Journal of Fluorine Chemistry, *22* (1983) 589–592 589

Received: March 21, 1983; accepted: March 28, 1983

PRELIMINARY NOTE

Reaction of Pyridinium t-Butoxycarbonylmethylide with Trifluoroacetonitrile

RONALD ERIC BANKS* and JULIE THOMSON

Chemistry Department, The University of Manchester Institute
of Science and Technology, Manchester M60 1QD (U.K.)

SUMMARY

Pyridinium t-butoxycarbonylmethylide (I), generated by treatment of N-(t-butoxycarbonylmethyl)pyridinium perchlorate with sodium hydride in acetonitrile, reacts with trifluoroacetonitrile to give 3-(t-butoxycarbonyl)-2-(trifluoromethyl)-imidazo[1,2-a]pyridine (II), pyridinium 4,5-dihydro-4-oxo-2,6-bis(trifluoromethyl)pyrimidin-5-ylide (III), and N-[2-amino-1-(t-butoxycarbonyl)-3,3,3-trifluoroprop-1-enyl]pyridinium perchlorate (IV). Formation of the last two products, plus the fact that when treated with sodium hydride the perchlorate (IV) yields the imidazopyridine (II), provides powerful evidence in support of a stepwise mechanism for the 1,3-dipolar cycloaddition involved in formation of the imidazopyridine nucleus in (II).

INTRODUCTION

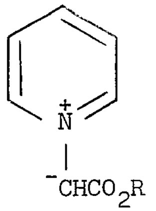
Japanese investigators reported recently that they had isolated the ethoxycarbonyl-substituted imidazopyridine (V)** in 18% yield from material produced by attack of pyridinium ethoxycarbonylmethylide (VI) on trifluoroacetonitrile; other

---

* To whom enquiries should be addressed.

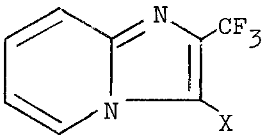
** Unfortunately, this imidazo[1,2-a]pyridine was not named in the paper, and its structure was drawn incorrectly [2] as that of the alternative regio-isomeric end-product of the 1,3-dipolar cycloaddition used, i.e. an imidazo[1,5-a]pyridine.

