Tetrahedron Letters No.26, pp. 2963-2965, 1966. Pergamon Press Ltd.
Printed in Great Britain.

REACTION OF DIAZOMETHANE WITH β-OXO-ALDEHYDES AND THEIR ENOL ETHERS

D.Nasipuri and K.K.Biswas

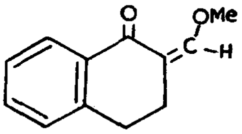
Department of Chemistry, University of Calcutta

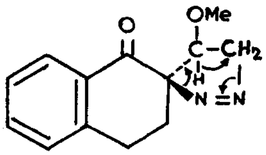
Calcutta-9, India

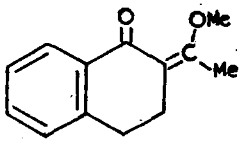
(Received 23 April 1966)

Diazomethane is known to react with enolizable β-oxo-esters and β-diketones with the formation of mainly O-methylated products. These enol ethers in principle can react with a second mole of diazomethane to afford pyrazoline derivatives (cf. α,β-unsaturated ketones[1]). No such reaction has, however, been reported in the literature to our knowledge. We now find that in case of β-oxo-aldehyde (hydroxymethylene ketone), the reaction does indeed go further and the methyl ether formed initially, adds up diazomethane to furnish a Δ^1-pyrazoline (e.g.,II), which readily eliminates nitrogen to form a new enol ether in which the β-proton has been replaced by a methyl group.

2-Hydroxymethylene-1-tetralone[2] was found to be a suitable model for study since it afforded a crystalline enol ether (I), m.p.62°, $\lambda_{max.}$ 264mμ. (logε 3.94) and 295mμ. (logε 4.06), on treatment with dimethyl sulphate and potassium carbonate. The structure was confirmed by its NMR spectrum: a pair of doublets (1H)


I


II


III

round about 1.62τ (C_8-H), a singlet (1H) at 2.15τ (=$\underline{CH}$OMe), an irregular multiplet (3H) centred at 2.30τ (arom. protons), a sharp singlet (3H) at 5.98τ (OCH_3), and a broad peak (4H) at 7.05 τ (methylenes). The enol ether (I) was kept in an ethereal solution of diazomethane (2-3 moles) at room temperature for several hours, ether removed under reduced pressure, and the product, a viscous liquid, ν 1602 cm.$^{-1}$ (strong, -N=N-), was found to contain 80% of the pyrazoline (II), on the basis of its nitrogen content. The latter decomposed slowly at room temperature but readily on warming, and on slow distillation afforded a crystalline enol ether (III), m.p.75°, $\lambda_{max.}$ 261mμ. (logε 3.86) and 316mμ. (logε 4.07), in good yield. The comparison of its NMR spectrum : multiplets at 1.63τ (1H) and at 2.35τ (3H) (arom. protons), singlet (3H) at 6.10τ(OCH_3), a broad peak (4H) at 7.10τ (methylenes), and a sharp singlet (3H) at 7.35τ ($-CH_3$), with that of the enol ether (I) showed the absence of the methine proton of the side chain at 2.15τ, and the appearance of a three-proton singlet at 7.35τ. This is consistent with the structure (III) which results from the Δ^1-pyrazoline (II) on nitrogen elimination. The structure was further confirmed by its hydrolysis to 2-acetyl-1-tetralone[3], m.p. and mixed m.p.55-56°, an authentic specimen of which was prepared according to Hansley[4]. Copper derivative, m.p.207° and IR spectra of the diketones were also compared and found identical. The same enol ether was obtained when the hydroxymethylene ketone was treated with an excess of diazomethane.

2-Hydroxymethylenecyclohexanone and its enol ether behaved similarly. The pyrazoline derivative, ν 1614 cm.$^{-1}$, was found to be even more unstable releasing nitrogen at appreciable rate at room temperature. The resultant methylated enol ether was identified through hydrolysis to 2-acetylcyclohexanone and the conversion of the latter into copper derivative[3], m.p.160°.

The reaction thus seems to be a general one and resembles similar reaction of diazomethane with α,β-unsaturated ketones[5], α-pyrones[6], and some other compounds carrying activating groups attached to a double bond.[7,8] It affords a convenient route to α-acetylketones from the easily accessible β-oxo-aldehydes[9], and may be particularly useful for the preparation of the enol ethers of the type (III) which are difficult to obtain otherwise in pure state. 2-Acetyl-1-tetralone, for example, on methylation yielded a liquid, possibly a mixture of isomeric enol ethers as shown by thin layer chromatography.

The authors are thankful to C.S.I.R, New Delhi for financial assistance, to Drs. U.R.Ghatak and S.K.Dasgupta of Indian Association for Cultivation of Science, Calcutta for discussion and IR spectra, and to Dr.D.N.Roy of Connecticut University for NMR spectra.

References

1. C.D.Gutsche, Organic Reactions, Vol.VIII, p.384 (1954).
2. W.S.Johnson and W.E.Shelberg, J. Amer. Chem. Soc., **67**, 1745 (1945).
3. H.Meerwein and D.Vossen, J. Prakt. Chem., **141**, 149 (1934).
4. V.L.Hansley, Chem. Abstr., **33**, 6342 (1939); **35**, 1066 (1941).
5. A.Sandoval, G.Rosenkranz, and C.Djerassi, J. Amer. Chem. Soc., **73**, 2383 (1951); also see ref.1.
6. J.Fried and R.C.Elderfield, J.Org.Chem., **6**, 577 (1941); C.Belil, J.Pascual, and F.Serratosa, Anales Real Soc. Espan. Fis. Quim. Ser.B. **59**, 507 (1963); Chem. Abstr. **60**, 5439 (1964).
7. F.D.Popp and A.Catala, J. Org. Chem., **26**, 2738 (1961); J.B.Bastus, Tetrahedron Lett., 955 (1963).
8. M.Alguero, J.Bosch, J.Castaner, J.Castella, J.Castells, R.Mestres, J.Pascual, and F.Serratosa, Tetrahedron, **18**, 1381 (1962).
9. C.R.Hauser, F.W.Swamer, and J.T.Adams, Organic Reactions, Vol.VIII, p.59 (1954).