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# Gas Chromatography-Mass Spectrometric (GC-MS) Analysis of *Ficus capensis* Leaf From Abakaliki, Ebonyi State, Nigeria

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**Abstract:** *Ficus capensis* is a common medicinal plants used in the treatment of various types of ailments and diseases such as convulsion, stomach ache, respiratory disorders and threatened abortion, in Nigeria and other African countries. GC-MS analysis of ethanol extract of *Ficus capensis* was carried out using standard method. Ten(10) chemical constituents were identified from the GC-MS analysis of the sample which include heptanoic acid (13.9%), 2, 2- dimethylbutane (5.2%), 5 – cyclo-methylidadiene (6%), hepta -3, 5-diene - 1- ol (10.4%), hepta-1-ol (6.4%), oct-1, 5-dien-1-ol (10.4%), Hepta-1, 5-1-ol (13.0%), hepta-1, 3-dien-1-ol (13.9%) and hepta-3, 5-dien-1-ol (8.6%) as the major constituents. This study therefore provided an information on the ethno-medical uses of *Ficus capensis* for treatment and prevention of various diseases.

**Key words:** GC-MS analysis · Chemical constituents · *Ficus capensis* leaf · Ethanol extract

## INTRODUCTION

Plants which have one or more of its parts contain substances that can be used for therapeutic purpose are called medical plants [1]. Plants have been as medical agents from the earliest days of man's existence and have made it necessary to study them in details in order to know how to apply them for different purpose [2]. Medicinal plants contain numerous biologically active compounds such as nutrients and phyto-chemicals which have physiological actions on the human body [3]. The inherent active ingredients are used to cure disease or relieve pain [4].

*Ficus capensis* commonly known as fig tree is a medicinal plant found in terrestrial zones mostly along rivers. *Ficus capensis* is a deciduous or evergreen tree with a thick bole and spreading roots. It produces fruits throughout the year and the leaves are broad and green. In Nigeria, *F. capensis* has been used by the Igede people for the treatment of dysentery and in wound healing [5]. It is also used in circumcision, leprosy and epilepsy [6]. It is also used in treatment of rickets, infertility, gonorrhea, oedema, respiratory disorders and emollient [7]. The leaves and stem bark of the plants have inhibitory effect against *Escherichia coli and Shigella species* [8]. It is also used in herbal medicines to treat threatened abortion [9].

With recent drop in the price of crude oil in the international market and its attendant effect on economy of less developed nations like Nigeria, it has become vivid that medicinal plants will play increasing role in the food, nutrition and health security of the rural populace and the increasing urban poor. As popular as *Ficus capensis* is in Nigeria, there is a paucity of information on GC-MS analysis of the leaf. This study therefore evaluates GC-MS analysis of the ethanol leaf extract of *Ficus capensis* leaf.


Fig. 1: *Ficus capensis* leaves [10]

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## MATERIALS AND METHODS

### Materials

**Plant Collection:** The fresh leaves of *Ficus capensis* were collected in the month of August, 2014 from Ngbabor Achara Izzi village in Abakaliki L.G.A, Ebonyi State of Nigeria and were identified and authenticated by a taxonomist Prof. J.C. Okafor of Department of Applied Biology, University of Nigeria, Nsukka, Nigeria. Some parts of the plant were also deposited in the herbarium for reference purpose.

**Preparation of Plant Sample:** The leaves were destalked, washed and shade dried at ambient temperature with constant turning to averts fungal growth. The dried leaves were later milled to obtained the vegetable leaf meals (VLMs) using an electric blender and was stored in 4°C temperature in refrigerator in well labeled air-tight containers for analysis.

**Preparation of *Ficus capensis* Ethanol Leaf-Extract:** Exactly 40grams of dried powdered leaves of *Ficus capensis* were extracted successively with 300ml of ethanol in an orbital shaker for 24hours at room temperature. The extract was filtered using what-man N0.1 filter paper to remove extractable substances at every 3hrs interval. The combined extracts were then evaporated with rotary evaporator and the dried extracts were stored at 4°C in air-tight sterile container in refrigerator.

### Methods

### GC-MS Analysis

**Procedures:** GC-Ms analysis of the ethanol extract of *Ficus capensis* leaf was performed using Shimadzu Japan gas chromatography QP2010 plus with a fused gas chromatography (GC) column (2010) coated with poly-methyl silicon (0.25nm x 50m) and the conditions were as follows: Temperature programming from 80-200°C held at 80°C for 1minute, rate 5°C/min and at 200°C for 20min. Field ionization detector (FID) Temperature of 300°C, njection temperature of 220°C, carrier gas nitrogen at a flow rate of 1ml/min, split ratio of 1:75. Gas chromatography mass spectrum was conducted using GCMS-QP 2010 plus Shimadzu Japan with injector temperature of 220°C and carrier gas presence of 116.9kpa. The column length is 30m with a diameter of 0.25mm and flow rate of 50ml/min. Elutes were automatically passed into a mass spectrometer with a dictator voltage set at 1.5 Kv and sampling rate of 0.2 sec. The mass spectrum was also equipped with a computer fed mass spectra bank. German Hermlez 233M-Z centrifuge was used.

**Component Identification:** Chemical constituent of the extract was identified by matching the peak with computer Wiley Ms libraries and confirmed by those comparing mass spectra of the peaks and those from literature.

## RESULTS

**Result of GC-MS Analysis Extract of *Ficus capensis* Leaf:** Ten (10) peaks were identified from the chromatogram of the ethanol leaf of *Ficus capensis* (Figure 2). These peaks (1-10) indicate the presence of ten compounds (1-10) in the extracts (Figure 2). The molecular formula, percentage content and molecular mass of the compounds are shown in Table 1. These compounds comprise mainly hydrocarbons, fatty acids, alcohol, esters and phenols. The composition of the extract comprises of hepatonic acid (13.9 %), 2.2 dimethyl butane (5.2), 5-cyclo-methylidiene (6 %), hepta -3, 5-dien-1-ol (8.6 %), hepta-1, 3-1en-ioi (13 %), hepta-1, 5-dien-1-ol (13 %), hepta 2, 4, 6-trienoic (21.7 %), hepta-1, 5, dien-1-ol (6.4 %), oct-1, 5-dien-1-ol (10.4 %) as the major chemical constituents.

