A V-EASI-MS Study of the Ugi Reaction Mechanism

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Keywords: reaction mechanism, multicomponent reaction, Ugi reaction
INTRODUCTION

Multicomponent reactions are defined as those where more than two substances react and essentially most of their atoms are incorporated in the product. In the case of the Ugi four component reaction an isocyanide, aldehyde, amine and carboxylic acid react to form a tripeptide. One important characteristic of the multicomponent reaction is the difficulty to elucidate the molecular sequence of events that take place in order to form the products.

Venturi easy ambient sonic-spray ionization (V-EASI) is an ambient ionization technique based on the Venturi effect that provides self-pumping and online monitoring of the Ugi reaction giving representative snapshots of the ionic composition of the reaction solution and therefore key information with respect to the mechanism(s). In this study, we have used V-EASI and charged tagged reagents with a remote quaternary ammonium functionality to improve detection of otherwise neutral or zwitterionic species. The model reaction employed 4-trimethylammonium benzoic acid, acetic acid, aniline and diisocyanatobenzene, in equimolar quantities and at ambient temperature in methanol.

RESULTS AND DISCUSSION

After initiation of the reaction, the first sample was analyzed after 10 minutes. At this time the ions detected in the reaction corresponded to the equilibrium of the imine formation. The structures presented in scheme 1 were confirmed by MS/MS experiments on the corresponding ions. The ion m/z 239 corresponding to the imine was the most intense signal in the spectrum.

In order to ascertain about the nature of these species in the solution, an MS/MS experiment of the ion of m/z 408 was carried out, as well as the synthesis of the product in order to compare the MS/MS spectra.

CONCLUSION

In the present work important advances towards the understanding of the Ugi reaction mechanism was undertaken, however the presence of different isobaric intermediates complicates the interpretation of the data, and additional experiments will be performed to overcome these difficulties.

REFERENCES


ACKNOWLEDGEMENTS