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IDENTIFICATION OF NONPOLAR COMPOUNDS IN *ZYGOPHYLLUM SIMPLEX* L

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ABSTRACT

Zygophyllum simplex L. is a plant known for its adaptation to grow in arid climatic conditions. Study on nonpolar phytochemicals and their functional group is not your reported from Thar desert. In the present study, the presence of nonpolar compounds and their functional group was identified by GC-MS and FTIR assay. Resulting, GC-MS analysis of fraction identified a total of twelve compounds. Among them, one compound is known for producing flexibility in the material. An antimicrobial agent was also identified for the first time in the plant extract of Zygophyllum simplex L. furthermore FTIR spectroscopy also identified functional groups in the plant extract.

Keywords: *Medicinal Plant, FTIR, GC-MS, Antimicrobial Compound, Nonpolar Fraction.*

Introduction

It is infeasible to imagine human civilization without plants. Plants are one of the major sources of shelter, medicines, and food like vegetables, cereals, fruits, et cetera from the days of yore[1-3]. Zygophyllaceae is a family known for its flowering plants. It is adapted to grow in arid and semi-arid climatic conditions. Studies on these plants reported approximately 285 number of species and 22 genera worldwide[4]. Ten species are reported from the Thar desert of Rajasthan, India. Among these plants *Zygophyllum simplex* L. is the plant that is adapted to grow in the super arid environment. Study till now reports scarcity of anti-microbial activity in this plant [5]. The presence of nonpolar compounds and their functional group in *Zygophyllum simplex* L. is not fully known. The plant is distributed in the Thar Desert, Rajasthan and Gujarat, India [6-8]. Thar desert, which is located in the western part of India covers approximately 2,00,000 Km^2 of area. Morphological feature of plant - "Plant is procumbent, dichotomously branched, green brown to purple, glabrous, annual herb. Leaves opposite, simple, unequal, sessile, 10-20 X1-2 mm, cylindrical, succulent. Flower *c*.5mm across, yellow. Sepals 5 c. 2X1 mm, obtuse, cucullate. Petals 5 c. 3X1 mm, spathulate, membranous. Stamens 10, 2-3 mm long; staminal scales c. 1mm long, bipartite. Capsules c. 3mm across, turbinate, 5-anbled, rugulose. Seeds c. 1.0 X 0.6 mm, fusiform, brown.''[9]. Plants are a tremendous source of phytochemicals that can be useful in many different ways. However, nonpolar phytochemicals from the *Zygophyllum simplex* L. is not yet reported. In the present study non polar hexane extract was isolated from the plant and Identification was done by GCMS and FTIR analysis.

Material and Method

- **Collection of Plant Material:** The plant was collected from Latitude: 27.131235 and Longitude: 72.358925 (Phalodi, Jodhpur district, Rajasthan, India). After collection the plant was washed under tap water followed by double distilled water. After removing dust particles the plant was shade dried at room temperature in a ventilated area. The plant was identified by the Botanical Survey of India (BSI) Jodhpur (Figure 1).

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- **Water Content:** Water is one of the most abundant molecules in cells. It is required for different reactions in the living organism. For identification of the presence of water in plant, three grams of the fresh harvested complete plant (stems and branches) was kept in oven for 10 hours at 60°C, these were then weighed immediately after cooling. Moisture content was calculated using the following formula-

$$\textbf{water content} = \frac{\textbf{fresh weight} - \textbf{dry weight}}{\textbf{fresh weight}} \textbf{ X 100}$$

- **Ash Content:** Ash content helps us to measure the amount of inorganic non-burnable material and ions Ash content was calculated using formula [10-12]

$$\textbf{Ash content} = \textbf{100} - \left[\frac{\textbf{pre weight} - \textbf{ash weight}}{\textbf{pre weight}} \textbf{ X 100} \right]$$

