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Full Length Research Article

STUDY OF MASS SPECTRA OF BENZIMIDAZOLE DERIVATIVES

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ABSTRACT

In the work, a study of mass fragmentation routes by the electron-impact mass spectrometry data has been examined for two open chain intermediates of benzimidazole derivatives and two imidazobenzodiazepines. By the isolation of open chain intermediate and the mass spectra, the structures of imidazobenzodiazepine have been confirmed

INTRODUCTION

Isolation of open-chain intermediates play a key role in a many synthetic organic reactions. Mass spectra data of the condensed benzimidazoles as imidazobenzodiazepines and the stability of the intermediates confirm the structure of the imidazobenzodiazepine product. The benzimidazole ring are an important pharmocophore in modern drug discovery (Tobbe *et al*., 1997 and Porcari *et al*., 1998). Tetrahydroimidazobenzodiazepine (TIBO) presenting the benzimidazole moiety which exhibit a Potent and selective inhibition of HIV-1 replication in vitro (Puodziunaite *et al*., 2000; Paulens *et al*., 1990; Parker and Coburn, 1991; Kukla *et al*., 1991 Parker and Coburn, 1992; Caldwell *et al*., 1993; Ho *et al*., 1995 and Mohrbacher, 1995). This report is concerned with the mass spectra of open-chain benzimidazole and condensed benzimidazole as imidazobenzodiazepine derivatives.

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Experimental

Synthesis of the studied compounds

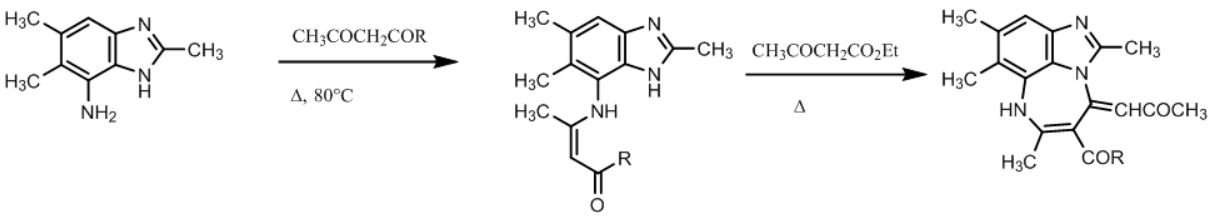
The studied compounds were synthesized as shown in scheme 1. Details of the synthetic methods are reported in our article (El Kihel *et al*., 2008). Also, all the compounds were previously characterized by mass, ^{1}H, and ^{13}C-NMR spectra.

MS measurements

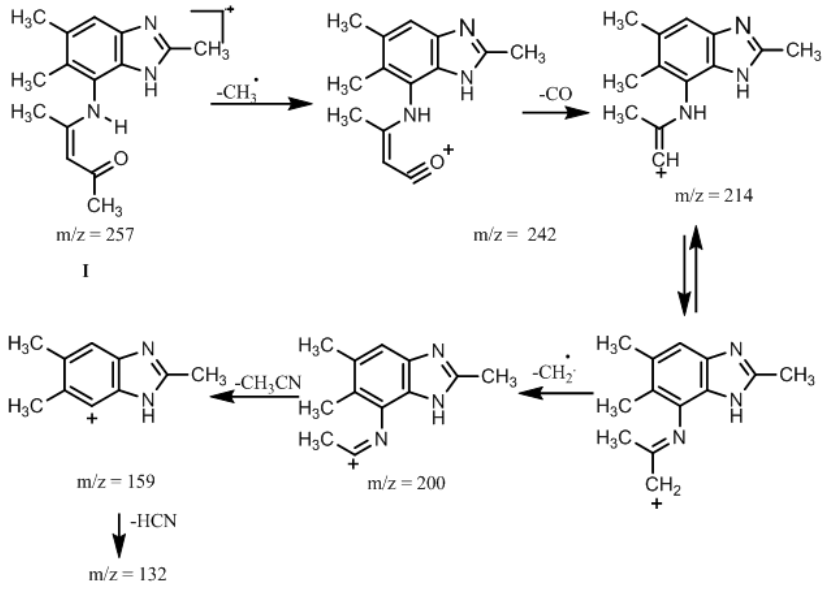
The electron-impact mass spectra were recorded on Varian Mat 311 spectrometer at 70 eV in the Centre de Mesures Physiques de l'Ouest (CRMPO) at Rennes 1 University. The electron ionization ion source was kept at 145°C. The EI mass spectra were obtained over the range of m/z 10-700.

