

THE RE-ARRANGEMENT OF QUINOLIZINIUM-1-DIAZONIUM SALTS INTO  
v-TRIAZOLO[1,5-a]PYRIDINES

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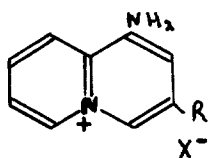
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We have reported<sup>1,2</sup> a reaction between 1-aminoquinolizinium salts (1) and (2) and aqueous nitrous acid which gave high yields of neutral, non-ionic, products tentatively formulated as (3) (R = H or Me). We have also noted<sup>2</sup> that the primary products of the reaction are rapidly converted under mildly acidic conditions into stable isomers. We have now shown that during the reaction with nitrous acid a novel and drastic re-arrangement has taken place, and that the products are the v-triazolo[1,5-a]pyridines (4) - (7).

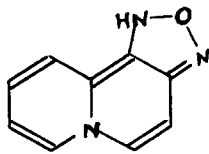
The most significant feature of the n.m.r. spectra of the initial products (4) and (5) was a downfield one proton signal at  $\delta$ 11.2 p.p.m.; this signal was a doublet ( $J = 7.8$  Hz) in compound (4) and a singlet in compound (5) indicating the grouping  $-C(R)CHO$ . As previously reported,<sup>2</sup> the initial products were rapidly isomerized by traces of acid into stable isomers (6) and (7); here the aldehyde proton signals were at  $\delta$ 9.8 p.p.m. The signal at highest field in the aldehydes (4) and (6) was a quartet, shown by de-coupling experiments to be adjacent to the aldehyde; its second coupling constant (12 Hz in compound (4) and 16 Hz in compound (6)) indicated a cis and trans

relationship in a  $\beta$ -substituted acrolein as shown in the formulae.

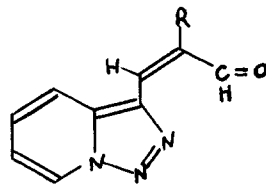


(1) R = H

(2) R = CH<sub>3</sub>

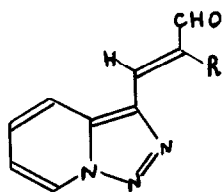


(3)



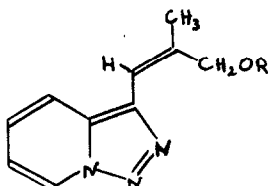
(4) R = H

(5) R = CH<sub>3</sub>



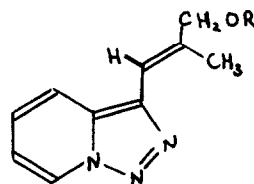
(6) R = H

(7) R = CH<sub>3</sub>



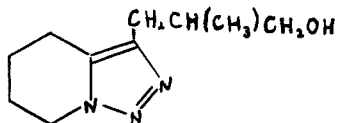
(8) R = H

(10) R = Ac

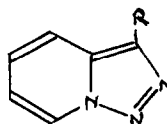


(9) R = H

(11) R = Ac



(12)

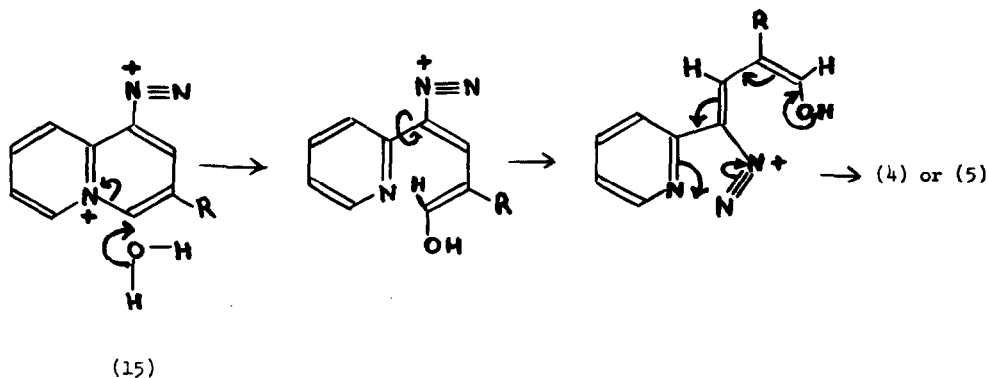


(13) R = CHO

(14) R = H

The presence of the aldehyde group in compounds (5) and (7) was confirmed by reduction with sodium borohydride, giving isomeric alcohols (8) and (9). Alcohol (8) had m.p. 113° - 114°;  $\gamma_{\text{max}}^{\text{CHCl}_3}$  3350 (broad);  $\delta(\text{CDCl}_3)$  2.15 (d, 3, CH<sub>3</sub>C=, J = 1.5 Hz) 4.41 (broad s, 2, CH<sub>2</sub>O) 4.8 - 5.4 (broad, 1, OH, exchanges with D<sub>2</sub>O) 6.58 (m, 1, HC=) 6.9 - 8.0 (m, 3) 8.8 (d, 1, 7-H) p.p.m.;  $\lambda_{\text{max}}^{\text{EtOH}}$  224, 262, 293, 320 (sh) nm (log<sub>10</sub>  $\epsilon$  4.23, 4.10, 3.97, -). The acetate (10) from alcohol (8) had m.p. 54° - 55°;  $\gamma_{\text{max}}^{\text{CHCl}_3}$  1735 cm<sup>-1</sup>;

