Note

Synthesis of octa-*O*-acetyl maltobiononitrile

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The synthesis of octa-*O*-acetylmaltobiononitrile was attempted by Zemplén by reaction of maltose with hydroxylamine, and subsequent acetylation of the crude oxime[1]. He obtained a syrup, containing 65% of acetylated nitrile, which did not afford a crystalline product. Application of modern techniques has allowed us to prepare the octaacetate of that nitrile in crystalline form by a slight modification of Zemplén's method that took into consideration that the proportion of hydroxylamine employed is decisive in minimizing secondary reactions.

It is noteworthy that preparation of this particular nitrile presented great difficulties. Maltose shows a low tendency to react with hydroxylamine, and a considerable proportion of free sugar remains unreacted in the mixture (prior to acetylation). This is not the case with cellobiose and lactose, which react almost completely with hydroxylamine and readily afford octa-*O*-acetylcellobiononitrile[2] and octa-*O*-acetyl-lactobiononitrile[3], respectively. This difference in behavior may be ascribable to the different stereochemistry of the glycosidic linkage between the two moieties of maltose (*alpha*) and the latter two sugars (both *beta*).

Inspection of molecular models of the conformational structures proposed[4] suggests that maltose presents less crowding as compared with cellobiose and lactose, whose moieties are sterically more interacting; this probably makes the reducing group of these sugars more reactive than that of maltose.

EXPERIMENTAL

Melting points are uncorrected. T.l.c. was performed on Silica Gel G (E. Merck, Darmstadt, Germany), with 47:3 (v/v) benzene–methanol as the mobile phase; the spots were detected with iodine vapor.

*Octa-*O*-acetylmaltobiononitrile.* — Sodium (0.84 g) was dissolved in 36 ml of absolute ethanol, and the solution was slowly added, with stirring, to a solution of 4.8 g of hydroxylamine hydrochloride in 10 ml of water, precooled to −5°. After 0.5 h, the sodium chloride formed was filtered off, and washed with 3 ml of ethanol.

Maltose monohydrate (6 g) was dissolved in 24 ml of warm water, and the ethanolic solution of hydroxylamine was slowly added at 60°, to avoid precipitation.

After 1 h at 65°, the mixture was made neutral with acetic acid, and evaporated to a thick syrup, which was repeatedly dissolved in methanol, and the solution evaporated to dryness. The resulting, amorphous maltose oxime was dried in a vacuum desiccator, and powdered.

Anhydrous sodium acetate (6 g) was mixed with the powdered maltose oxime, and 40 ml of acetic anhydride was added; the mixture was slowly and cautiously warmed in a water bath, with continual shaking, a violent reaction being avoided by inmersion of the flask in ice-water whenever necessary. When the syrup had dissolved, and the reaction had apparently ceased, the solution was kept for 1 h at 100°, and then poured into 350 ml of ice-water. After 24 h, the liquid was decanted, and the resulting gum was washed by stirring several times with cold water, until a powder was obtained; this was filtered off and washed with water until neutral. Crude octa-*O*-acetylmaltobiononitrile gave two spots by t.l.c., one of them identified as octa-*O*-acetylmaltose.

The crude product was dissolved in 10 ml of benzene, and chromatographed on Silica Gel (Davison). The column (620 × 50 mm) was eluted with benzene (fractions 1–10, total 300 ml), and with increasing concentrations of methanol as follows: 0.5% (fractions 11–20, total 300 ml), 1% (fractions 21–36, total 480 ml), 2% (fractions 37–136, total 3 liters), 3% (fractions 137–236, total 3 liters), 10% (fractions 237–246, total 300 ml), and finally with 1 liter of methanol. Fractions (30 ml each) were collected, evaporated separately, dissolved in methanol, and then combined according to their composition as revealed by t.l.c.

Fractions 1–40 gave no residue. Fractions 41–134 gave 2.3 g of octa-*O*-acetylmaltose, m.p. and mixed m.p. 158–159°, $[\alpha]_D^{19}$ +62° (*c* 0.6, chloroform)[5]. On t.l.c., it showed only one spot, of R_F 0.65, identified by comparison with authentic *β*-octa-*O*-acetylmaltose.

Fractions 138–235 gave 5.1 g (45.1%) of octa-*O*-acetylmaltobiononitrile, m.p. 168–169°. After two recrystallizations from methanol, needles of m.p. 170–171°, $[\alpha]_D^{20}$ +67.8° (*c* 0.76, chloroform) were obtained; t.l.c. showed only one spot, of R_F 0.51. The analytical sample was dried at 100°/1mtorr.

Anal. Calc. for $C_{28}H_{37}NO_{18}$: C, 49.75; H, 5.52; N, 2.06. Found: C, 49.45; H, 5.67; N, 2.04.

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