mercury(II) chloride, and iodine in acetonitrile containing molecular sieves. The resulting, ~5:1 mixture of 3,4,6-tri-*O*-acetyl-2-deoxy-2-iodo- α -D-talo- (**2**) and - β -D-galacto-pyranosyl chloride (**3**) was treated with either the alcohol **4** or **5**, to give the disaccharide **6** or **8** in yields of 73% and 55%, respectively.

EXPERIMENTAL

General methods were the same as those reported⁸. Chromatographic separations on silica gel were performed by using the flash method⁹. ¹³C-N.m.r. spectra were proton-decoupled.

3,4,6-Tri-O-acetyl-2-deoxy-2-iodo- α -D-talo- and - β -D-galactopyranosyl chlorides (2 + 3). — A mixture of mercury(II) chloride (814 mg, 3 mmol), silver imidazolate (350 mg, 2 mmol), and powdered 3Å molecular sieves in acetonitrile (10 ml) was



stirred in the dark at room temperature for 1 h. Iodine (508 mg, 2.0 mmol) and **1** (408 mg, 1.5 mmol) were added. After the mixture had been stirred for 0.5 h in the dark at room temperature, t.l.c. (toluene–ethyl acetate, 2:1) indicated that no **1** remained and the formation of a u.v.-absorbing product having an R_F value higher than that for **1**. The mixture was diluted with toluene–ethyl acetate (2:1, 20 ml) containing triethylamine (2 ml), stirred for a few minutes, filtered through a pad of silica gel, and concentrated. Any remaining mercury(II) chloride (the presence of which can be checked by means of t.l.c. with u.v. detection) was removed by dissolving the crude mixture in chloroform and washing with aqueous sodium iodide, aqueous sodium carbonate, and then water. The solution was dried (MgSO₄), filtered, concentrated, and the residue was subjected to column chromatography on silica gel (toluene–ethyl acetate, 2:1). An ~5:1 mixture of **2** and **3** was obtained. ¹H-N.m.r. data (CDCl₃): **2** δ 5.33 (H-1, $J_{1,2}$ ~1 Hz); **3** δ 4.64 (H-1, $J_{1,2}$ 9.0 Hz). ¹³C-N.m.r. data (CDCl₃): **2** δ 21.6 (C-2), 102.2 (C-1); **3** δ 27.8 (C-2), 103.1 (C-1).

1,2:3,4-Di-O-isopropylidene-6-O-(3,4,6-tri-O-acetyl-2-deoxy-2-iodo- α -D-talopyranosyl)- α -D-galactopyranose (6). — To the reaction mixture containing **2** and **3** [obtained from 408 mg (1.5 mmol) of **1**] was added **4** (260 mg, 1 mmol), and the mixture was stirred in the dark at room temperature for 4 h. Iodine (127 mg, 0.5 mmol) and silver imidazolate (87 mg, 0.5 mmol) were added and the stirring was continued for another 3 h at room temperature. The product was worked-up as described for **2** and **3**, to give **6** (480 mg, 73%), [α]_D 0° (c 1.1, chloroform). ¹H-N.m.r. data (CDCl₃): δ 1.34 (s, 6 H, 2 Me); 1.44 and 1.55 (2 s, each 3 H, 2 Me); 2.05, 2.06, and 2.18 (3 s, each 9 H, 3 OAc); 3.69–3.97 (m, 3 H, H-5,6,6); 4.24–4.39 (m, 6 H, H-2,4,2',5',6',6'); 4.62 (dd, 1 H, H-3); 4.90 (dd, 1 H, H-3'); 5.37 (m, 2 H, H-1',4'); and 5.50 (d, 1 H, H-1); $J_{1,2}$ 4.9, $J_{2,3}$ 2.4, $J_{3,4}$ 8.0, $J_{1',2'}$ ~1, $J_{2',3'}$ 3.4, and $J_{3',4'}$ 5.1 Hz. ¹³C-N.m.r. data (CDCl₃): δ 20.7, 20.8, and 20.9 (3 COCH₃); 21.3 (C-2'); 24.4, 24.9, 25.9, and 26.1 (4 CH₃); 61.9, 65.1, 65.3, 65.9, 66.6, 66.7, 70.4, 70.5, 70.8 (9 C), and 96.0 (C-1); 102.2 (C-1'); 108.5 and 109.2 [(2 C(OR))₂]; 169.1, 169.7, and 170.0 (3 COCH₃).

