

## Gas Chromatography Mass Spectrometry Analysis of *Abutilon Indicum*

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### ABSTRACT

In this study, the bioactive compounds of *Abutilon Indicum* have been analyzed using Gas Chromatography-Mass Spectrometer (GC-MS). The chemical compounds of the whole plant ethanol and aqueous extracts of *Abutilon Indicum* were investigated using Shimadzu GC-MS. Analysis of *Abutilon Indicum* whole plant was carried out after extraction of bioactive compounds in ethanol and aqueous extracts. The compounds identified in alcoholic extract were Salicylic acid methyl and ethyl esters, Steroids, Palmitic acid, Palmitic acid ethyl ester, Myristic acid, Phytol, Linoleic acid ethyl ester, Linolenic acid ethyl and methyl esters and Oleic acid methyl ester having antioxidant activities with anti-inflammatory and anticancer properties. The existence of the compounds like 1,2-Benzendicarboxylic acid diethyl ester and 1,2-Benzenedicarboxylic acid diethyl ester was also identified. Other minor compounds were also identified in the aqueous extract of plant sample by GCMS study which had medicinal value. Bioactive compounds are more in ethanolic extract of plants than in water extracts.

**Keywords:** GC-MS analysis, Bioactive compounds, *Abutilon Indicum*, Ethanol and Aqueous extract

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### INTRODUCTION

*Abutilon indicum* is a common Indian shrub, belonging to the family Malvalceae; known as mallow in English. *Abutilon indicum* is used as a medicinal plant<sup>[1]</sup>. It has been extensively used as a traditional medicine, as a laxative, emollient, analgesic, anti-diabetic, anti-inflammatory and also in the treatment of leprosy, urinary disease, jaundice, piles, relieving thirst, cleaning wounds and ulcers, Vaginal

infections, rheumatism, mumps, pulmonary tuberculosis, bronchitis, allergy, blood dysentery, some nervous and ear problems. Various studies on the plant extract have been performed to confirm the anti-oxidant, anti-bacterial, analgesic, anti-inflammatory, anti-cancer, hepato-protective, immunomodulatory and larvicidal activities of the plant<sup>[2]</sup>.

In traditional medicine, *Abutilon indicum* is used as a aphrodisiac, demulcent, diuretic, laxative, pulmonary and sedative (leaves). The bark is astringent and diuretic; laxative, expectorant and demulcent (seeds); laxative and tonic, anti-inflammatory and anthelmintic (plant); analgesic (fixed oil); diuretic and for leprosy (roots). The plant is very much used in siddha medicines. In fact, the bark, root, leaves, flowers, and seeds are all used for medicinal purposes in Tamilnadu.. The plant exhibits several potential pharmacological activities<sup>[3]</sup>.

*Abutilon indicum*, commonly called ‘Thuthi’ or ‘Kanghi’ in Hindi, is a native plant of south Asia. Natural drugs are effective in action without side effect. *Abutilon indicum* (Linn.) sweet (Malvalceae) commonly called ‘Country Mallow’ is a perennial plant grown up to 3 m in nature’s gift to human beings. The *Abutilon* L. genus of the Malvalceae family comprises about 150 annual or perennial in countries of America, Africa, Asia and Australia<sup>[4]</sup>.

The plant is a shrub, softly tomatoes and grown up to 3m in height. The plant is found in India, Sri Lanka, topical regions of America and Malaysia. The leaves are ovate, acuminate, toothed, rarely sub 718research718 and 1.9-2.5cm long. The flowers are yellow in color, peduncle joined above the middle. The petioles are 3.8-7.5cm long; stipules 9cm long; pedicels often 2.5- 5mm long, axillary solitary, joined very near the top; calyx 12.8mm long, divided into middle, lobes ovate, apiculate and corolla 2.5cm diameter, yellow, opening in the evening. The fruits are capsule, densely pubescent with conspicuous and horizontally spreading peaks. It is useful in gout, tuberculosis, ulcers, bleeding disorders and worms. It can be used as Digestive, laxative, expectorant, diuretic, astringent, analgesic,

anti-inflammatory, anthelmintic, demulcent and aphrodisiac. Decoction used in toothache and tender gums<sup>[5]</sup>.

Demulcents of leaves are locally applied to boils and ulcers. Roots are prescribed in fever, chest problems and urethitias. Seeds are used in urinary disorders<sup>[6]</sup>.

## MATERIALS AND METHODS

### Plant Material:

*Abutilon indicum* was collected from the surrounding of Nagapattinam during August to December 2019.

