

Catalytic Deacylation of Sugars with Strong Base Ion-exchange Resins; an Alternative to the Zemplén Procedure

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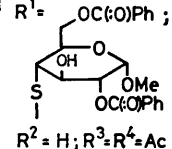
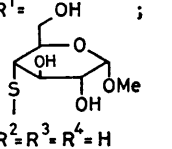
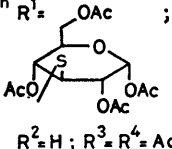
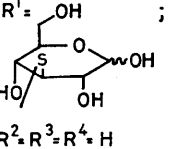
Summary Strong base ion-exchange resins may be used for the catalytic deacylation of sugars; this new technique permits the facile isolation of water-soluble products without deionization.

THE classical method for removing acyl blocking groups (ordinarily acetates and benzoates) from sugars is the

Zemplén¹ procedure which employs a catalytic quantity of sodium methoxide in methanol. When removal of the small amounts of ionic salts that accompany the deacylated product is easy the method works very well, but instances exist where deionization of the reaction mixture is difficult and purification of the deblocked product is a problem. We experienced such a difficulty in preparing a number of free

sugars and deblocked glycosides and report a procedure that, in our hands, has represented a distinct improvement over the Zemplén procedure.

TABLE. Catalytic deacylation of sugar substrates.

Substrate ^a	t/h ^b	Product ^a	Yield/% ^c
(1) ^e R ¹ =R ⁴ =H; R ² =OMe; R ³ =C(O)Ph	6	(2) ^f R ² =OMe; R ¹ =R ³ =R ⁴ =H	94 ^c
(3) ^e R ¹ =H; R ² =OMe; R ³ =C(O)Ph; R ⁴ =SO ₂ Me	6	(4) ^e R ² =OMe; R ¹ =R ³ =H; R ⁴ =SO ₂ Me	87 ^d
(5) ^g R ¹ =OBu [†] ; R ² =H; R ³ =R ⁴ =Ac	2	(6) ^{h,i} R ¹ =OBu [†] ; R ² =R ³ =R ⁴ =H	94 ^c
(7) ^h R ¹ =SBu [†] ; R ² =H; R ³ =R ⁴ =Ac	6	(8) ^{h,j} R ¹ =SBu [†] ; R ² =R ³ =R ⁴ =H	92 ^c
(9) ^h R ¹ =SO ₂ Bu [†] ; R ² =H; R ³ =R ⁴ =Ac	4	(10) ^{h,k} R ¹ =SO ₂ Bu [†] ; R ² =R ³ =R ⁴ =H	89 ^c
(11) ^l R ¹ =OC(O)Ph; 	24	(12) ^l R ¹ =OH; 	90 ^d
(13) ^h R ¹ =OAc; 	3	(14) ^{h,m} R ¹ =OH; 	96 ^c

^a All previously unreported compounds gave satisfactory analytical data. ^b Reaction times determined by t.l.c. ^c Isolated yield. ^d Yield of analytically pure product. ^e Cf. ref. 4, (4) m.p. 157.5–158.5 °C (lit. 159–160 °C). ^f $[\alpha]_D^{30} = 173.8^\circ$ (c 1, H₂O), (lit. $[\alpha]_D^{25} = 179-180^\circ$), S. A. Barker, E. J. Bourne, and D. H. Whiffen, *J. Chem. Soc.*, 1952, 3865. ^g Cf. ref. 2. ^h Details of the preparations of these compounds will be reported elsewhere. ⁱ M.p. 119–120 °C, $[\alpha]_D^{29} = -11.5^\circ$ (c 1, H₂O). ^j M.p. 113–114 °C, $[\alpha]_D^{24} = -36.9^\circ$ (c 1, H₂O). ^k M.p. 135–136 °C, $[\alpha]_D^{21} = -0.5^\circ$ (c 1, EtOH). ^l Cf. ref. 3. ^m M.p. 218–220 °C (decomp.), $[\alpha]_D^{21} = 15.6^\circ$ (c 0.5, H₂O).

† Amberlyst A-26(Cl) (10 g) was stirred with 1 N sodium hydroxide (100 ml) for 1 h then was filtered off and washed with water (2 × 300 ml) and methanol (2 × 100 ml). The moist resin in the OH⁻ form was stored at 0 °C.

¹ A. Thompson, M. L. Wolfrom, and E. Pacsu, *Methods Carbohydr. Chem.*, 1962, II, 215.

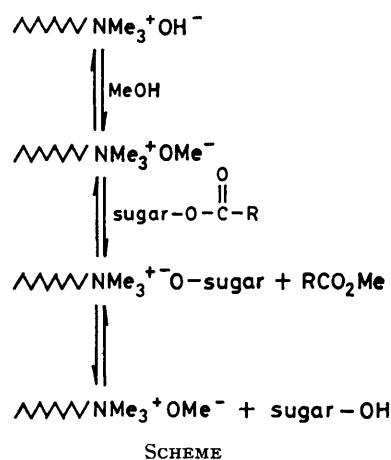
² P. A. Risbood, L. A. Reed, III, and L. Goodman, *Carbohydr. Res.*, 1981, **88**, 245.

³ L. A. Reed, III, and L. Goodman, *Carbohydr. Res.*, in the press.

⁴ E. J. Reist, R. R. Spencer, D. F. Calkins, B. R. Baker, and L. Goodman, *J. Org. Chem.*, 1965, **30**, 2312.

When an acylated or benzoylated sugar (presumably other acyl groups can be removed) was stirred in methanol solution at room temperature with a catalytic amount (typically we have used 150 mg of the moist resin per gram of blocked sugar) of the macroreticular Amberlyst A-26(OH),† debenzoylation or deacetylation was usually complete within 6 h. Isolation was accomplished by filtration and evaporation of the filtrate. When methyl benzoate was a product trituration with hexane sufficed for its removal. In two cases in the Table, that of the t-butyl glycoside (6)² and the methyl thio-lactoside (12)³ we were unable to obtain crystalline products or satisfactory microanalytical data when the Zemplén procedure was employed but use of the ion-exchange procedure gave high yields of analytically pure crystals in both cases. Also noteworthy is the high yield obtained of the mesylate (4); the reported yield by the Zemplén method was 59%.⁴

We believe that the deacylation occurs by a series of ion exchanges at the resin surface, as is depicted in the Scheme, and that the sugar is exposed to strongly basic conditions for short periods of time.



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