Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/lsyc20

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Published online: 21 Aug 2006.

To cite this article: Jie Xia & Yongzheng Hui (1996) A Convenient Method for Highly Selective Deprotection of Benzylidene Acetals from Sugars, Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry, 26:5, 881-886, DOI: 10.1080/00397919608003691

To link to this article: http://dx.doi.org/10.1080/00397919608003691

SYNTHETIC COMMUNICATIONS, 26(5), 881-886 (1996)

# A CONVENIENT METHOD FOR HIGHLY SELECTIVE DEPROTECTION OF BENZYLIDENE ACETALS FROM SUGARS

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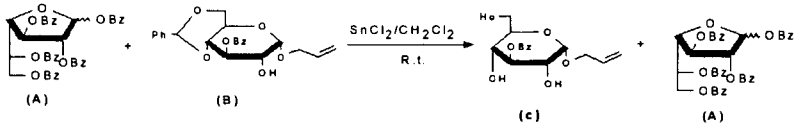
**Abstract:** A new procedure for cleavage of benzylidene acetals from glycopyranosides using tin (II) chloroide is described which does not affect other protecting groups such as benzoyl, acetyl, benzyl, and acetonide.

Benzal derivatives are used extensively as protecting groups in carbohydrate chemistry and peptide chemistry, [1-4] and, for example, synthesis of peptides of bacterial cell walls preferentially use benzyl and benzylidene residues to protect the hydroxyl gropus in positions 1 and 4,6-of N-acetylmuramic acid. So far many methods [5-7] have been described for deprotection of benzylidene acetals, but most have disadvantages, especially that they may not be very selective. For instance, removal of a benzylidene acetal by catalytic hydrogenation using Pd-C (10%) and hydrogen may remove a benzyl group simultaneously. Furthermore, although

benzylidene acetals can be cleaved by using Lewis acids such as boron trichoride, use of such acids can also result in cleavage of other groups, in cluding acetonides. Here we report a new procedure for removing benzylidene acetals from glycopyranosides with high selectivity and without affecting other protecting groups such as benzoyl, acetyl, benzyl and acetonide.

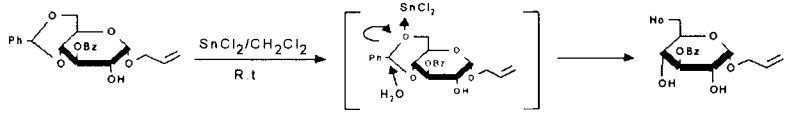
We attempted disaccharide formation by linking building block A and building block B using tin(II) chloride as promotor. However, the product from reaction of A with B was the deprotected sugar C.

Scheme 1.



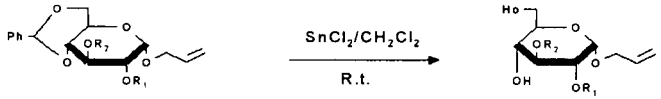

The reason for cleavage of the benzylidene acetal is presumably that the oxygen atoms of ethers, esters and many other derivatives of carbohydrates provide sites for coordination with electron-deficient molecules such as Lewis acids. Thus, tin(II) chloride first complexes with oxygen of the benzylidene acetal in the glycopyranoside to form an electron-deficient benzylic centre which can be attacked by water as outlined in Scheme 2:

Scheme 2.




Further examples are given in Tables 1-2 and Schemes 3-4:

Scheme 3.



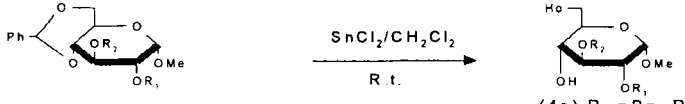

(1a) $R_1$=OH, $R_2$=Bz.
(1b) $R_1$=$R_2$=Ac.
(1c) $R_1$=$R_2$=Bn.

(2a) $R_1$=OH, $R_2$=Bz.
(2b) $R_1$=$R_2$=Ac.
(2c) $R_1$=$R_2$=Bn.

Table 1. Formation of diols (2a-2c) with tin(II) chloride in dichloromethane

| Entry | Agent | Temp.(° C) | Time(h) | Product | Yield(%) |
|---|---|---|---|---|---|
| (1a) | $SnCl_2$ | r.t | 4 | (2a) | 88 |
| (1b) | $SnCl_2$ | r.t | 3 | (2b) | 86 |
| (1c) | $SnCl_2$ | r.t | 12 | (2c) | 95 |

Scheme 4.




(3a) $R_1$=Bz, $R_2$=Bz.
(3b) $R_1$=$R_2$=Ac
(3c) $R_1$=$R_2$=Bn

(4a) $R_1$=Bz, $R_2$=Bz
(4b) $R_1$=$R_2$=Ac
(4c) $R_1$=$R_2$=Bn

Table 2. Formation of diols (4a-4c) with tin(II) chloride in dichloromethane

| Entry | Agent | Temp.(° C) | Time(h) | Product | Yield(%) |
|---|---|---|---|---|---|
| (3a) | $SnCl_2$ | r.t | Overnight | (4a) | 89 |
| (3b) | $SnCl_2$ | r.t | Overnight | (4b) | 85 |
| (3c) | $SnCl_2$ | r.t | Overnight | (4c) | 91 |

Finally, we attempted to remove an acetonide group from a glycopyranoside D under similar conditions, but were unsuccessful; the starting material was recovered.