### Preparation of Extract:

The collected plant leaves were washed with water. Washed leaves were dried at room temperature for 10-15 days in shaded place and grinded into fine powder. Required quantity of the whole plant of *Abutilon indicum* was weighed and transferred to flask treated with ethanol and aqueous solvent until the fine powder was fully immersed through overnight and filtered through a Whatmann No.41 filter paper<sup>[7]</sup>. The fine powder was subjected to successive extraction with solvents. The extracts were collected and subjected to concentrate. The active compounds were identified by Gas Chromatography-Mass Spectrometer technique.

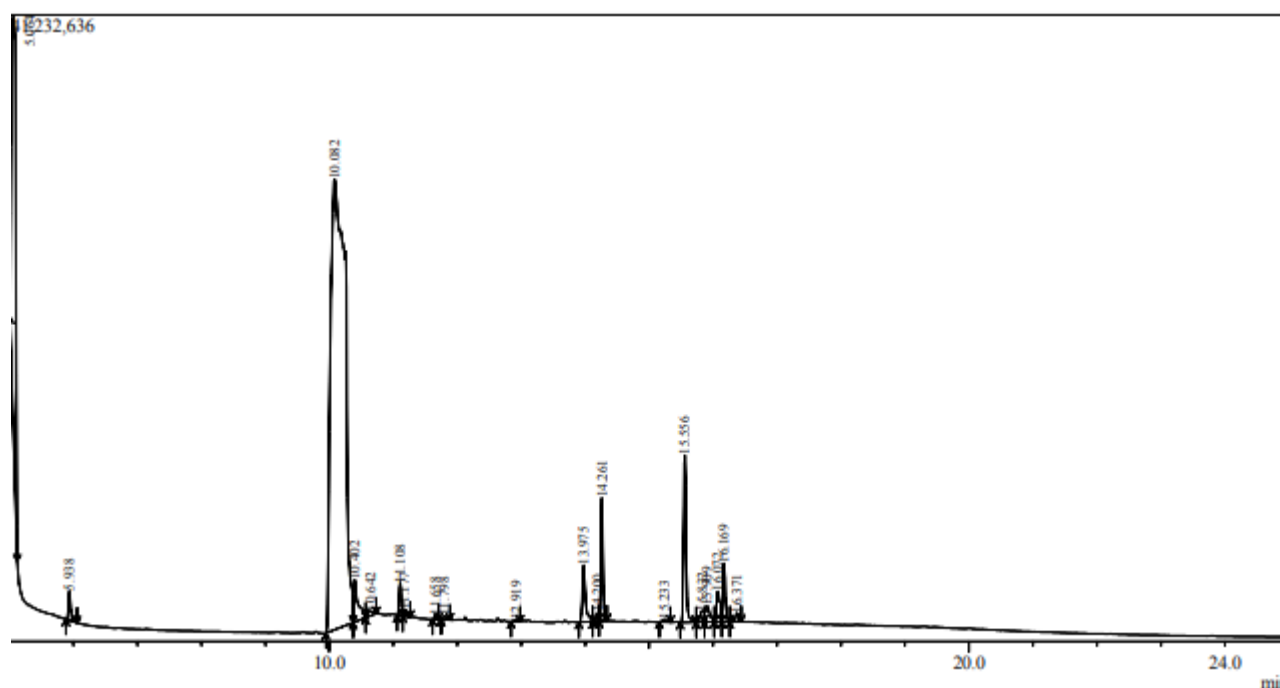
### GAS CHROMATOGRAPHY-MASS SPECTROMETER PROGRAM:

The GC-MS analysis was carried out using a SHIMADZU-GCMS-QP-2010 plus (auto system XL) Gas chromatograph equipped and coupled to a mass detector SHIMADZU RTE-5 MS 5.1 spectrometer, column dimension was (30meter × 0.50mmID ×1µm) of capillary column. The instrument was set to on initial temperature of 120°C and maintained at this temperature for 0-5 min for solvent delay. At the end of this period, the oven temperature was rose up to 270°C at the rate of an increase of 5°C/min. and the analysis completed in 30 min, Injection port temperature was ensured as

260°C and Helium gas flow rate is fixed as 1ml/min. The ion source temperature in the instrument was fixed as 270 deg C.. The samples were injected in split mode in the ratio of 10:1. Mass spectral scan range was set at 45-450(m/z). The NIST library is used to identify the compounds present in the sample extract<sup>[8]</sup>. The mass spectrum of individual compound is matched with the mass spectrum of compounds in the sample chromatogram showed as peaks and identified the nature of compounds.