$\delta(\text{CDCl}_3)$  2.2 (m, 6,  $\text{CH}_3\text{CO}$  and  $\text{CH}_3\text{C}=\text{C}$ ) 5.6 (s, 2,  $\text{CH}_2\text{OAc}$ ) and aromatic protons as above. The isomeric alcohol (9) had m.p.  $130^\circ - 131^\circ$ ;  $\gamma_{\text{max}}^{\text{mult}}$   $3350 \text{ cm}^{-1}$ ;  $\delta(\text{CDCl}_3)$  2.25 (s, 3,  $\text{CH}_3\text{C}=\text{C}$ ) 3.48 (broadened s, OH, exchanges with  $\text{D}_2\text{O}$ ) 4.4 (s, 2,  $\text{OCH}_2$ ), aromatic protons as above;  $\lambda_{\text{max}}^{\text{EtOH}}$  224, 252 (sh), 259, 269, 293 nm ( $\log_{10}\epsilon$  4.22, 4.07, 4.08, 3.99, 3.92). The acetate (11) from alcohol (9) had m.p.  $92^\circ - 93^\circ$ ;  $\gamma_{\text{max}}^{\text{CHCl}_3}$   $1734 \text{ cm}^{-1}$ ;  $\delta(\text{CDCl}_3)$  2.22 (s, 3) 2.36 (s, 3) 4.9 (s, 2,  $\text{CH}_2\text{OAc}$ ), aromatic protons as above. The alcohols (8) and (9) were only with difficulty interconvertible. Catalytic hydrogenation of the aldehydes (5) or (7) was difficult and gave mixtures; conversely, the alcohols (8) and (9) were readily reduced, giving the same hexahydroderivative (12), b.p.  $150^\circ - 160^\circ/0.3 \text{ mm}$  (bulb tube);  $\gamma_{\text{max}}^{\text{CCl}_4}$   $3430 \text{ cm}^{-1}$ ;  $\delta(\text{CDCl}_3)$  0.9 (d, 3,  $\text{CH}_3\text{CH}$ ) 1.7 - 2.4 (m, 5) 2.6 - 3.0 (m, 4,  $\text{CH}_2\text{-C}=\text{C-CH}_2$ ) 3.62 (d, 2,  $\text{CH}_2\text{O}$ ) 4.3 (s, 1, OH) 4.5 (t, 2,  $\text{CH}_2\text{N}$ );  $\lambda_{\text{max}}^{\text{EtOH}}$  225 nm ( $\log_{10}\epsilon$  3.40). Oxidation of the aldehydes (5) or (7) or of the alcohols (8) or (9) with neutral permanganate - metaperiodate mixture gave 3-formyl-v-triazolo-[1,5-a]pyridine (13) m.p.  $147^\circ - 148^\circ$ ;  $\gamma_{\text{max}}^{\text{CHCl}_3}$   $1680 \text{ cm}^{-1}$ ;  $\delta(\text{CDCl}_3)$  7.58 (m, 1, 6-H) 8.0 (m, 1, 5-H) 8.65 (q, 1, 4-H,  $J_{4,5} = 8.5 \text{ Hz}$ ,  $J_{4,6} = 1 \text{ Hz}$ ) 9.25 (d, 1, 7-H,  $J_{6,7} = 6.5 \text{ Hz}$ ) 10.7 (s, 1, CHO);  $\lambda_{\text{max}}^{\text{EtOH}}$  258, 290 (sh) 313 nm ( $\log_{10}\epsilon$  3.59, -, 4.13). The formyl derivative (13) was synthesized by a Vilsmeier-Haack procedure from the parent v-triazolo[1,5-a]pyridine (14)<sup>3</sup> and was identical with the oxidation product (13).



We assume that the 1-aminoquinolizinium salts (1) and (2) are converted into the 1-diazonium salts (15); this is known to occur in a non-aqueous medium.<sup>1</sup> The dication would be very susceptible to nucleophilic attack by solvent water at position 4, and opening of the six-membered ring of un-activated quinolizinium salts has been reported when powerful nucleophiles are used.<sup>4</sup> Rotation around the C1 - C9a bond with retention of configuration in the carbon chain is followed by cyclisation (well documented with *v*-triazolo[1,5-a]pyridines<sup>5</sup>), giving the cis isomers (4) or (5).

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