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Note

Reactions of 4,5,6-tri-*O*-benzoyl-1,3-dideoxy-1-diazo-D-*erythro*-hexulose*

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As part of a study of the nonenzymic browning-reaction between aldohexoses and amines, an improved synthetic route to the key intermediate 3-deoxy-D-*erythro*-hexosulose[1] (**4**) by way of a diazomethyl ketone[2] was sought. The proposed sequence involved the conversion of the protected chloride (**2**) of the tribenzoate (**1**) of 2-deoxy-D-*erythro*-pentonic acid by diazomethane into the diazomethyl ketone **3**, followed by conversion of the triphenylphosphazine (**5**) of **3** by action of nitrous acid into the 4,5,6-tribenzoate of the aldosulose **4**, following a general route[3] for conversion of diazomethyl ketones into α-ketoaldehydes. Although satisfactory conditions for the final step in this sequence were not established before a much simpler and direct preparation[4] of **4** became available, isolation of a crystalline product obtained by reduction and subsequent acetylation of the diazomethyl ketone **3** prompts this brief report.

2-Deoxy-D-*erythro*-pentose (Hoffmann–La Roche & Co.) was converted[5] into the dithioacetal (yield, 64% of distilled syrup), which was benzoylated[6] (yield 85%), the product demercaptalated to the aldehyde[6] (yield 78%), and the latter oxidized[7] with bromine water to give 3,4,5-tri-*O*-benzoyl-2-deoxy-D-*erythro*-pentonic acid (**1**) in 96% yield. Conversion of **1** into the acid chloride **2** was achieved under conditions somewhat milder than those described in the literature[7], to give **2** in improved yield (90%).

The chloride **2** reacted with an excess of diazomethane to afford the diazomethyl ketone **3**, having m.p. and specific rotation in agreement with values reported by Zorbach *et al.*[7]. The product was analytically pure and showed characteristic $C=N_2$ absorption in the i.r. spectrum at 2110 cm^{-1}, and its n.m.r. spectrum showed the H-1

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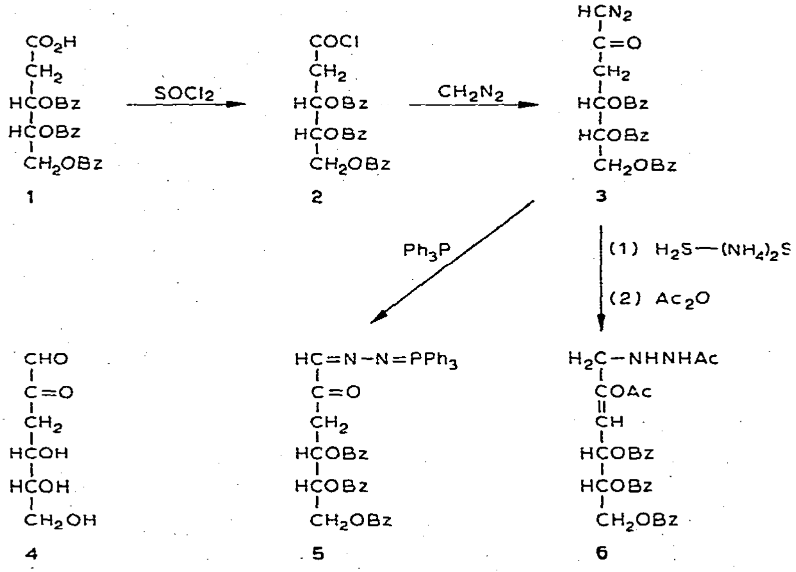
signal as a singlet upfield of the H-4 and H-5 signals, and the C-2 methylene signals at high field. It reacted with an equimolar proportion of triphenylphosphine to give a homogeneous syrup formulated as the phosphazine **5**; the latter showed no i.r. absorption for the diazo group.

Hydrogen sulfide–ammonium sulfide converted **3** into a syrupy product showing no $C{=}N_2$ band in the i.r. spectrum. Acetylation of this syrup gave a crystalline product tentatively formulated as the enol acetate derivative **6**. The compound gave an elemental analysis in agreement with that calculated for the formula $C_{31}H_{28}N_2O_9$, and its n.m.r. spectrum showed the presence of two acetyl groups. Further support for this structural formulation was provided by the i.r. spectrum, which showed, in addition to absorptions for acetyl and benzoyl groups, bands for N–H stretching and bending modes, and C=C stretching and vinylic C–H stretching modes.



