

VERY MILD INTERCONVERSION BETWEEN AMINOACETONITRILE
AND THE INTERSTELLAR SPECIES METHANIMINE AND HYDROGEN CYANIDE

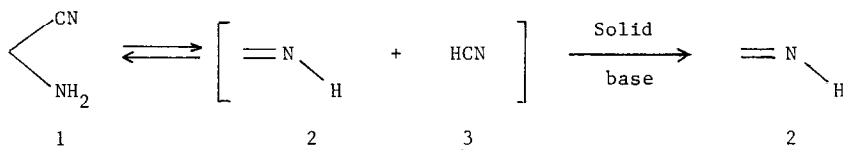
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Abstract : Methanimine 2 and hydrogen cyanide 3 were detected at RT in the microwave spectrum of aminoacetonitrile 1. As 2 and 3 react together in the condensed phase, on a KBr cell cooled at very low temperature, an important role of 1 in interstellar chemistry may be postulated.

In the last ten years, molecular astrophysics has become an interesting field of interdisciplinary research. The interstellar chemistry observed so far is mainly organic : three quarters of the about sixty known interstellar molecules discovered by radioastronomy : free radicals, molecular ions or neutral species, contain carbon (1). In particular, the reactive parent compounds of the main organic functions are present. We describe here the very mild interconversion between aminoacetonitrile 1, a prebiotic molecule (2), and two interstellar species, methanimine 2 (3) and hydrogen cyanide 3.



Methanimine 2 has been detected in the gas phase pyrolysis decomposition products of 1 at 780°C (4). We have recently reported the formation of 2 in a pure form and in a nearly quantitative yield by flash vacuum thermolysis (FVT) of 1 at 300°C and subsequent vapour phase removal of HCN on a solid base (5). Our anticipation that the cleavage of 1 occurs at lower temperature is confirmed by the fact that compounds 2 and 3 are also identified when 1 is continuously pumped (10^{-4} torr) at RT through the absorption cell of a microwave spectrometer maintained at this temperature (6).

The very easy reverse formation of compound 1 is demonstrated by the following experimental evidence : methanimine 2 is the only product resulting from the FVT of 1, after HCN removal on a solid base, within the accuracy of IR spectroscopy at 77 K. On the other hand, in the absence of a solid base, addition of 2 to 3 takes place in the condensed phase on the KBr window even when this latter is cooled at 4 K, leading to 1 as the sole product detected by IR. This result is in agreement with the mechanism postulated by Shelvin and coll. to account for the formation of glycine in the hydrolysis products of the reaction of carbon atoms with ammonia at 77 K (7).

Consequently, methanimine 2 could play an important role as intermediate (2) or reagent in prebiotic chemistry ; direct use of 1 as a synthetic equivalent of 2 seems possible (8). Furthermore addition of 2 to 3 takes place at interstellar temperature (< 77 K), 1 can be also postulated as a cosmic species.

Acknowledgment : We thank Dr. J.L. Ripoll and Dr. M.C. Lasne for recording low temperature IR spectra and for useful discussions.

References and Notes :

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(Received in France 10 January 1986)