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Note

Synthesis of 1,2-*trans*-glycopyranosyl chlorides using the dichloromethyl methyl ether–boron trifluoride etherate reagent

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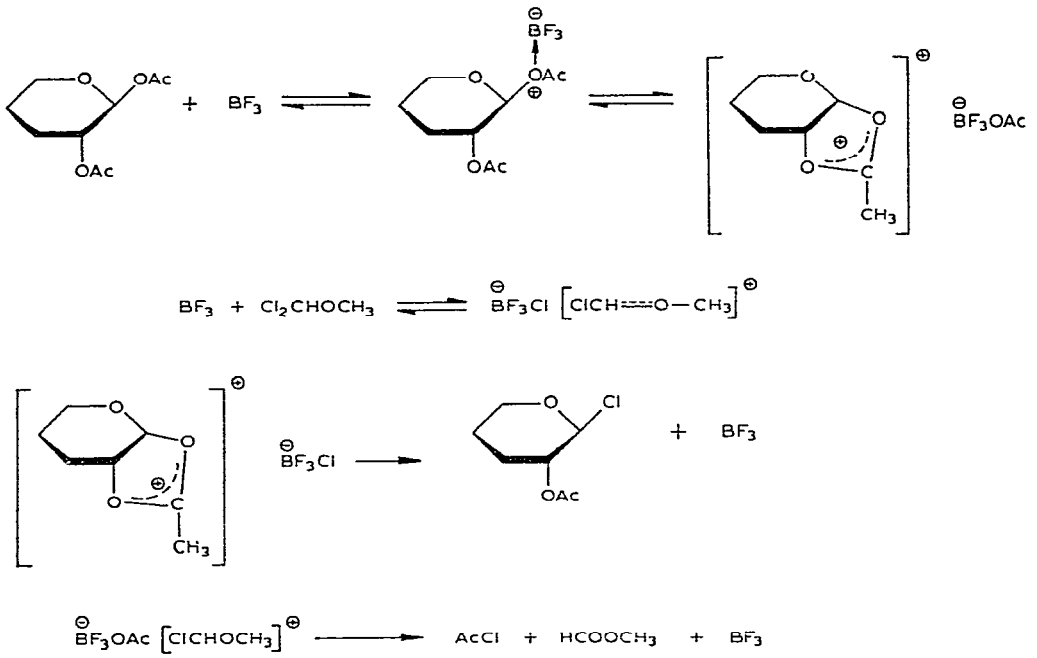
The preparation of the thermodynamically more-stable per-*O*-acylhexopyranosyl halides by treatment of the corresponding anomeric acyl derivatives with dihalogenomethyl methyl ethers in the presence of a catalytic amount of zinc chloride has been described[1]. The procedure has been successfully applied[2] for the preparation of some pentopyranosyl halides, and other catalysts (mercuric chloride and boron trifluoride etherate) have been investigated[2]. The preparation of 2,3,4-tri-*O*-benzoyl-β-D-xylopyranosyl bromide by reaction of the β-tetrabenzoate with dibromomethyl methyl ether in the presence of boron trifluoride etherate is of special interest, as a 1,2-*trans*-dibenzoate gave the thermodynamically less-stable (β-D) glycosyl halide. We were thus prompted to examine the general applicability of boron trifluoride etherate in the preparation of 1,2-*trans*-glycopyranosyl chlorides from the corresponding 1,2-*trans*-diacetates.

We have found that the boron trifluoride etherate-catalyzed reaction of 1,2-*trans*-glycopyranose acetates with dichloromethyl methyl ether at 20° under homogeneous conditions gave the corresponding 1,2-*trans*-glycopyranosyl chlorides in a reproducibly high yield. 1,2,3,4,6-Penta-*O*-acetyl-β-D-mannopyranose is unreactive under these conditions, suggesting that the glycosyl halides are formed *via* an acyloxonium ion intermediate (see annexed reaction scheme). This view is supported by the rapid appearance of the singlet for the methyl group of the acyloxonium ion[3] 0.4 p.p.m. downfield from the signals of the acetyl methyl groups in the p.m.r. spectrum of 1,2,3,4,6-penta-*O*-acetyl-β-D-glucopyranose after addition of boron trifluoride etherate.

Several known glycosyl chlorides of the "unstable" series were prepared by the foregoing convenient procedure. Since the reagents are readily obtainable and easy to handle, the method appears to be superior to other procedures[4–10].



EXPERIMENTAL

G.l.c. was performed using a Hewlett–Packard 5750 instrument equipped with a flame-ionization detector and a column (180 × 2 mm i.d.) packed with Porapak Q (80–100 mesh), a temperature programme of 120–200° at 8°/min, and a nitrogen flow-rate of 20 ml/min.