Table 1: GC-MS Analysis and Mass Spectral Data of Ethanol Fraction from the leaf of *Ficus capensis* Showing Molecular Formula, Molecular Weight, Percentage Content, Mass Peak and Retention Time

| Peak | Compounds | Molecular Formula | Molecular Weight | Retention Time | Percentage Content (%) | Mass Peaks | Base Peaks |
|---|---|---|---|---|---|---|---|
| 1 | 2.2 dimethyl butane | $C_6H_{14}$ | 86 | 10.756 | 5.2 | 12 | 43 |
| 2 | 5-cyclo-methylidadiene | $C_7H_{10}$ | 94 | 11.420 | 6 | 18 | 41 |
| 3 | Hepta-3, 5-dien-1-ol | $C_7H_{10}O$ | 110 | 11.212 | 8.6 | 22 | 41 |
| 4 | Hepta-1, 3-dien-1-ol | $C_7H_{11}O$ | 111 | 15.656 | 13.9 | 24 | 41 |
| 5 | Hepta-1, 5-1-ol | $C_7H_{11}O$ | 111 | 19.318 | 13.0 | 26 | 43 |
| 6 | Heptanoic acid | $C_7H_{16}O_2$ | 132 | 19.609 | 9.5 | 30 | 43 |
| 7 | Hepta 2, 4, 6-trienoic acid | $C_7H_8O_2$ | 124 | 22.319 | 21.7 | 30 | 105 |
| 8 | Hepta-1, 5-diene-1-ol | $C_7H_{11}O$ | 111 | 22.64 | 6.4 | 23 | 43 |
| 9 | Oct-1, 5-dien-1-ol | $C_8H_{12}O$ | 124 | 4.57 | 10.4 | 46 | 43 |

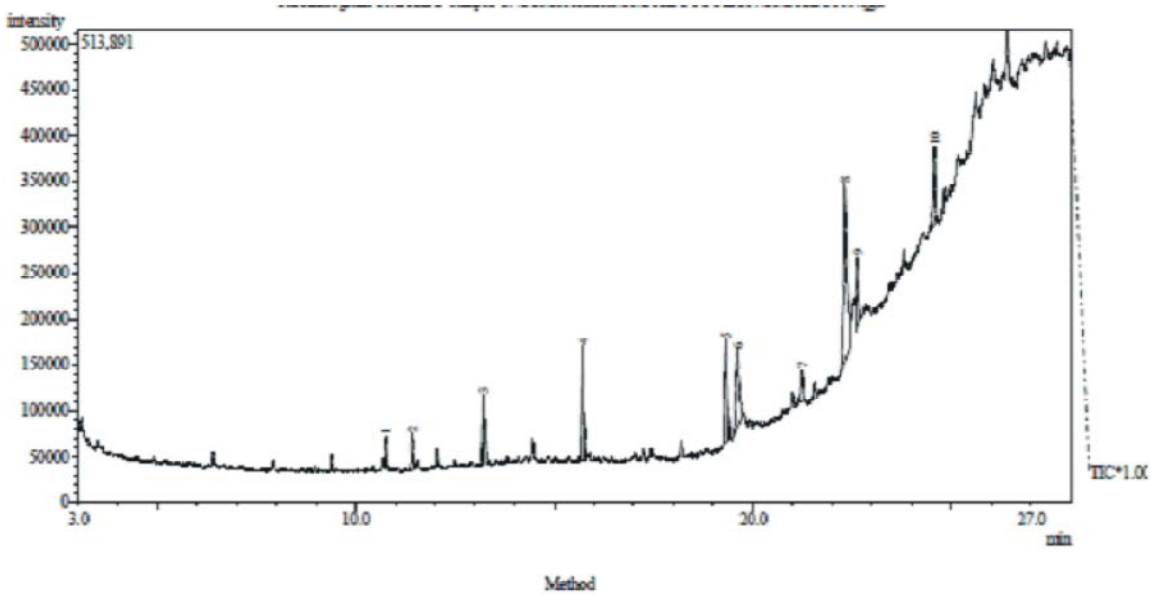


Fig. 2: Chromatogram of Ethanol-LeafExtract of *Ficus capensis*

Compound 1 was identified as 2, 2-dimethylbutane and has a molecular formula of $C_6H_{14}$ (m/z 86) with base peak at m/z 43 and constitute 5.2 % of the extract. Compound 2 constitute 6 % of the extract with molecular formula of $C_7H_{10}$ and base peak at m/z 41 and was identified as 5-chloromethylidadiene. Compound 3 has molecular formula of $C_7H_{10}$ and base peak at m/z 41. The compound 4 is hepta-1, 3-dien-lol with molecular formula of $C_7H_{11}$ (m/z 111) and base peak at m/z 41. The constitute 13.9 % of the extract. Compound 5 was identified as hepta-1, 5-dien-1-ol with molecular formula of $C_7H_{11}O$ and base peak at m/z 43, it constitute 13 % of the extract. Compound 6 constitute 9.5 % of the extract with molecular formula of $C_7H_{16}O_2$ (m/z 132) and base peak as (m/z 43) and was identified as hepatonic acid. Compound 7 was identified as hepta-2, 4, 6-trienoic acid. It has a molecular formula of $C_7H_8O_2$ (m/z 124) and a base peak of 105. It constitutes 21.7 % of the extract. Compound 8 is oct-1, 5-dien-1-ol with $C_8H_{12}O$ as a molecular formula (m/z 124). It has a base peak (m/z 43) and constitutes 10.4% of the extract.

## DISCUSSION

GC-MS analysis of medicinal plants reveals the possible bioactive chemical constituents of the plant. The result of this study showed that *Ficus capensis* leaf contain ten bioactive compounds which correspond to the peaks as shown in Figure 2. Results of GC-MS analysis of *Ficus capensis* leaf showed ten different peaks which corresponded to ten compounds as shown in the chromatogram in Figure 2. These findings of this research study were in correlation with Aja *et al.* [11] and Nweke *et al.* [12] which reported the presence of esters, alcohols, aldehydes, fatty acids and phenolic compounds in *Moringa oleifera* leaf and seed and *Vitex doniana* leaf.

Hepata-1, 5-dien-1-ol is an aliphatic secondary alcohols, it is rapidly absorbed in the gastrointestinal tract. These aliphatic esters are hydrolyzed by enzyme to their component secondary alcohols and carboxylic acid [13]. The carboxylic acids are completely oxidized in the fatty acid pathway and the tri-carboxylic acid pathway. It is used a flavouring agent in foods. 2, 2-Dimethylbutane is a central nervous system depressant at high concentration [14].

