Tetrahedron Letters No. 16, pp. 1023-1026, 1963. Pergamon Press Ltd.
Printed in Great Britain.

# MUTAROTATION OF A D-GLUCURONE DERIVATIVE

F. P. Johnson and N. V. Riggs

Department of Organic Chemistry, University of New England,

Armidale, New South Wales

(Received 8 April 1963)

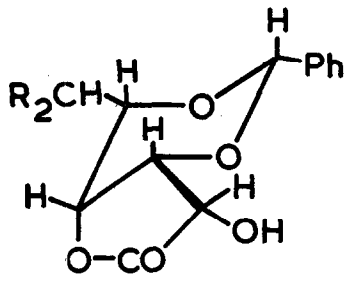
IN an attempt to obtain a representative of the so far unauthenticated aldohexopyranurono-3,6-lactones, we have reinvestigated the conversion of D-glucurone dibenzyl mercaptal into 2,4-*O*-benzylidene-D-glucurone monohydrate and mutarotation of the latter in formdimethylamide[1]. It was suggested[1] that the (irreversible) mutarotation could represent the change, α-pyranose ⟶ β-pyranose, which seemed to us unlikely as being the transfer of an equatorial substituent to the less stable axial position unless configurational assignments are reversed for this pyranurono-3,6-lactone in which the conformation of the pyranose ring would be inverted with respect to that in the uronic acid. Further, in 2,4-*O*-benzylidene-D-glucurone dibenzyl mercaptal (Ia) we may assume that the phenyl group is equatorial to the benzylidene ring[2]; formation of a pyranose ring on demercaptalation would then require inversion of the benzylidene ring and involve the phenyl group in strong non-

---

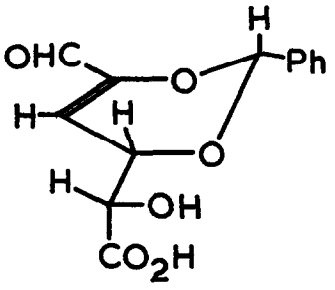
[1] H. Zinner and C.-G. Dässler, Chem. Ber. 93, 1597 (1960).

[2] J. A. Mills, Adv. Carbohydrate Chem. 10, 1 (1955).

bonded interactions with two other axial substituents on the same side of this ring. The gem-diol structure (Ib) is therefore preferred for the monohydrate.



Ia: R=$SCH_2Ph$
Ib: R=OH



II

Although D-glucurone dibenzyl mercaptal, $\nu_{C=O}^{Nujol}$ 1793 $cm^{-1}$, its 2,4-O-benzylidene derivative (Ia), $\nu_{C=O}^{Nujol}$ 1785 $cm^{-1}$, and the monohydrate (Ib), $\nu_{C=O}^{Nujol}$ 1793 $cm^{-1}$, retain a $\gamma$-lactone ring, the product of mutarotation in formdimethylamide does not. Our product, needles, m.p. 130 - 132° (decomp.), from ethyl acetate-light petroleum, $[\alpha]_D^{15}$ - 61° (c, 0.68 in formdimethylamide), $[\alpha]_D^{15}$ - 117° (c, 0.85 in pyridine), differs in rotation in pyridine but agrees reasonably in other properties with those previously reported[1]. It is clearly 2,4-O-benzylidene-4(S), 5(S)-hex-2-en-1-al-2,4,5-triol-6-oic acid (II). It shows $\nu_{max}^{Nujol}$ (in $cm^{-1}$): 3300 br (hydroxyl), 2623 br and 1739 vs (carboxyl), 1688 vs ($\alpha,\beta$-unsaturated aldehyde), and 1649 m (double bond); $\lambda_{max}^{EtOH}$ 254 mμ (ε, 7300) (whereas the monohydrate precursor shows only resolved benzenoid absorption, ε 200 - 300,

in this region); and titrates in water as an acid, pK ~ 3.5, equiv. weight ~ 270. (Found: C, 59.4; H, 4.7. Calc. for $C_{13}H_{12}O_6$: C, 59.1; H, 4.6%; M, 264). Signals (one proton intensity, except as stated) in its proton magnetic resonance spectrum in perdeuteropyridine are assigned as follows ($\delta$ values in p.p.m. downfield from tetramethylsilane, J values in c.p.s.): doublet at $\delta$5.06 (H5, $J_{45}$ = 5.0); quartet at $\delta$5.65 (H4, $J_{45}$ = 5.0, $J_{34}$ = 2.0); doublet at $\delta$6.69 (vinyl H3, $J_{34}$ = 2.0); singlet at $\delta$6.20 (benzylidene H7); singlet at $\delta$9.43 (aldehyde H1); complex multiplet, intensity 6 - 7 protons, at $\delta$7 - 8 (aromatic protons plus residual protons in solvent); singlet, intensity two protons, at $\delta$11.27 (carboxyl H6 plus hydroxyl H5a). The assignment for the carboxyl proton is unexceptionable, and coalescence of its signal with that of the hydroxyl proton indicates rapid exchange of these protons[3]. Upon addition of deuterium oxide to the solution, the signal at $\delta$11.27 is replaced by a singlet, intensity two protons, at $\delta$6.42 and due to water formed by exchange.

We have been unable to isolate the mutarotation product (II) from pyridine solutions, or to prepare crystalline derivatives. Its ethanolic solution on addition of alkali shows a rapid, large rise in optical density and develops a yellow colour. Mutarotation is however much slower in purified formdimethylamide than in the commercial product, and is formulated as (acid- or base-catalyzed) elimination of the

---

[3] L. M. Jackman, Nuclear Magnetic Resonance Spectroscopy, p.26, Pergamon Press, London (1959).

3-acyloxy group and the 2-proton in probably the free aldehydo-form in equilibrium with monohydrate (Ib), the requisite trans-conformation being readily achieved.

In our hands, shaking a mixture of D-glucurone, benzyl mercaptan, and conc. hydrochloric acid rapidly gave benzylthio-α-D-glucuronofuranoside, needles from ethyl acetate-light petroleum, m.p. 168.5 - 171°, $[\alpha]_D^{20}$ + 278° (c, 1.22 in pyridine), $\nu_{max}^{Nujol}$ 3330 $cm^{-1}$ (OH), 1786 $cm^{-1}$ (γ-lactone) (Found: C, 55.5; H, 5.3; S, 11.5. Calc. for $C_{13}H_{14}O_5S$: C, 55.3; H, 5.0; S, 11.4%). D-Glucurone dibenzyl mercaptal was obtained by addition of methanol to the hot reaction mixture and cooling.

This work was carried out during the tenure of a Commonwealth Post-graduate Scholarship by F.P.J.. We thank Dr. A. V. Robertson for the p.m.r. spectra (Varian A-60 instrument).