- **Extract Preparation:** Freshly powdered plant samples was extracted according to the methodology described by Delfel. Acetonitrile (Molychem, Mumbai, India) saturated with hexane (Molychem, Mumbai, India) was prepared. 10 grams of freshly pulverized plant sample was taken in mortar-pestle and crushed with saturated hexane. After crushing the mixture was transferred into erlenmeyer flask and incubated at 37 ºC for 48 hrs. After incubated mixture was filtered with Whatman filter paper (Size 110mm) Grade No 1. The filtrate was collected and dried in a vacuum. The dried filtrate was stored at -20 degree celsius for further use [13].
- **Functional Group Identification:** For identification of the functional group in plant extract Fourier transform infrared spectrophotometer (FTIR) was used. FTIR Can detect vibrational bands like N-H (ester), O-H (amine), C-H (ketone), C = O (aldehyde), vibrational modes of a tetrapyrrole rings (C = C, C = N) and even C = N [14]. Drop casting method was adopted. Sample was loaded on a borosil glass plate. Reading of blank glass plate was taken to reduce the noise of glass plate.
- **GC MS Analysis:** 3 µl of the sample was injected in GC-MS. GC column (Rxi5 Si MS) was used with a diameter of 0.25 mm, length of 30.0 m, and thickness of 0.25 um. The column oven temperature was 50°C. Injection temperature 250 °C. Due to its low boiling point, density, and solubility helium was used as a carrier gas. The pressure was maintained at 66.8 kPa, the total flow was kept at 23.9 mL/min. flow in the column was at 1.18 mL/min, the linear velocity was at 39.4 cm/sec, and the purge flow was at 5.0 ml/min. The ion source temperature and interface temperature of mass spectrometry was 280 °C. The total time of GC-MS was 34 minutes [15].

Result and Discussion

One gm fresh plant remains 0.217 (gram) after drying the plant. Resulting percentage of water content 78.3 % and 21.7 solid residue. one gm dry plant remains 0.073 gm resulting percentage of ash content 7.366 %, Colour of ash is white.

Functional group Identification was done by FTIR, after removing the reading of blank the plant extract is showing strong O-H broad (alcohol), C-H stretching with medium appearance, strong C=O stretching primary amide, C-H bending (alkane), and strong S=O stretching (sulfoxide) (Figure 2).

GC-MS analysis identified a total of twelve compounds in hexane fraction, these are 1,2-Propadiene-1,3-dione, Tetramethylammonium acetate, Methylene chloride, Pentane, 2,4-dimethyl, Cyclopentane, methyl, Pentane, 3,3-dimethyl, Cyclohexane, Hexane, 3-methyl, 1-Heptene, 5-methyl, 2-Pentanone, 4-hydroxy-4-methyl, 2-Propenoic acid, butyl ester, Dibutyl phthalate (Table 1,2).

Bioactivity- Pentane, 2,4-dimethyl is nonpolar in nature it is present in *Cymbopogon citratus,* which is known for its flavoring agent and herbal medicinal property [16]. 2-Pentanone, 4-hydroxy-4-methyl is tertiary alcohol in nature reported as an antimicrobial compound, It may inhibit the growth of *E. coli, Klebsella pneumonia, Staphylococcus aureu*s [17-18]. Non-polar compound 2-propenoic acid, butyl ester is a non-cancer causing compound useful in many chemical reactions [19]. Dibutyl phthalate is useful for the flexibility of material (fast-fusing plasticizers) [20]

Figure 1: *Zygophyllum simplex* L.