Hepata-2, 4, 6-trienoic has selective activity on retinols acid receptor (RAR) and retinol X receptor (RXRs) or against activity on one or more each of the RAR and RXR iso-forms [15]. The vitamin A metabolite, retinoic acid has long recognized to induce a broad spectrum of biological effects. Retinoic acids also have been found to be bioactive example of such as retin-A and accutane have found utility as therapeutic agents for the treatment of various pathological conditions such as melanoma, cervical cancer, some forms of leukemia and basal and squamous cell carcinomas (Kellof *et al.,* 2005). The RARs and RXRs have different target gene specifically. For example, response elements have recently been identified

in the cellular retinol binding protein type II (CRBPII) and Apo-lipoprotein AI genes which confer responsiveness to RXR, but not RAR. RAR has also been recently shown to repress RXR-mediated activation through the CRBPII RXR response element (Kellof *et al.,* 2005).

Hepatanoic acid is used to esterify steroids in the preparation of drugs such as testosterone enanthate, drostanolone enathate and methenolone enathate. It is also one of many additives in cigarettes (Noguchi, 1994). They are use as an additive and flavour to food. Methylpenta-2, 4-dienoate serves as an intermediate in the biosynthesis of cholesterol. The acid bears a close chemical relationship to 3-hydroxy-3-methylglutaric acid; this relationship prompted a possible intermediate in cholesterol synthesis (Hong, 1999).

Hepta- 3, 5- diene-di-1-ol is a well known acyclic diarylheptanoic. It is a major constituent of coumarene. It has potent antioxidant activity and has received attention as a promising nutraceutical or a component of designer foods for its cancer preventive ability. Hepta-diene-3, 5-dio-ol, shows a typical radical-trapping ability as a chain breaking antioxidant. In addition, curcumin blocks growth factor signaling via inhibition of the kinase activity or depletion of ERbB-2. More recently, it has been shown that hepta- 3, 5- diene-di-1-ol causes cleavage of h-catenin, resulting in apoptosis in a colon cancer-derived cell line. Antioxidant compounds play an important role as a health protecting factor (Kummaraswany and Satich, 2007). Scientific evidence suggests that antioxidant reduce the risk for chronic disease including cancer and heart diseases (Kummaraswany and Satich, 2007).

## CONCLUSION

The GC-MS analysis of *Ficus capensis* leaf showed that the leaf of plants posses ten bioactive chemical compounds which may be responsible for its medicinal and dietary values.

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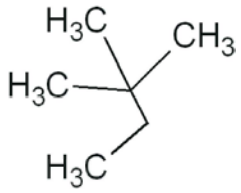
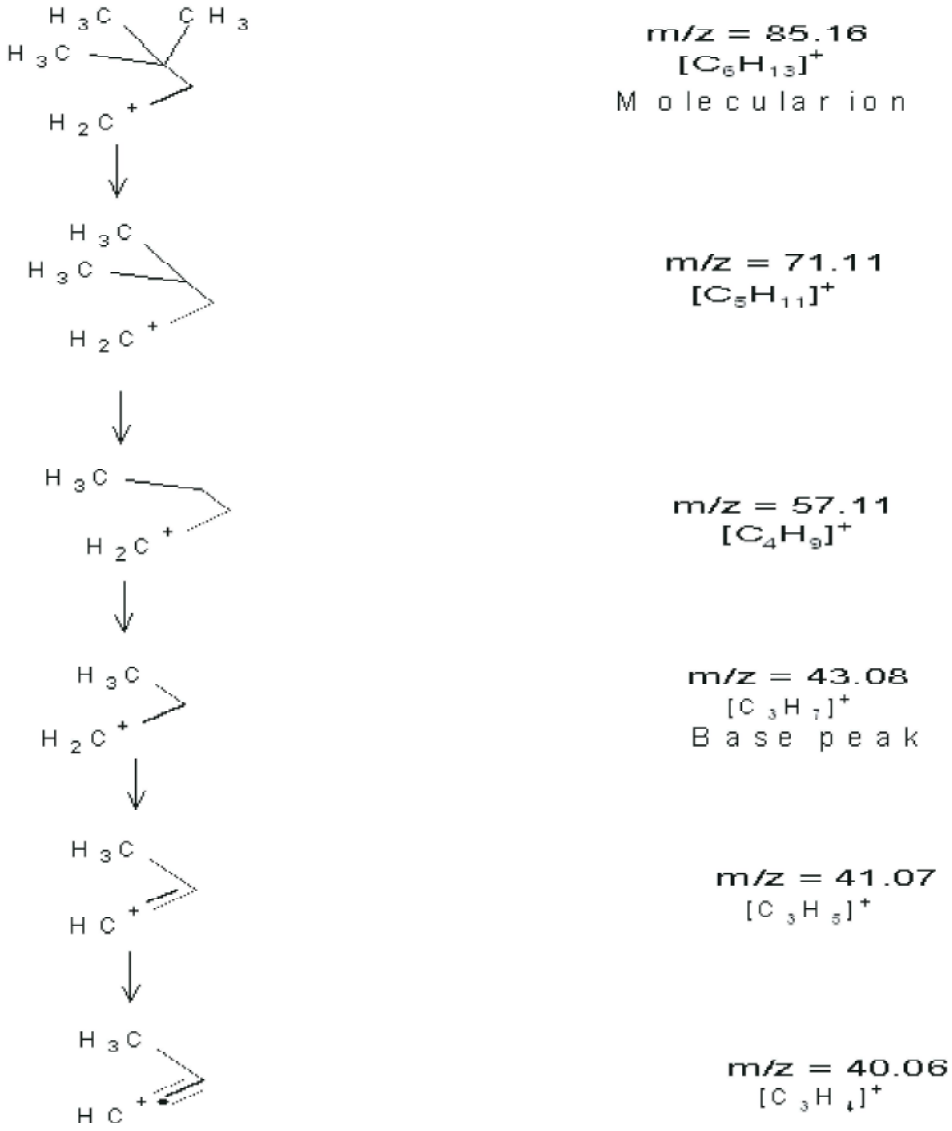