EXPERIMENTAL

*3,4,5-Tri-*O*-benzoyl-2-deoxy-*D-erythro*-pentonyl chloride* (**2**). — A solution of dried 3,4,5-tri-*O*-benzoyl-2-deoxy-D-*erythro*-pentonic acid (**1**, 2 g) in pure thionyl chloride (b.p. 75.5–76.5°) was heated for 10 h at 65–70°, and then concentrated *in vacuo*. Benzene was several times added to and evaporated from the concentrated solution (to remove the excess of thionyl chloride), and the product was crystallized from a large volume of hot cyclohexane that was allowed to cool to ~25°; yield (in two crops) 1.88 g (90%), m.p. 122–123.5°, $[\alpha]_D^{21}$ +20° (*c* 0.1, dichloromethane) (lit.[7] m.p. 118–121°, $[\alpha]_D$ +17° in dichloromethane); ν_{max}^{KBr} 1820 and 1735 cm^{-1}.

*4,5,6-Tri-*O*-benzoyl-1,3-dideoxy-1-diazo-*D-erythro*-hexulose* (**3**). — A solution of **2** (1.5 g) in dry ether (200 ml) was slowly added to a magnetically stirred, ethereal solution (240 ml) of diazomethane (~3 g). Crystals separated after 30 min, and the mixture was kept for ~18 h at 0°, to afford 1.0 g of crystalline 3; m.p. 130–134° (lit.[7] m.p. 137.5–144°, $[\alpha]_D^{24}$ −28.4° in dichloromethane); ν_{max}^{KBr} 2110 (C=N$_2$), 1635 (COCN$_2$), and 1735 cm^{-1}; n.m.r. (60 MHz, chloroform-*d*): δ 2.95 (2-proton doublet, H-3), 4.60–4.82 (2-proton multiplet, H-6), 5.34 (singlet, H-1), 6.12–6.80 (2-proton multiplet, H-4,5), 7.25–7.66 and 7.94–8.20 (15 protons, phenyl). Additional crops from the mother liquor raised the total yield to near quantitative.

Recrystallization from ethanol gave pale-yellow crystals, m.p. 146–147°, $[\alpha]_D^{21}$ −30° (*c* 1, dichloromethane).

Anal. Calc. for $C_{27}H_{22}N_2O_7$: C, 66.65; H, 4.55; N, 5.75. Found: C, 66.38; H, 4.55; N, 5.73.

Reaction of compound 3 *with ammonium hydrogen sulfide.* — To a solution of 3 (100 mg) in ethanol (20 ml) were added 4 drops of 20% aqueous ammonium sulfide, and a stream of hydrogen sulfide was passed through the solution for 6 h at ~25°, followed by a stream of nitrogen for 3.5 h. The resultant suspension was clarified by filtration, and the filtrate was evaporated to a syrup, ν_{max}^{film} 1670 and 1550 cm^{-1} (no C=N$_2$ band at 2110 cm^{-1}), which was dissolved in acetic anhydride (5 ml). After 18 h at ~25°, ethanol was added, and the solution was evaporated. The residue was crystallized from methanol. Recrystallization (twice) from methanol gave a pure compound, tentatively formulated as 2-*O*-acetyl-1-(2-acetylhydrazino)-4,5,6-tri-*O*-benzoyl-1,3-dideoxy-D-*erythro*-hex-2-enitol (6); yield 60.3 mg, m.p. 113–115°, $[\alpha]_D^{18}$ +0.21° (*c* 0.8, chloroform); ν_{max}^{KBr} 3450, 3250, 3020, 2940, 1770, 1735, 1725, 1695, 1675, 1660, 1610, 1575, and 1540 cm^{-1}; n.m.r. δ 2.1 (2 acetyl groups).

Anal. Calc. for $C_{31}H_{28}N_2O_9$ (572.5): C, 64.91; H, 4.92; N, 4.89. Found: C, 64.71; H, 4.96; N, 4.81.

Triphenylphosphazine (5) *of* 3. — Triphenylphosphine (59.3 mg) and compound 3 (100 mg) in a mixture of dry ether (2 ml) and benzene (10 ml) were kept for 3 h at ~25°. Evaporation gave the chromatographically homogeneous phosphazine 5; yield 160 mg, ν_{max}^{film} 1500 cm^{-1}, no C=N$_2$ band at 2115 cm^{-1}; R_F 0.25 (t.l.c., silica gel G, 10:1 benzene–methanol).

Anal. for $C_{45}H_{37}N_2O_7P$: N, 3.74. Found: N, 3.67.

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