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UNEXPECTED RECYCLIZATION OF PYRIDINIUM SALTS TO GIVE OXAZOLES

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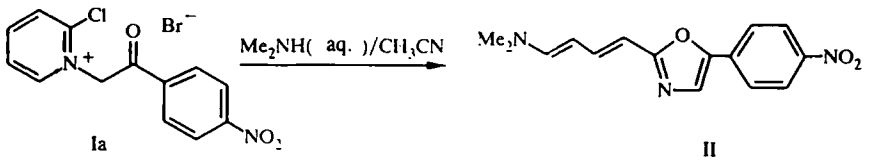
N-(Acylalkyl)-2-halopyridinium salts (I) are commonly used in the synthesis of azolopyridines with a bridging nitrogen atom. In particular, the formation of imidazo[1,2-*a*]pyridines and their N-alkyl- and N-aryl derivatives in the reaction of salts I with ammonia and primary amines [1, 2] or aromatic amines [1] is well known. Cations I undergo enolization and intramolecular cyclization upon the action of tertiary amines to give oxazolo[3,2-*a*]pyridinium salts [3]. Reactions of salts I with secondary amines have not been reported.

We have found that 1-(*p*-nitrophenacyl)-2-chloropyridinium bromide (Ia) undergoes an unusual recyclization upon reaction with saturated aqueous dimethylamine to give 4-dimethylamino-1-[5-(*p*-nitrophenyl)-2-oxazolyl]-1,3-butadiene (II):



Ia II

This reaction proceeds upon heating the reagents in acetonitrile at reflux. A sample of 2 mmoles salt Ia was suspended in 50 ml acetonitrile and 3 ml saturated aqueous dimethylamine was added. The mixture was heated at reflux for 3 h. A dark cherry-red, homogeneous solution was obtained. After cooling, the mixture was poured into water. Dark violet crystalline butadiene II (0.34 g, 60%) was filtered off. The product did not require further purification, mp 184-186°C. Found: C, 63.79; H, 5.72%. Calculated for $C_{15}H_{15}N_3O_3$: C, 63.16; H, 5.26%. Mass spectrum, *m/z* (%): 285 (32, M^+), 241 (100, $M^+ - NMe_2$), 195 (56). PMR spectrum in $CDCl_3$ at 400 MHz: 8.2-7.7 (4H, m, 5-*p*-NO_2Ph), 7.47 (1H, s, H-oxazolyl), 7.28 (1H, d.d, J_{23} = 11.3, J_{34} = 15.1 Hz, 3-H), 6.64 (1H, d, J_{12} = 12.2 Hz, 1-H), 5.97 (1H, d, J_{34} = 15.1 Hz, 4-H), 5.20 (1H, d.d, J_{12} = 12.1, J_{23} = 11.3 Hz, 2-H), 2.89 ppm (3H, s, 1-NMe_2).

The elemental analysis and mass spectral data for II indicate the loss of HCl and HBr molecules from starting salt Ia and addition of a dimethylamine molecule. The strongest peak in the mass spectrum corresponds to loss of NMe_2, which is characteristic for other 1-amino-4-(2-oxazolyl)butadienes [4, 5]. The PMR spectrum of II shows a single signal for the dimethylamino group in the aliphatic proton region, downfield singlet for the oxazole ring proton, standard multiplet for the *p*-nitrophenyl residue, and characteristic set of signals for the butadiene fragment protons. The coupling constants of the butadiene proton signals [5, 6] indicate that butadiene II is the 1*E*,3*E* stereoisomer.

It is unlikely that opening of the pyridine ring in this transformation precedes formation of the oxazole ring. Enolization of the phenacyl residue at the nitrogen atom in I probably is the initial step, followed by closure of the oxazole ring, i.e., the bicyclic oxazolo[3,2-*a*]pyridinium system is formed as an intermediate. (The reaction of salts I with tertiary amines proceeds precisely in this manner [3]). Closure of the pyridinium fragment of the bicyclic system by the action of dimethylamine occurs only then. Such opening of a six-membered ring is extremely typical for the reactions of the oxazolo[3,2-*a*]pyridinium cation [4, 5] and its heteroanalogs [6] with secondary amines. The reported method for the synthesis of oxazole derivatives from pyridinium salts has no precedent, while the structural design of the reaction (according to our topological classification of recyclization [7]) is related to the nontrivial 562-(*a*,*e*) class. The range of applicability of this transformation is rather broad and is the subject of a separate communication.

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