Fig. 1: 2,2-Dimethylbutane




Scheme 1: Fragmentation pattern for 2,2-Dimethylbutane

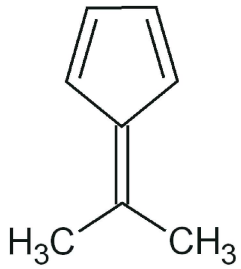
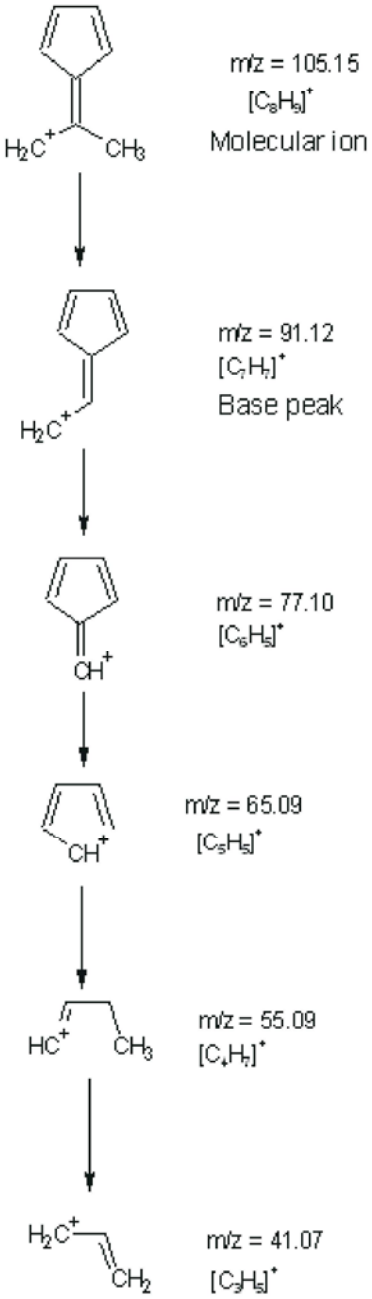



Fig. 2: 5-(1-methylethylidene-1,3-Cyclopentadiene




Scheme 2: Fragmentation pattern for 5-(1-methylethylidene-1,3-Cyclopentadiene

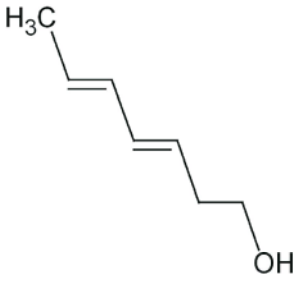
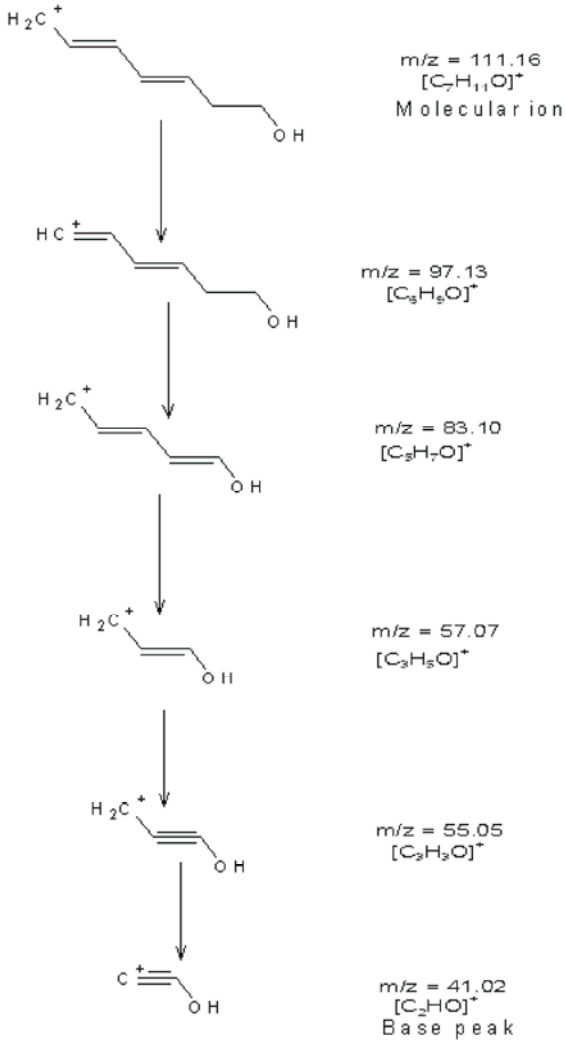



Fig. 3: Hepta-3,5-dien-1-ol




Scheme 3: Fragmentation pattern for Hepta-3,5-dien-1-ol

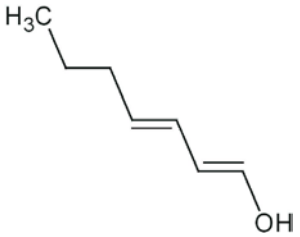
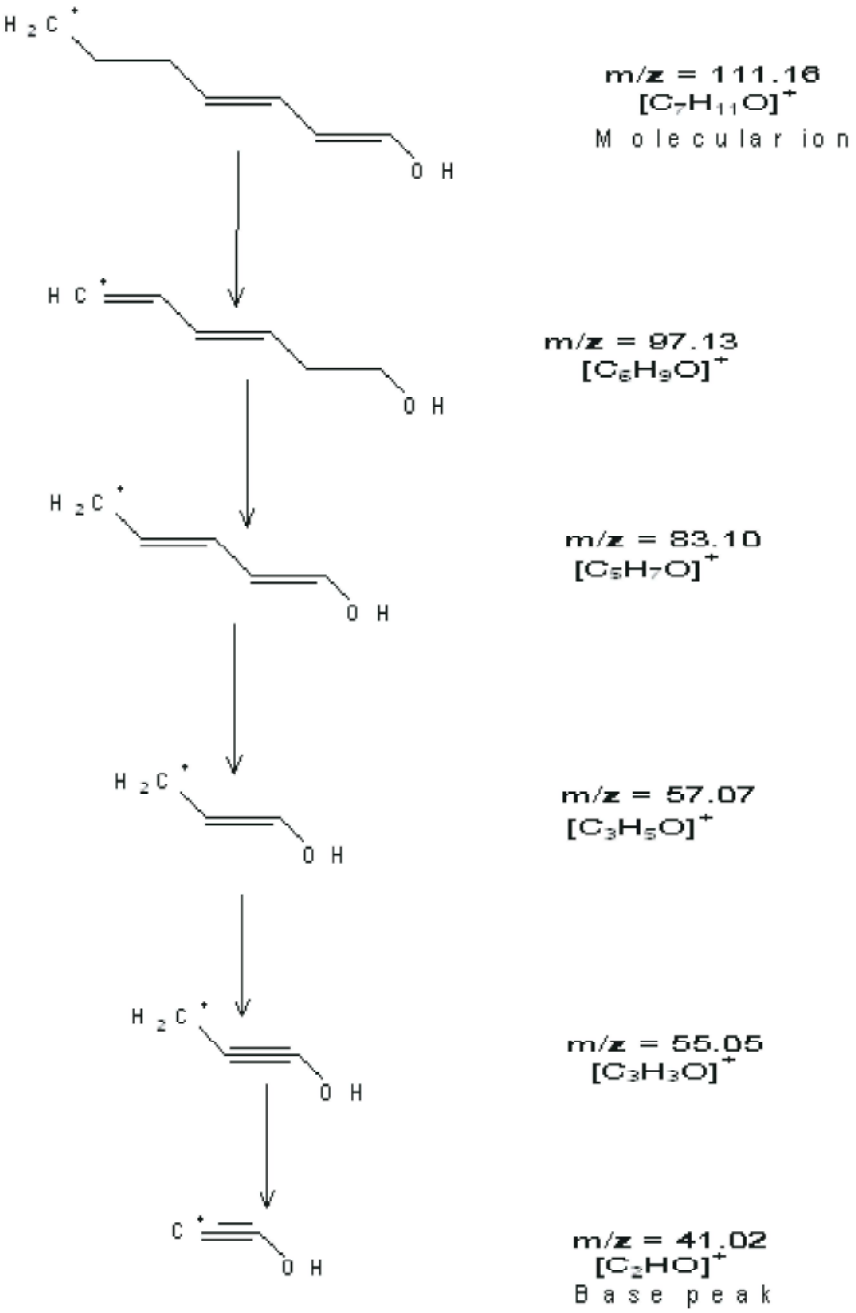