RESULTS AND DISCUSSION

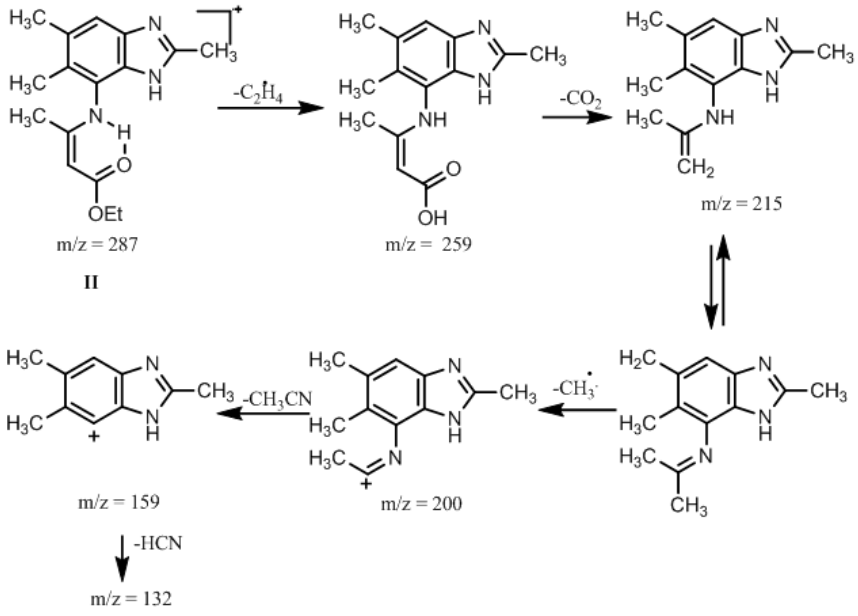
The scheme 1 shows the details of the synthetic methods that are reported in our article (El Kihel *et al*., 2008). Among the works on the study of mass spectra about benzimidazole series are those relating substituted benzimidazoles in positions 1 and 2 (Hida *et al*., 1994 and Ibrahim *et al*., 2008).



Scheme 1.



Scheme 2.



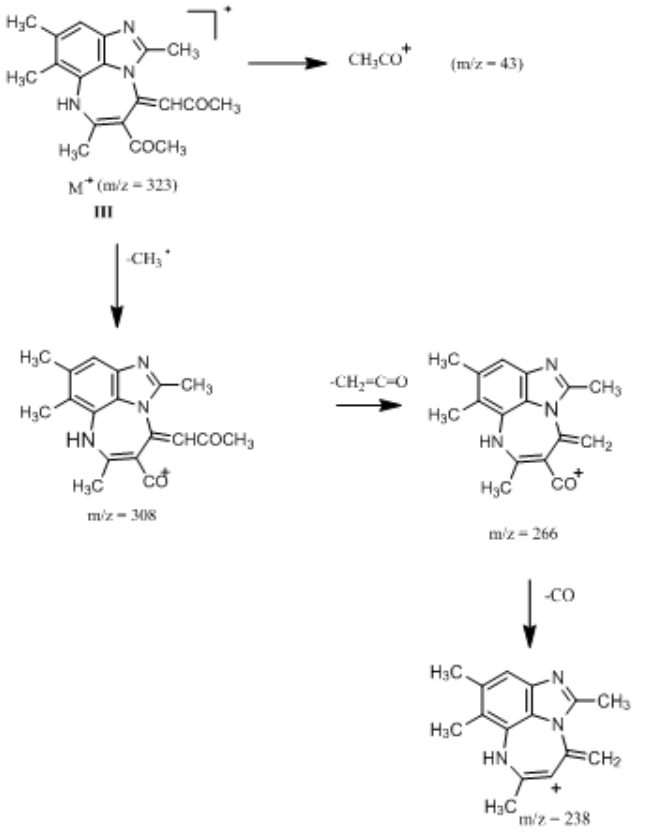
Scheme 3.

The open chain intermediates I and II

The composition of ions determined by exact mass measurements of these compounds are reported in schemes 2 and 3.