Anal. Calc. for C₂₄H₃₅IO₁₃: C, 43.8; H, 5.36; I, 19.3. Found: C, 43.7; H, 5.30; I, 19.4.

From the chromatographic separation, a minor product, 1,2:3,4-di-*O*-isopropylidene-6-*O*-(3,4,6-tri-*O*-acetyl-2-deoxy-2-iodo- β -D-galactopyranosyl)- α -D-galactopyranose (**7**; 90 mg, 14%) was isolated; m.p. 136–137° (from ether), $[\alpha]_D -23^\circ$ (*c* 1, chloroform). $^1\text{H-N.m.r.}$ data (CDCl_3): δ 1.34 (s, 6 H, 2 Me); 1.45 and 1.57 (2 s, each 3 H, 2 Me); 2.04, 2.06, and 2.12 (3 s, each 3 H, 3 OAc); 3.79–4.35 (m, 9 H, H-2,4,5,6,6',5',6',6') 4.62 (dd, 1 H, H-3); 4.80 (d, 1 H, H-1'); 5.08 (dd, 1 H, H-3'); 5.20 (dd, 1 H, H-4'); and 5.53 (d, 1 H, H-1); $J_{1,2}$ 4.9, $J_{2,3}$ 2.2, $J_{3,4}$ 7.8, $J_{1',2'}$ 8.8, $J_{2',3'}$ 11.5, $J_{3',4'}$ 3.2, and $J_{4',5'}$ \sim 1 Hz. $^{13}\text{C-N.m.r.}$ data (CDCl_3): δ 20.5 (3 COCH_3); 24.4, 24.9, 25.9, and 26.2 (4 CH_3); 27.3 (C-2'); 61.0, 67.0, 68.6, 70.2, 70.5, 71.0, and 73.9 (9 C); 96.1 (C-1); 103.1 (C-1'); 108.5 and 109.1 [2 C(OR) $_2$]; 169.1, 169.6, and 169.9 (3 COCH_3).

Anal. Calc. for $\text{C}_{24}\text{H}_{35}\text{IO}_{13}$: C, 43.8; H, 5.36; I, 19.3. Found: C, 43.7; H, 5.43; I, 19.3.

1,2:5,6-Di-O-isopropylidene-3-O-(3,4,6-tri-O-acetyl-2-deoxy-2-iodo- α -D-talopyranosyl)- α -D-glucofuranose (8). — Glycosylation of **5**, using the same procedure and quantities as those described for **6**, yielded **8** (360 mg, 55%), $[\alpha]_D +30^\circ$ (*c* 0.8, chloroform). A satisfactory analysis could not be obtained for this compound which, however, gave the expected $^1\text{H-}$ and $^{13}\text{C-n.m.r.}$ spectra. Only a minor amount ($\sim 5\%$) of the presumed β -D-galacto isomer of **8** was observed in t.l.c. of the original reaction mixture. The minor component was not isolated pure. $^1\text{H-N.m.r.}$ data (CDCl_3): δ 1.33, 1.37, 1.42, and 1.49 (4 s, each 3 H, 4 Me); 2.08 (s, 6 H, 2 OAc); 2.19 (s, 3 H, OAc); 3.91–4.39 (m, 9 H, H-3,4,5,6,6',5',6',6'); 4.57 (d, 1 H, H-2); 4.85 (dd, 1 H, H-3'); 5.38 (m, 1 H, H-4'); 5.65 (s, 1 H, H-1'); and 5.89 (d, 1 H, H-1); $J_{1,2}$ 3.7, $J_{2,3}$ and $J_{3,4}$ 3.7 and 4.9, $J_{1',2'}$ \sim 1 Hz. $^{13}\text{C-N.m.r.}$ data (CDCl_3): δ 20.1, 20.6, 20.8, and 20.9 (3 COCH_3 and C-2'); 25.3, 26.3, 26.7, and 26.8 (4 CH_3); 62.3, 65.1, 65.3, 67.5, 67.9, 72.4, 81.4, and 83.7 (9 C); 103.5 (C-1'); 105.2 (C-1); 109.2 and 111.9 [2 C(OR) $_2$]; 169.1, 169.6, and 170.2 (3 COCH_3).

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