Fig. 4: Hepta-1,3-dien-1-ol




Scheme 4: Fragmentation pattern for Hepta-1,3-dien-1-ol

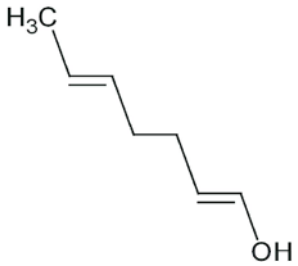
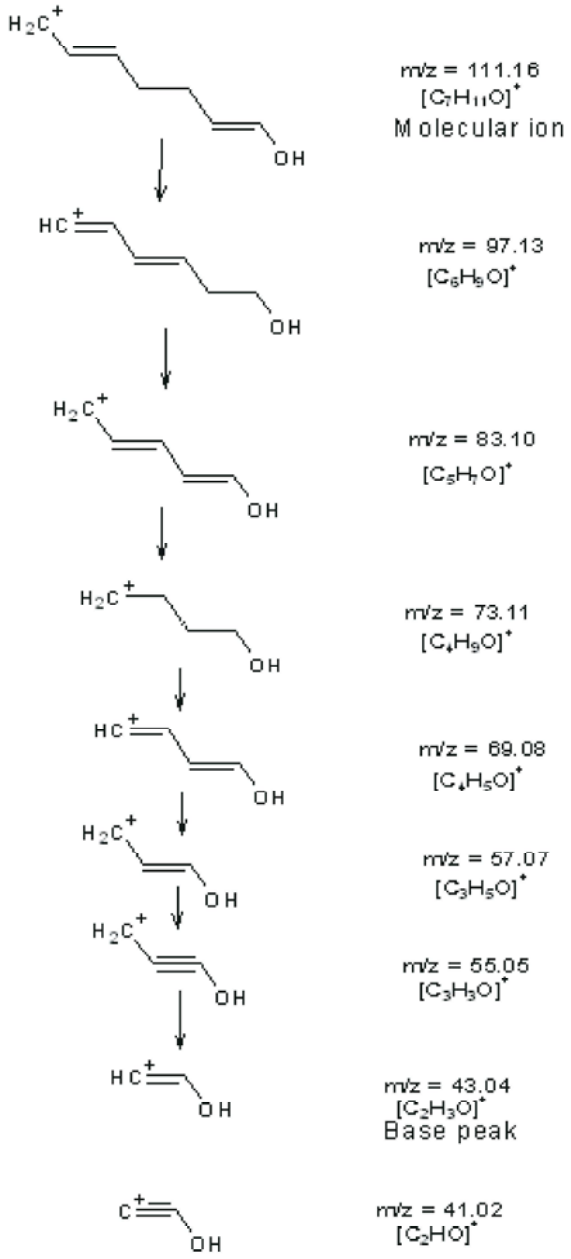