Figure 2: FTIR Spectrum of Plant Extract

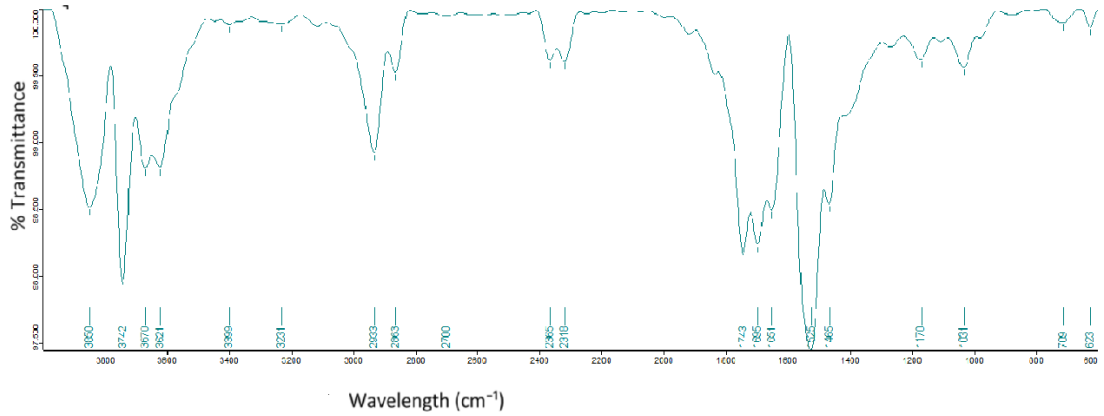
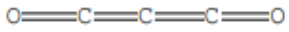
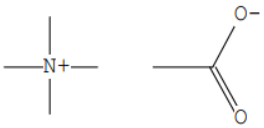
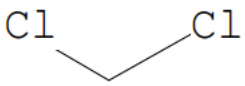
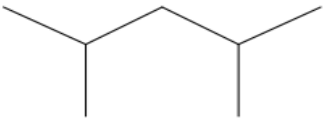
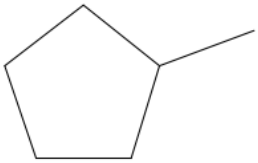
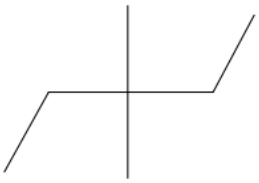
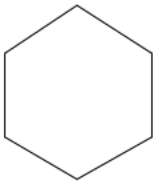
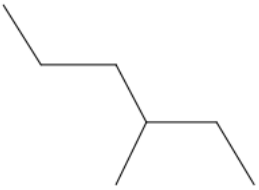
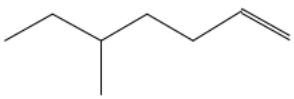
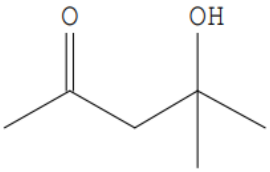
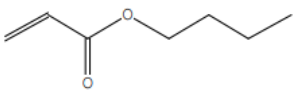
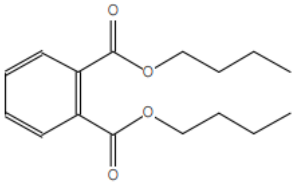


Table 1: GCMS Analysis of Plant Extract

S. No.	RT	Compound Name	Molecular Formula	Molecular Weight g/mole
1	1.443	1,2-Propadiene-1,3-dione	C_3O_2	68
2	1.615	Tetramethylammonium acetate	$C_6H_{15}NO_2$	133
3	1.715	Methylene chloride	CH_2Cl_2	84
4	1.943	Pentane, 2,4-dimethyl	C_7H_{16}	100
5	2.168	Cyclopentane, methyl	C_6H_{12}	84
6	2.326	Pentane, 3,3-dimethyl	C_7H_{16}	100
7	2.397	Cyclohexane	C_6H_{12}	84
8	2.466	Hexane, 3-methyl	C_7H_{16}	100
9	2.571	1-Heptene, 5-methyl	C_8H_{16}	112
10	4.844	2-Pentanone, 4-hydroxy-4-methyl	$C_6H_{12}O_2$	116
11	5.776	2-Propenoic acid, butyl ester	$C_7H_{12}O_2$	128
12	17.950	Dibutyl phthalate	$C_{16}H_{22}O_4$	278

Table 2: Structure of the Compounds

 1,2-Propadiene-1,3-dione	 Tetramethylammonium acetate
 Methylene chloride	 Pentane, 2,4-dimethyl
 Cyclopentane, methyl	 Pentane, 3,3-dimethyl
 Cyclohexane	 Hexane, 3-methyl
 1-Heptene, 5-methyl	 2-Pentanone, 4-hydroxy-4-methyl
 2-Propenoic acid, butyl ester	 Dibutyl phthalate

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