



E-ISSN: 2321-2187
P-ISSN: 2394-0514
IJHM 2016; 4(6): 95-97
Received: 14-09-2016
Accepted: 15-10-2016

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GC-MS Analysis of bioactive components on the Leaves extract of *Artocarpus hirsutus*: A potential folklore medicinal plant

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Abstract

Background: *Artocarpus hirsutus* belongs to the family Moraceae and this comprises 50 varieties of species. They are deciduous and evergreen tall tree grows up to 75 meters in height in southern regions of India.

Objective: The primary objective of this study was to investigate the bioactive constituents from (MEAH) methanolic extract of *Artocarpus hirsutus* leaves using (GC-MS) Gas Chromatography and Mass Spectroscopy.

Material and methods: The methanolic extract obtained was subjected to GC-MS for the determination of bioactive volatile compounds. GC-MS analysis was carried out using 6890 GC with 5973 I MSD Column. Helium was used as the carrier gas, the temperature programming was set with initial oven temperature at 400C and held for 3 min, and the final temperature of the oven was 4800C with rate at 100C. A 2-µl sample was injected with split less mode. Mass spectra was recorded over 35-650 amu range with electron impact ionization energy 70 eV. The total running time for a sample is 20 min.

Results: The GC-MS analysis of the methanolic extract revealed the presence of 18 bioactive compounds with valuable biological activities. The major chemical constituents are Butanal, 3-methyl; 2-Methylbutyraldehyde; 2-Methyl-3-propyloxirane; 2-Furancarboxaldehyde 5-methyl-; Propylphosphonic dichloride; 5-Hydroxymethylfurfural; 3,3-Dimethylbutan-2-yl methylphosphonofluoridate; N-PENTADECANE; 2,6-dimethoxy-4-vinyl phenol; Quinic acid; 5,6-Dimethoxy-2-methyl-1-indanone; and n- Hexadecanoic acid.

Conclusion: The presence of various bioactive compounds in *A. hirsutus* proved that the pharmaceutical importance. It can be concluded that the plants investigation have opened up a new perspective in pharmaceutical research and they can be used for the development of potential, novel antioxidant agents for the treatment of many diseases.

Keywords: GC-MS, Phytochemicals, *Artocarpus hirsutus*, Methanolic extract

1. Introduction

Artocarpus hirsutus belongs to the family Moraceae and this comprises 50 varieties of species. They are deciduous and evergreen tall tree grows up to 75 meters in height in southern regions of India. This species occurs wild and is also cultivated for its edible fruits, leaves, bark and also timber. It is known by a variety of names such as Aani, Aini, Aini-maram, Anjili and Anhili found in Karnataka, Kerala and Tamil Nadu. The plant image is shown in Fig.1. The other *Artocarpus* genus like *Artocarpus altilis* (bread fruit), *Artocarpus heterophyllus* (jack fruit) have medicinal value of their source as an edible aggregate fruit [1]. *Artocarpus hirsutus* (Wild jack fruit) is been used in antimicrobial activity [2] anti-ulcer activity [3] traditional medicine, food and industry [4]. Plants are vital for the remedies as well as existence for human disease because they contain components of therapeutic value [5].

A number of *Artocarpus* species are used as traditional medicine is South-East Asia; they contain medicinally important secondary metabolites possessing useful biological activities [6]. The medicinal actions of plants are unique to particular plant species [7]. Therefore, it is worthwhile to use modern tools for verifying therapeutic potential of *Artocarpus hirsutus*. Such information may unravel novel treatment strategies for disorders [8]. Based on the arena of research data and review this study was taken to investigate phytochemical analysis leave extracts present in this plant which is known to have pharmacological importance.

Plants are a rich source of secondary metabolites with remarkable biological activities. The secondary metabolites are significant source with a variety of structural arrangements and properties [9]. Natural products which come out from medicinal plants are important for pharmaceutical research and for drug development as a source of therapeutic agents. At presents the demand for herbal or medicinal plant products has increased significantly [10].

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Fig 1: Plant of *Artocarpus hirsutus*

GC-MS is the best technique to identify the bioactive constituents of long chain hydrocarbons, alcohols, acids, esters, alkaloids, steroids, amino and nitro compounds etc. [11]. A wide range of medicinal plant parts is used for extract as raw drugs and they possess varied medicinal properties [12]. Traditionally used medicinal plants have recently attracted the attention of the biological scientific communities. This has involved the isolation and identification of secondary metabolites produced by plants and their use as active principles in medicinal preparations [13].