Fig. 5: Hepta-1,5-dien-1-ol




Scheme 5: Fragmentation pattern for Hepta-1,5-dien-1-ol

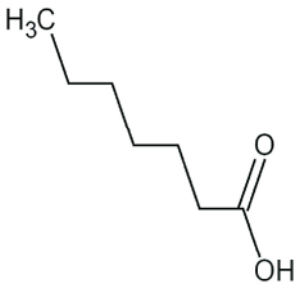
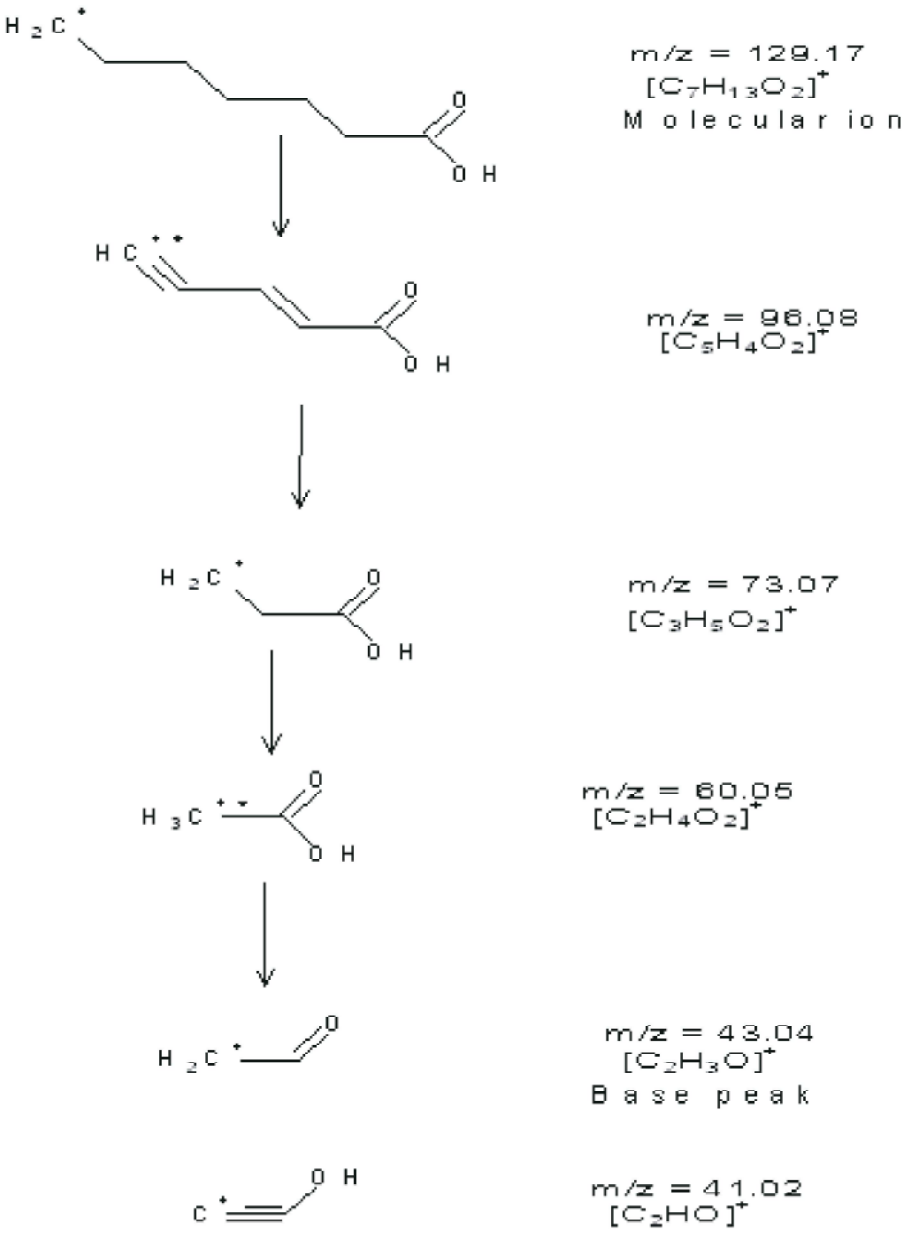


Fig. 6: Heptanoic acid (Enanthic acid)




Scehme 6: Fragmentation pattern for Heptanoic acid (Enanthic acid)

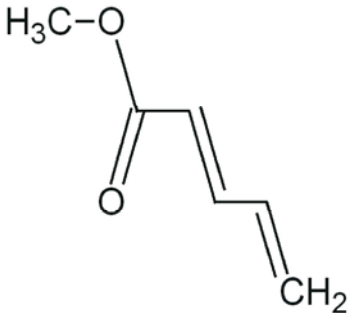
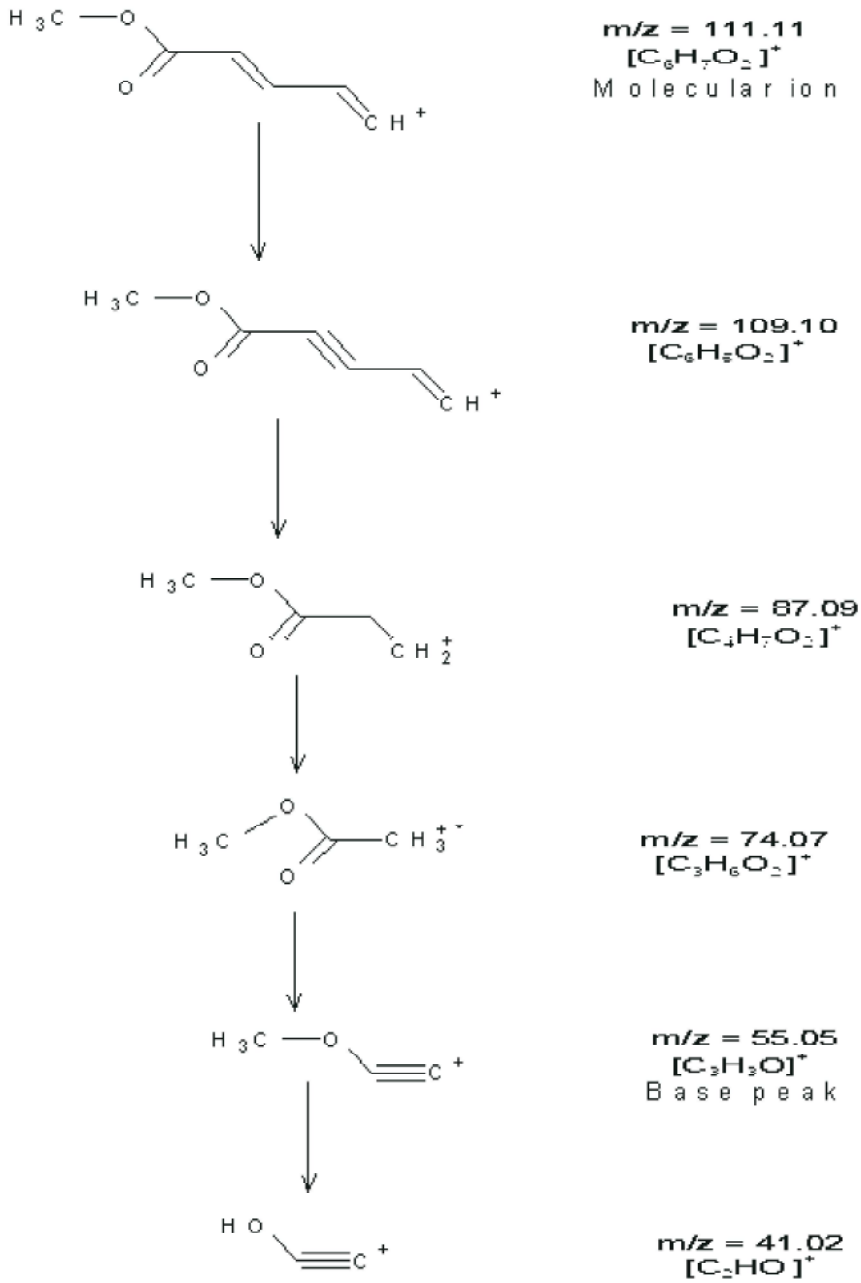