Preparation of acetylated β-D-aldopyranosyl halides. — A solution of 1,2,3,4-tetra-*O*-acetyl-β-D-xylopyranose (1 g) in chloroform (2 ml), dichloromethyl methyl ether (2 ml), and boron trifluoride etherate (0.1 ml) was kept at 20° for 75 min, then concentrated to dryness *in vacuo*. (The distillate contained acetyl chloride, which was identified in the form of methyl acetate by g.l.c.). A solution of the residue in ether was washed with ice-cold water, aqueous potassium hydrogen carbonate, and water, dried ($MgSO_4$), and concentrated to 5 ml. The product crystallized after the addition of light petroleum. Recrystallisation from ether–light petroleum gave 2,3,4-tri-*O*-acetyl-β-D-xylopyranosyl chloride (0.77 g, 83%), m.p. 113°, $[\alpha]_D$ −136° (*c* 1, chloroform); lit.[4,8]: m.p. 112–113°, $[\alpha]_D$ −131°, −141° (chloroform).

By essentially the above procedure, the following glycosyl chlorides were prepared from the corresponding peracetate or perbenzoate.

2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyl chloride (89%), m.p. 96–97°, $[\alpha]_D$ −17° (*c* 0.5, chloroform); lit.[7,9,11]: m.p. 96°, 98°; $[\alpha]_D$ −17.8°, −22° (chloroform).

2,3,4,6-Tetra-*O*-benzoyl-β-D-glucopyranosyl chloride (91%, m.p. 109–110°), m.p. 112° (from ether–light petroleum), $[\alpha]_D$ +45° (*c* 0.6, chloroform); lit.[12]: m.p. 109–111°, $[\alpha]_D$ +45.7° (chloroform).

2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyl chloride (77%), m.p. 92° (from ether–light petroleum), $[\alpha]_D$ +15°; lit.[4,8,9]: m.p. 91–94°; $[\alpha]_D$ −6.95°, +14.9° (chloroform).

Hepta-*O*-acetyl-β-maltosyl chloride (81%), m.p. 114–116°, $[\alpha]_D$ +60° (*c* 0.8, chloroform); lit.[8,13,14]: m.p. 110–113°, 112–114°, 125°; $[\alpha]_D$ +57.4°, +67.5°, +72.2° (chloroform).

REFERENCES

1 H. Gross and I. Farkas, *Chem. Ber.*, 93 (1960) 95–99; I. Farkas, M. Menyhárt, R. Bognár, and H. Gross, *ibid.*, 98 (1965) 1419–1426.
2 K. Bock, C. Pedersen, and P. Rasmussen, *J. Chem. Soc. Perkin I*, (1973) 1456–1461.
3 H. Paulsen, W. P. Trautwein, F. Garrido Espinosa, and K. Heyns, *Chem. Ber.*, 100 (1967) 2822–2836.
4 H. H. Schlubach and R. Gilbert, *Ber.*, 63 (1930) 2292–2297.
5 K. Igarashi, T. Honma, S. Mori, and J. Irisawa, *Carbohyd. Res.*, 38 (1974) 312–315.
6 E. Pacsu, *Ber.*, 61 (1928) 1508–1513; R. U. Lemieux and C. Brice, *Can. J. Chem.*, 30 (1952) 295–310.
7 G. Zemplén, L. Mester, and A. Eckhart, *Acta Chim. (Budapest)*, 4 (1954) 73–77.
8 W. Korytnyk and J. A. Mills, *J. Chem. Soc.*, (1959) 636–649.
9 J. de Pascual Tereza and F. Garrido Espinosa, *An. Real Soc. Españ. Fis. Quim., Ser. B*, 52 (1956) 347–352; *Chem. Abstr.*, 51 (1957) 227.
10 F. Garrido Espinosa and C. Sunkel, *An. Univ. Catolica Valparaiso*, 6 (1959) 189–197; *Chem. Abstr.*, 58 (1963) 2495.
11 R. U. Lemieux and C. Brice, *Can. J. Chem.*, 33 (1955) 109–119.
12 Z. Csürös, G. Deák, and L. Fenichel, *Acta Chim. (Budapest)*, 62 (1969) 121–123.
13 K. Freudenberg and O. Ivers, *Ber.*, 55 (1922) 929–941.
14 K. Heyns, W. P. Trautwein, F. Garrido Espinosa, and H. Paulsen, *Chem. Ber.*, 99 (1966) 1183–1191.