2. Materials and Methods

2.1 Collection of Plant Material

The leaves of the plant collected from Tirumala Hills, Chittoor district (A.P.). The plant materials were identified and authenticated by Dr. K. Madhav chetty Assistant professor, S.V. University, Tirupati India. The authentication letter (Voucher specimen No.-1116) has been deposited in Pharmacognosy department, KVK College of Pharmacy, Surmaiguda, Hyderabad (TS).

2.2 Preparation of Powder and Extract

The collected leaves were shade-dried at room temperature and powdered. The coarse powder (100 gms) were extracted by using successive soxhlet extraction using solvent in increasing order of polarity such as petroleum ether, chloroform, methanol and distilled water for 72 hrs. After completion extracts were filtered and solvent evaporated in rotary evaporator [14].

2.3 GC-MS analysis of bioactive compounds

The MEAH was subjected to GCMS at Indian Institute of Chemical Technology (CSIR-IICT), Uppal Road, Tarnaka, Hyderabad, Telangana 500007 for the determination of bioactive volatile compounds. GC-MS analysis of the samples was carried out using 6890 GC with 5973 I MSD. Helium was used as the carrier gas and the temperature programming was set with initial oven temperature at 400C and held for 3 min and the final temperature of the oven was 4800C with rate at 100C. A 2 µL sample was injected with split less mode. Mass spectra was recorded over 35-650 amu range with electron impact ionization energy 70 eV. The total running time for a sample is 20 min. The chemical components from the methanolic extracts of plants were identified by comparing the retention times of chromatographic peaks using Quadra pole detector with NIST Library to relative retention indices. Quantitative determinations were made by relating respective peak areas to TIC areas from the GC-MS [15]. The constituents obtained from GCMS analyzer are given in table 1 and fig.2.

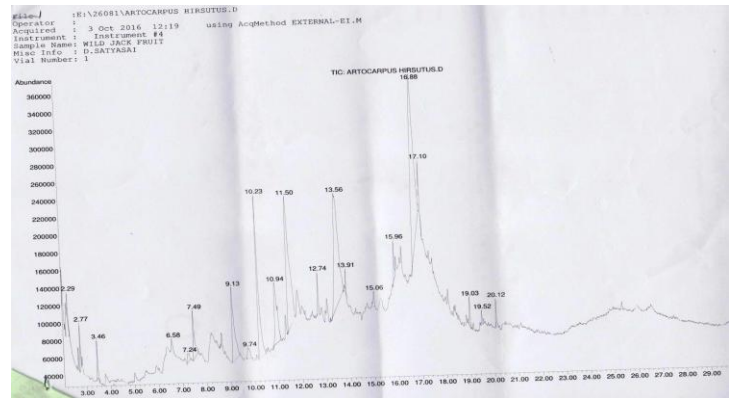


Fig. 2: GC-MS spectrum of methanol extract of leaves of *Artocarpus hirsutus*

Table 1: Bioactive compounds detected from methanolic extract of *A. hirsutus* leaves

S.N.	R.T. (min.)	Compound name	Molecular formula	Molecular weight
1	2.691	Butanal, 3-methyl	C ₅ H ₁₀ O	86.1323
2	2.766	2-Methylbutyraldehyde	C ₅ H ₁₀ O	86.1323
3	3.460	2-Methyl-3-propyloxirane	C ₆ H ₁₂ O	100.159
4	7.231	2-Furancarboxaldehyde, 5-methyl-	C ₆ H ₆ O ₂	110.1106
5	7.496	Propylphosphonic dichloride	C ₃ H ₇ C ₁₂ OP	160.967
6	9.148	1,3,5-Triazine-2,4,6-triamine	C ₃ H ₆ N ₆	126.1199
7	10.207	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	C ₆ H ₈ O ₄	144.1253
8	10.951	5-(Hydroxymethyl)dihydro-2(3H)-furanone	C ₅ H ₈ O ₃	116.115
9	11.531	5-Hydroxymethylfurfural	C ₆ H ₆ O ₃	126.1100
10	12.755	2-Methoxy-4-vinylphenol	C ₉ H ₁₀ O ₂	150.18
11	13.461	3,3-Dimethylbutan-2-yl methylphosphonofluoridate	C ₇ H ₁₆ FO ₂ P	182.18
12	13.915	1-(3,6,6-Trimethyl-1,6,7,7a-tetrahydrocyclopenta[c]pyran-1-yl)ethanone	C ₁₃ H ₁₈	206.281
13	15.062	N-PENTADECANE	C ₁₅ H ₃₂	212.41
14	15.958	2,6-dimethoxy-4-vinylphenol	C ₁₀ H ₁₂ O ₃	180.203
15	16.828	Quinic acid	C ₇ H ₁₂ O ₆	192.167
16	17.106	5,6-Dimethoxy-2-methyl-1-indanone	C ₁₂ H ₁₄	206.238
17	19.035	1H-3a,7-Methanoazulen-6-ol, octahydro-3,6,8,8-tetramethyl-, acetate,[3R-3.alpha.]	C ₁₇ H ₂₈ O ₂	264.403
18	20.120	n-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256.4241