Fig. 7: Methylpenta-2,4-dienoate




Scheme 7: Fragmentation pattern for Methylpenta-2,4-dienoate

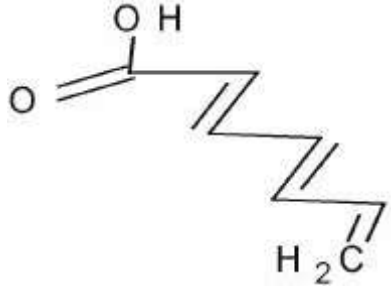


Fig. 8: Hepta-2,4,6-trienoic acid

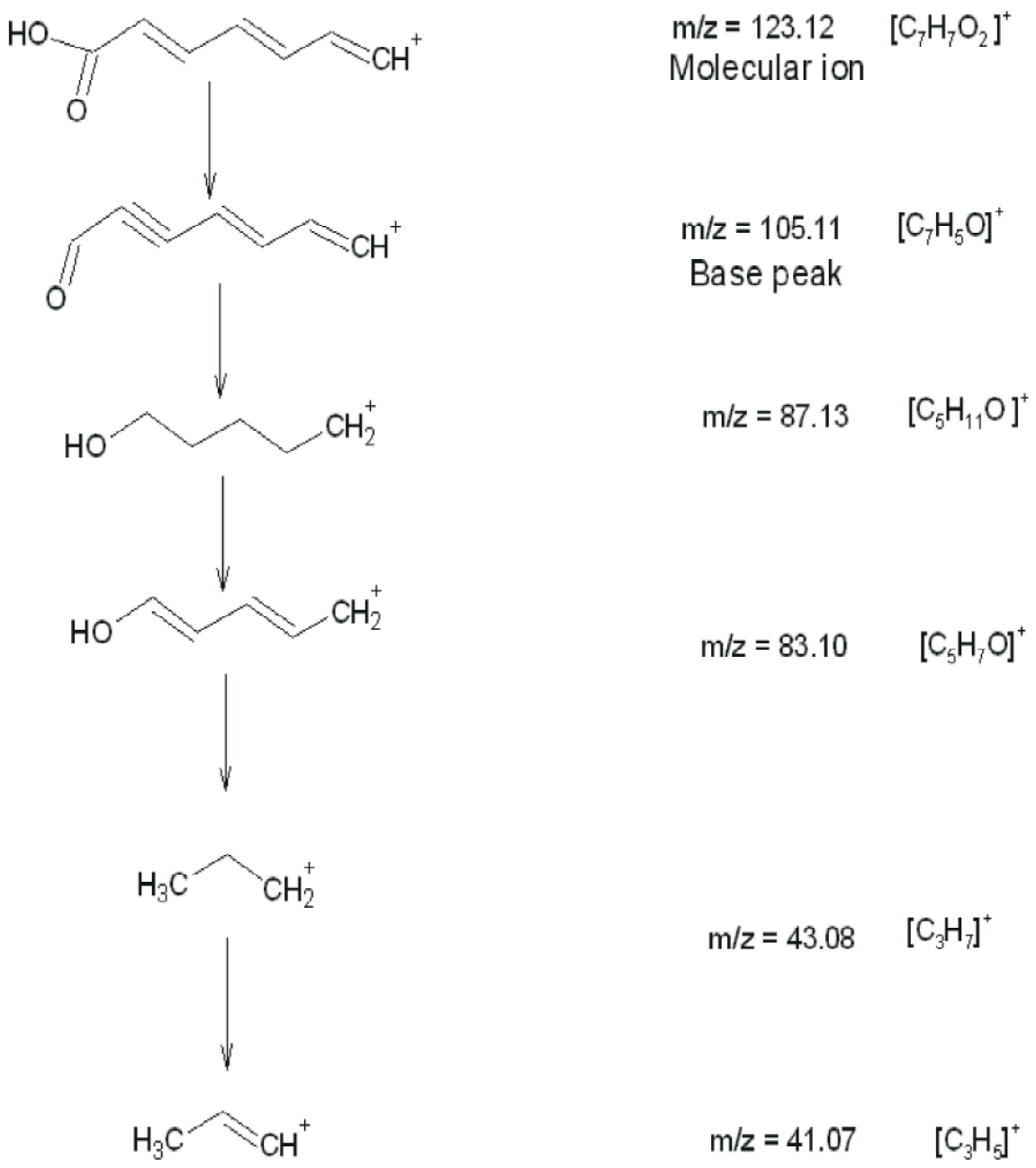



Fig. 8: Fragmentation pattern for Hepta-2,4,6-trienoic acid

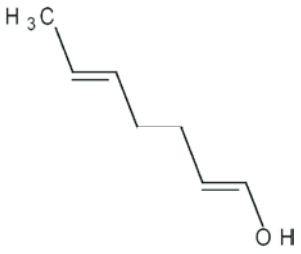