## RESULTS AND DISCUSSION

The Studies on the active compounds in the *Abutilon indicum* whole plant ethanol extract by Gas Chromatography-Mass Spectrometer analysis is clearly showed in the Chromatogram. **Figure.1**



**Figure.1 GC-MS Chromatogram of Ethanol Extract of *Abutilon indicum***

The presence of twenty compounds were detected and tabulated below with RetentionTime (RT), Molecular Formula and Peak area in **Table.1**

**Table.1 Compounds identified in GCMS analysis in Ethanol Extract**

No	RT	Name of the compound	Molecular Formula	Peak area %	Compound Nature	*Activity
1	5.064	Benzoic acid, 2-hydroxy-, Methyl ester	C <sub>8</sub> H <sub>8</sub> O <sub>3</sub>	17.98	Salicylic acid methyl ester	Antimicrobial Anti-inflammatory Growth promoter
2	5.938	Benzoic acid, 2-hydroxy-, ethyl ester	C <sub>9</sub> H <sub>10</sub> O <sub>3</sub>	0.67	Salicylic acid ethyl ester	Antimicrobial Anti-inflammatory Growth promoter
3	10.08 2	1,2-Benzenedicarboxylic acid, diethyl ester	C <sub>12</sub> H <sub>14</sub> O <sub>4</sub>	64.64	Plasticizer compound	Antimicrobial Antifouling
4	10.40 2	1,4-Benzenedicarboxylic acid, 2-(acetyloxy)-dimethyl ester	C <sub>12</sub> H <sub>12</sub> O <sub>6</sub>	1.93	Plasticizer compound	Antimicrobial Antifouling
5	10.64 2	Undecanoic acid	C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	0.37	Saturated fatty acid	No activity reported
6	11.10 8	1,2-Benzenedicarboxylic acid, dipropyl ester	C <sub>14</sub> H <sub>18</sub> O <sub>4</sub>	0.72	Plasticizer compound	Antimicrobial Antifouling
7	11.17 7	.Alpha-Coppaene-11-ol	-	0.15	-	-
8	11.65 8	1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester	C <sub>16</sub> H <sub>22</sub> O <sub>4</sub>	0.09	Plasticizer compound	Antimicrobial Antifouling
9	11.79 8	Tetradecanoic acid	C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	0.10	Myristic acid	Antimicrobial Anti-inflammatory Antioxidant Anticancer
10	12.91 9	Ethyl iso-allocholate.	C <sub>26</sub> H <sub>44</sub> O <sub>5</sub>	0.08	Steroid	Antimicrobial Anti-inflammatory Antioxidant Antiasthma Haepatoprotective
11	13.97 5	Hexadecanoic acid	C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	1.85	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant,

						Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
12	14.20 0	9-Hexadecenoic acid, methyl ester, (Z)-	$C_{17} H_{32} O_2$	0.24	Oleic acid methyl ester	Anti- inflammatory, Antiandrogenic Cancer preventive, Dermatitigenic Hypocholesterole mic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge,
13	14.26 1	Hexadecanoic acid, ethyl ester	$C_{18} H_{36} O_2$	2.58	Palmitic acid ethyl ester	Antioxidant, Hypocholesterole mic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
14	15.23 3	Propyl Hexadecanoate.	$C_{19} H_{38} O_2$	0.11	Ester compound	No activity reported
15	15.55 6	Phytol isomer	$C_{20} H_{40} O$	4.30	Phytol	Antimicrobial Anti- inflammatory Anticancer Antioxidant Diuretic
16	15.83 2	(Z)6-Pentadecen-1-ol	$C_{15} H_{30} O$	0.47	Unsaturated alcoholic compound	No activity reported
17	15.90 9	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)	$C_{19} H_{32} O_2$	0.75	Linolenic acid methyl ester	Anti- inflammatory, Hypocholesterole mic Cancer

						preventive, Hepatoprotective, Nematicide Insectifuge, Antihistaminic Antieczemic, Antiacne, 5- Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary, Insectifuge
18	16.07 2	Ethyl linoleate	$C_{20} H_{36} O_2$	1.21	Linoleic acid ethyl ester	Anti- inflammatory, Hypocholesterole mic Cancer preventive, Haepatoprotectiv e, Nematicide Insectifuge, Antihistaminic Antieczemic, Antiacne, 5- Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary, Insectifuge
19	16.16 9	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	$C_{19} H_{32} O_2$	1.51	Linolenic acid ethyl ester	Anti- inflammatory, Hypocholesterole mic Cancer preventive, Haepatoprotectiv e, Nematicide Insectifuge, Antihistaminic Antieczemic, Antiacne, 5- Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary,