0022-1139/83/$3.00



(I) R = Bu^t

(VI) R = Et

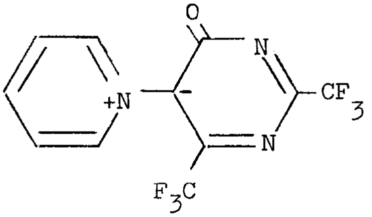


(II) X = CO_2Bu^t

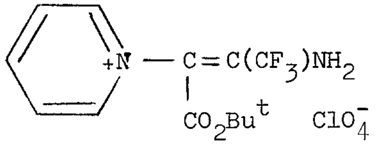
(V) X = CO_2Et

(VII) X = CO_2H

(VIII) X = H

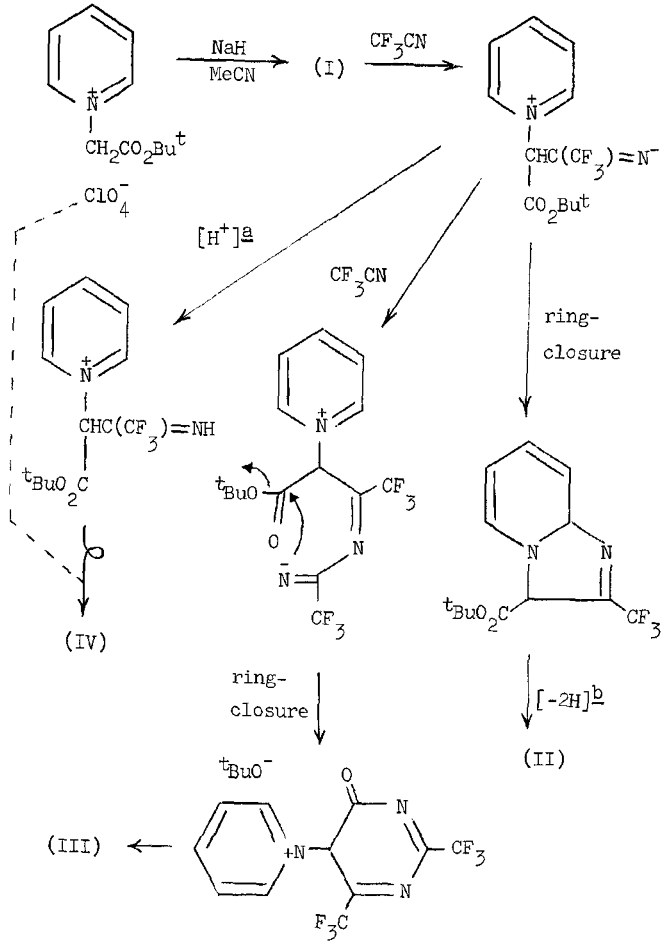


(III)



(IV)

pyridinium methylides were said to give very complex mixtures of products [1]. We have managed to isolate chromatographically ('flash' method [3]) two other products besides a new imidazopyridine [(II), m.p. 102 - 103 °C; 18% yield] from material produced by mixing trifluoroacetonitrile with a half-molar equivalent of pyridinium t-butoxycarbonylmethylide (I) generated from N-(t-butoxycarbonylmethyl)pyridinium perchlorate and sodium hydride in anhydrous acetonitrile [4]; these were identified by elemental analysis, spectroscopic techniques [i.r., n.m.r. (^{1}H, ^{13}C, ^{19}F), and mass], X-ray crystallography [in the case of (III)], and chemical methods (see below) as pyridinium 4,5-dihydro-4-oxo-2,6-bis(trifluoromethyl)pyrimidin-5-ylide [(III), m.p. 266 - 267 °C; 30% yield] and N-[2-amino-1-(t-butoxycarbonyl)-3,3,3-trifluoroprop-1-enyl]pyridinium perchlorate [(IV), m.p. (dec.) 146 - 146.5 °C; 25%]. Treatment of the new ylide (III) with zinc dust in acetic acid gave



Scheme

[a] Several 'built-in' proton sources are obvious.

[b] See ref. 7 for a discussion of aromatization stages of this type.

4-hydroxy-2,6-bis(trifluoromethyl)pyrimidine (a known compound [5]; ca. 45% yield) plus material not yet identified; and 3-(t-butoxycarbonyl)-2-(trifluoromethyl)imidazo[1,2-a]pyridine (II) was converted to its parent acid (VII) with trifluoroacetic acid, and thence, via thermal decarboxylation [cf. 6], into 2-(trifluoromethyl)imidazo[1,2-a]pyridine [(VIII), m.p. 90 - 91 °C; overall yield from (II), 75%]. Treatment of the new pyridinium perchlorate (IV) with sodium hydride in anhydrous acetonitrile at room temperature led to clean formation of 3-(t-butoxycarbonyl)-2-(trifluoromethyl)imidazo[1,2-a]pyridine (II).

The last piece of information completes the evidence on which we base our assertion that the 1,3-dipolar cycloaddition responsible for the formation of an imidazopyridine from pyridinium t-butoxycarbonylmethylide and trifluoroacetonitrile in acetonitrile at room temperature is stepwise in type, not concerted (see Scheme). Evidence has already been presented in support of the contention that construction of the bicyclic skeleton in 1-(t-butoxycarbonyl)-2-fluoro-3-(trifluoromethyl)-pyrrolo[1,2-a]pyridine from the same methylide and perfluoropropene occurs in a stepwise manner [6].

REFERENCES

1 Y. Kobayashi, I. Kumadaki, and E. Kobayashi, Heterocycles, 15 (1981) 1223.

2 Persònal communication from Professor Yoshiro Kobayashi.

3 W.C. Still, M. Kahn, and A. Mitra, J. Org. Chem., 43 (1978) 2923.

4 J. B. Bapat, J. Epsztajn, A. R. Katritzky, and B. Plau, J.C.S. Perkin I, (1977) 1692.

5 S. Inoue, A. J. Saggiomo, and E. A. Noduff, J. Org. Chem., 26 (1961) 4504.

6 R. E. Banks, S. M. Hitchen, and J. Thomson, J. Fluorine Chem., 20 (1982) 127.

7 R. E. Banks and S. M. Hitchen, J. Fluorine Chem., 20 (1982) 373.