3. Results and Discussion

Now a day the study of the organic compounds from plants and their activity has increased. The combination of a best separation technique (GC) with the best identification technique (MS) made GC-MS an ideal technique for qualitative analysis for volatile and semi-volatile bioactive compounds [16]. The most abundant components found in the methanolic extract of leaves were Butanal, 3-methyl; 2-Methylbutyraldehyde; 2-Methyl-3-propyloxirane; 2-Furancarboxaldehyde 5-methyl-; Propylphosphonic

dichloride; 1,3,5-Triazine-2,4,6-triamine; 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- ; 5-(Hydroxymethyl) dihydro-2(3H)-furanone; 5-Hydroxymethylfurfural; 2-Methoxy-4-vinylphenol; 3,3-Dimethylbutan-2-yl methylphosphonofluoridate; N-PENTADECANE; 2,6-dimethoxy-4-vinyl phenol; Quinic acid; 5,6-Dimethoxy-2-methyl-1-indanone; 1H-3a,7-Methanoazulen-6-ol, octahydro-3,6,8,8-tetramethyl-, acetate, [3R-3.alpha] and n-Hexadecanoic acid.

Investigation of medicinal value of *Artocarpus hirsutus* have added a great deal in the field of phytochemistry with regard to their availability of complex phytochemical components, antibacterial activity, anthelmintic, anti-inflammatory and antiviral. There has been growing interest regarding thousands of bioactive compounds that have been produced by this plant species [17].

The GC-MS analysis revealed that the methanolic extract is mainly composed of oxygenated hydrocarbons, alkane hydrocarbon, predominantly phenolic hydrocarbons and tannins. These phytochemicals are responsible for various pharmacological actions like hepatoprotective activity, antioxidant property, wound healing and antimicrobial activity etc. This study is only a preliminary study of the occurrence of certain properties of *Artocarpus hirsutus* leaves extract an in-depth study will provide a good concrete base for all the biochemical and phytochemical functions mentioned above. New scientific strategies for the evaluation of natural products with specific biological activities require the implementation of large screening process. *Artocarpus hirsutus* is a potential folklore medicinal plant used for antimicrobial activity [2], anti-ulcer activity [3] and many traditional medicines. Phytochemical analysis by GC-MS revealed presence of Palmitic acid, tannins, hydrocarbons, aldehydes, fatty acid esters, fatty acid amide, terpenoids, Terpene alcohol and phytol as major compound groups. Compositional variation in quantities, qualities and structural features may influence compounds behaviour on GC-MS, as well as bioactivities of their precursor fractions. It can be concluded that the plants investigation have opened up a new perspective in pharmaceutical research and they can be used for the development of potential, novel antioxidant agents for the treatment of many diseases.

4. Conclusion

In the present investigation, eighteen bioactive compounds have been identified from methanolic extract of *Artocarpus hirsutus* by GC-MS. The presence of various bioactive compounds in *A. hirsutus* proved that the pharmaceutical importance. However, further studies will require finding out its bioactivity, toxicity profile.

5. Acknowledgment

The authors are thankful to the Indian Institute of Chemical Technology (CSIR-IICT), Uppal Road, Tarnaka, Hyderabad, Telangana 500007 and also KVK college of Pharmacy, Surmaiguda (V), RR District (affiliated to Jawaharlal Nehru Technological University- Hyderabad) for providing facilities.

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