In conclusion, we have found a new procedure to remove the benzylidene acetal without affecting other protecting groups such as benzoyl, acetoyl, benzyl and acetonide by using tin(II) chloride in dichloromethane.

## EXPERIMENTAL

The $^1$HNR spectra were recorded at 300MHz with a Bruker AM-300 spectrometer using deuteriochloroform and deuterioacetone as solvent and $SiMe_4$ as internal standard. TLC was performed on silical gel (Silica gel F254,0.2mm thickness supplied by Qing Dao) and Column chromatography was performed on silica gel H 400 mesh from Qing Dao, China.

**General Procedure:** To the solution of benzylidene sugar (1mmol) dissolved in dichloromethane (20 ml), a catalytic amount of tin(II) chloride was added. The mixture was stirred at room temperature and was monitored by TLC. The solution was filtered and the organic layers were evaporated to oily residues, the residues were purified by column chromatography washed with petroleum ether:ethyl acetate:methanol after the reaction was completed.

**Compound(2a):**

$R_f$ =0.45(petroleum ether: ethyl acetate:methanol: 4:1:1.

$^1$HNMR($CDCl_3$): 8.00-7.90ppm(m 2H) 7.60-7.50ppm(m 1H) 7.50-7.40ppm(m 2H) 5.90-5.70ppm(m 2H) 5.40-5.30ppm(m 3H) 5.20-5.00ppm(m 1H) 4.40-4.20ppm (dtdt 1H) 4.10-3.90ppm(m 5H).

**Compound(2b):**

$R_f$ =0.26( petroleum ether: ethyl acetate:methanol: 4:1:0.6).

$^1$HNMR(acetone-$d_6$): 6.00-5.80ppm(m 1H) 5.40-5.3ppm(m 1H) 5.20-5.10ppm(m 1H) 5.00-4.90ppm(m 3H) 4.80-4.60ppm(m 1H) 4.40-4.20ppm(m 1H) 4.20-4.00ppm(m 1H) 3.90-3.40ppm(m 4H) 2.00-1.80ppm(2s 6H).

**Compound(2c):**

$R_f$=0.51(petroleum ether: ethyl acetate:methanol: 4:1:0.6).

$^1$HNMR(acetone-$d_6$): 7.40-7.30ppm(m 10H) 6.10-5.90ppm(m 1H) 5.40-5.20ppm(m 1H) 5.20-5.00ppm(m 1H) 4.95-4.80ppm(m 4H) 4.80-4.60ppm (m 2H) 4.20-4.00ppm(d 1H) 4.00-3.90ppm(m 1H) 3.90-3.70ppm(m 1H) 3.70-3.60ppm(m 2H)3.50-3.40ppm(m 2H).

**Compound(4a):**

$R_f$ =0.43( petroleum ether: ethyl acetate:methanol: 4:1:0.6).

$^1$HNMR(acetone-$d_6$):m 8.10-7.90ppm(d 2H) 7.90-7.80ppm(d 2H) 7.60-7.50ppm(m 2H) 7.50-7.40ppm(m 4H) 5.90-5.70ppm(t 1H J=9.6Hz J=9.3Hz) 5.10-5.00ppm(m 2H) 4.10-3.90ppm(m 2H) 3.80-3.70ppm(m 2H) 3.50-3.40ppm(s 3H).

**Compound(4b):**

$R_f$ =0.37( petroleum ether: ethyl acetate:methanol: 4:1:0.6).

$^1$HNMR($CDCl_3$): 5.40-5.30ppm(t 1H J=9.1Hz J=9.4Hz) 5.00-4.90ppm(d 1H J=3.5Hz) 4.90-4.80ppm(dd 1H J=3.6Hz J=3.6Hz) 4.20-4.10ppm(d 1H) 4.00-3.80ppm(s 2H) 3.80-3.60ppm(d 2H) 3.50-3.40ppm(s 3H).

**Compound(4c):**

$R_f$ =0.35( petroleum ether: ethyl acetate:methanol: 4:1:1).

$^1$HNMR($CDCl_3$): 7.40-7.20ppm(m 10H) 5.00-4.90ppm(s 2H) 4.82-4.78ppm(s 2H )4.40-4.20ppm(d 1H J=3.6Hz) 3.90-3.70ppm(m 3H) 3.60-3.40ppm(m 3H) 3.40-3.30ppm(s 3H).

References:

[1].Fletcher, Jr., H.G. *Methods Carbohydr.Chem.* 1963,**II**, 307.

[2].Munavu, R.M.;Szmant, H.H. *Tetrahedron Lett.* 1975, **28**,4543.

[3].Carman, R.M.; Kibby, J.J. *Aust. J. Chem.* 1976, **29**, 1761.

[4]. Kusumoto, S.; Tarumi, Y.; Ikenaka K.; Shiba, T. *Bull Chem.Soc. Jap.* 1976, **49**, 533.

[5].Zaoral, M.; Masek, K. *Collect. Czech Chem.Commun.*, 1978, **43,** 1979.

[6].Mariranovsky V.G. *Angew. Chem. Inter. Ed. Engl.* 1976, **15**, 281.

[7].Hanessian, S.; Staub, P.A. *Tetrahedron Lett.* 1973, **25**, 3551.

(Received in the UK 26 July 1995)