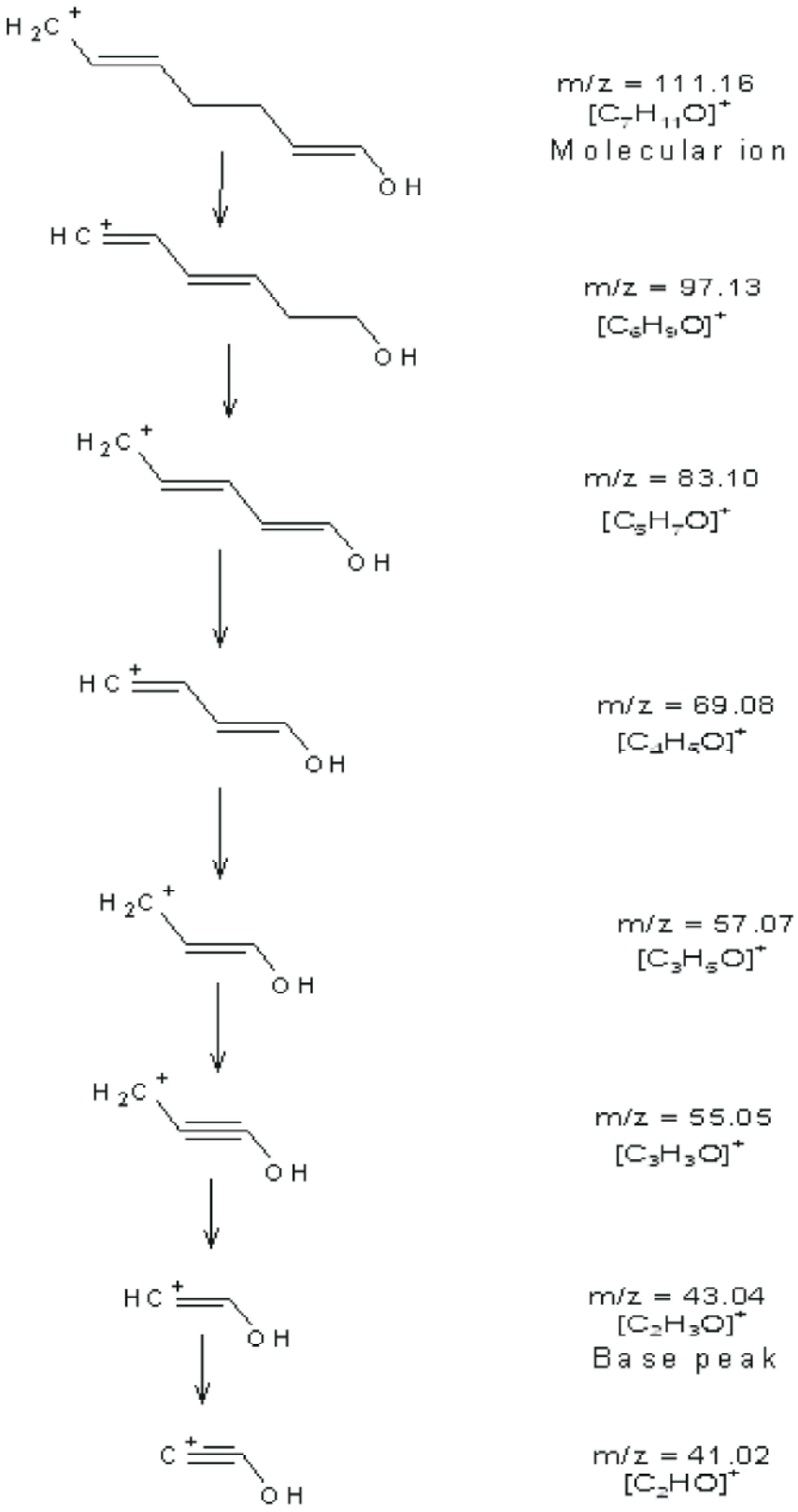


Fig. 9: Hepta-1,5-dien-1-ol




Scheme 9: Fragmentation pattern for Hepta-1,5-dien-1-ol

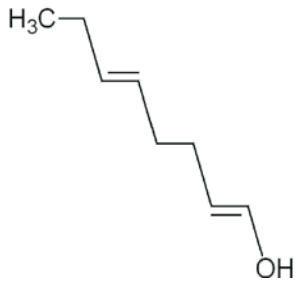
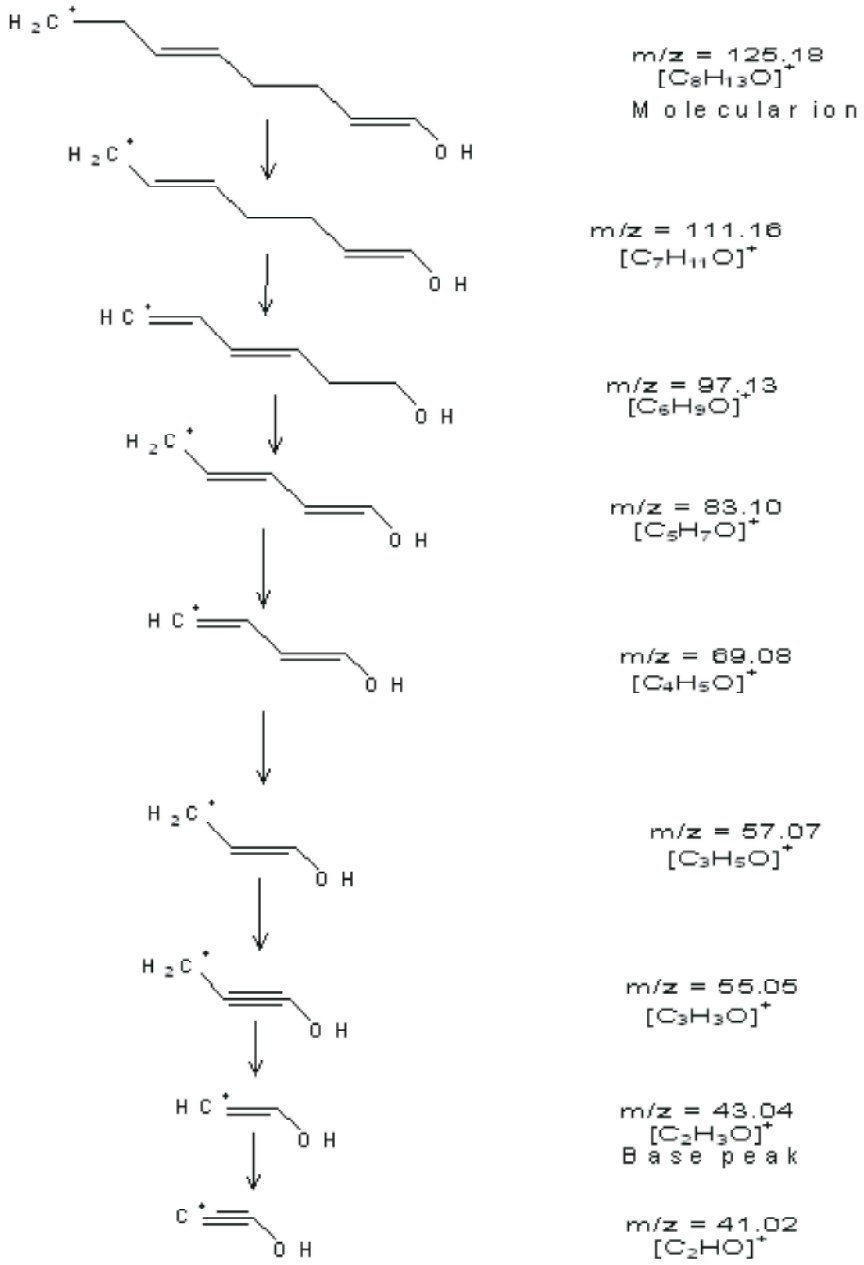



Fig. 10: Octa-1,5-dien-1-ol




Scheme 10: Fragmentation pattern for Octa-1,5-dien-1-ol