In mass spectrometry, the presence of acetyl group is proved by ejection of one methyl radical from the molecular ion leading to ion m/z = 242 followed by the loss of one molecule of carbon monoxide. The loss of CH_3CN then HCN fragments leads to the ions m/z = 159 and 132. This fragment which

eliminate one molecule of HCN leading to the ion m/z = 132 is characteristic in benzimidazole fragmentation (Hida *et al*., 1994). The cation m/z = 214 for I was transformed to your tautomer then eliminate a methylene radical leading to the fragment m/z = 200.

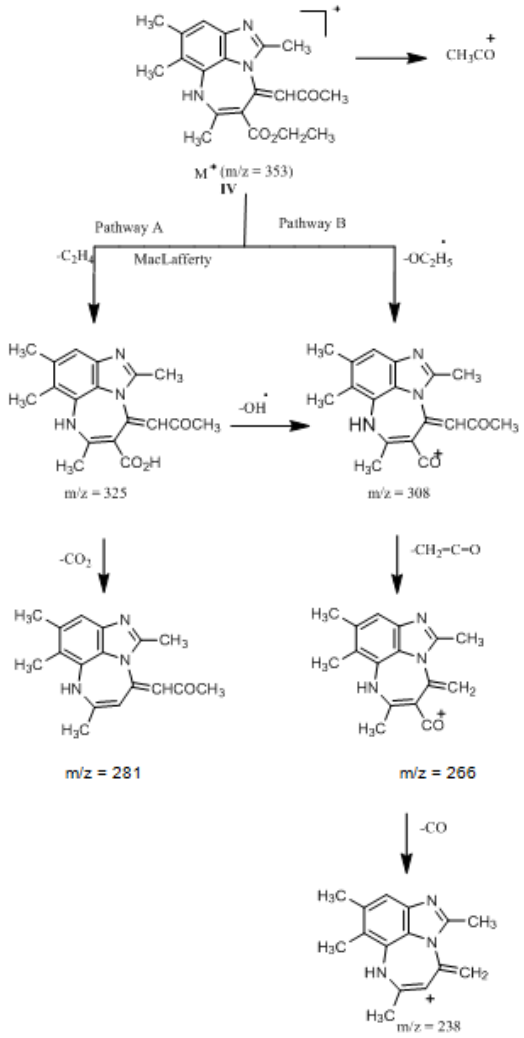


Scheme 4.

For the compound II, the presence of the ester function is deduced by splitting of a molecule of ethylene C_2H_4 leading to the molecule m/z = 259 following by ejection of one molecule of carbon dioxide giving the fragment m/z = 172. This last by tautomery, the other tautomer is obtained which eject one methyl radical giving the cation m/z = 200. The next fragmentations are similar to those of compound I. and are fragmentations relative to the benzimidazole nucleus.

Condensed benzimidazole: imidazobenzodiazepines

The mass spectra of the condensed benzimidazole, the imidazobenzodiazepines III and IV present the fragment ion CH_3CO^+ (m/z = 43) which represent the base pick (100%). This data confirm the structure of the two products. The difference between the structure of III and IV is the presence of acetyl group in III and the ester function in IV (schemes 3 and 4). However, the mass spectra of compound III show the ejection of one methyl radical from moleculer ion leading to the cation m/z = 308 following by the loss of a cetene molecule giving the cation m/z = 266 then this cation, by losing CO, leads to the cation m/z = 238 (scheme 4). For the compound IV, the molecule of m/z = 353 fragmented further and involved two various possible pathways as illustrated by scheme 5.



Scheme 5

In the pathway A, the molecular ion fragmented by losing an ethylene molecule to give the molecule m/z = 325 which present an acid function, this last ejected a carbon dioxide molecule to lead to molecule m/z = 281. In the pathway B, the molecular ion underwent loss of a ethoxy radical to give a cation m/z = 308, which fragmented further to give a peak at m/z = 266 by losing a ketene molecule, this fragment can loss the monoxide carbon to obtain the cation m/z = 238. In another hand, the molecule m/z = 325, in pathway A, fragmented to give the cation m/z = 308, in pathway B, by ejecting a hydroxyl radical.

Conclusion

In this work, mass fragmentation pathways of open chain intermediates of benzimidazole and imidazobenzodiazepine derivatives were investigated by electron impact mass spectrometry (EI-MS). The principal fragmentation processes in benzimidazole series are reported. The mass spectra of imidazobenzodiazepines show that the fragment CH_3CO^+ represent the base peak (100%) and the fragmentation of imidazobenzodiazepine which present the ester function involved two various possible pathways of fragmentation.

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