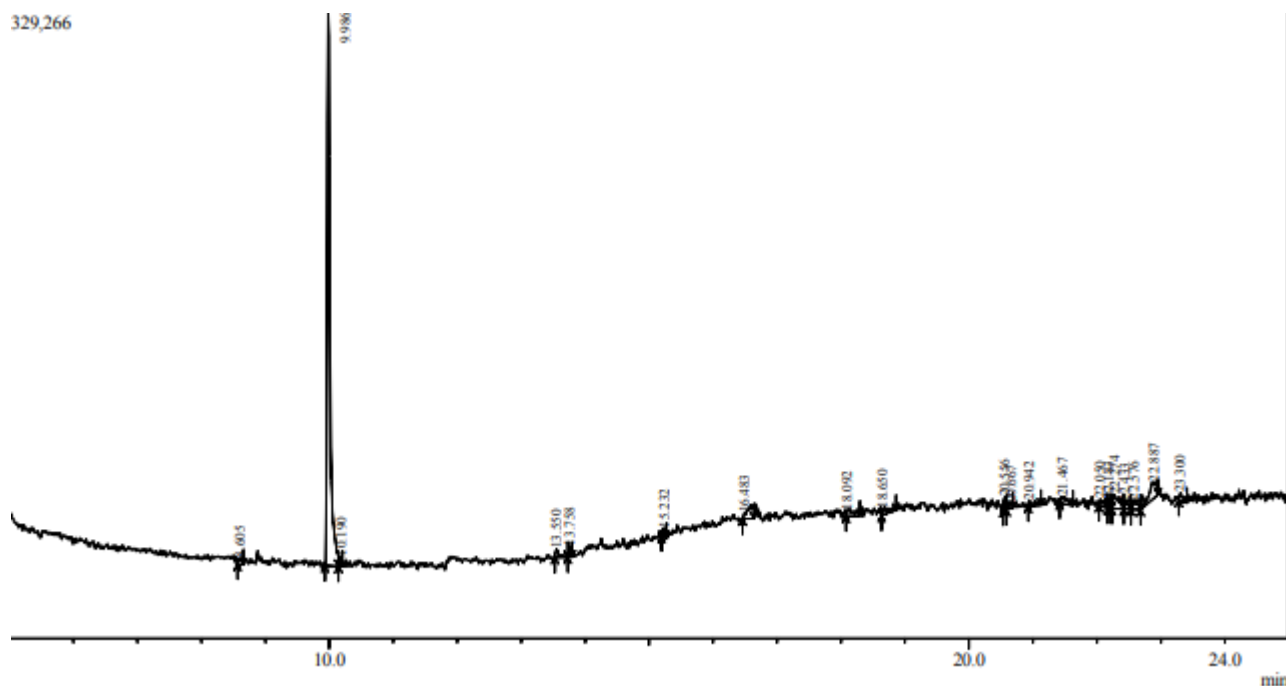
						Insectifuge
20	16.37 1	Octadecanoic acid, ethyl ester	C <sub>20</sub> H <sub>40</sub> O <sub>2</sub>	0.26	Stearic acid ethyl ester	No activity reported

**\*\*Source:** - Dr.Duke's Phytochemical and Ethnobotanical Database

The Gas Chromatography Mass Spectrometer analysis of ethanol extract of the plant revealed twenty peaks of compounds of which fifteen compounds are bioactive as shown in Figure-1 and tabulated in Table-1. The compounds Salicylic acid methyl and ethyl esters, Steroids, Palmitic acid, Palmitic acid ethyl ester, Myristic acid, Phytol, Linoleic acid ethyl ester, Linolenic acid ethyl and methyl esters and Oleic acid methyl ester were having antioxidant activities with anti-inflammatory and anticancer properties. The results revealed that 1, 2-Benzenedicarboxylic acid diethyl ester (64.64%) and Benzoic acid, 2-hydroxy-methyl ester (17.98%) were in higher percentage in the ethanol extract. Benzoic acid, 2-hydroxy-methyl ester (Salicylic acid methyl ester) is well known as Anti-inflammatory compound.

Active compounds of *Abutilon indicum* in aqueous extract by Gas chromatography – Mass spectrometer analysis clearly showed in **Figure.2**.





**Figure.2 GC-MS Spectra of Aqueous Extract**

The presence of twenty compounds is tabulated in the **Table.2** with activities of each active compound..

**Table.2: Compounds identified in GCMS analysis in Aqueous Extract**

No	RT	Name of the compound	Molecular Formula	Peak area %	Compound Nature	*Activity
1	8.605	Glycol monoformate	C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>	0.92	Alcoholic compound	Antimicrobial Preservative
2	9.986	1,2-Benzenedicarboxylic acid, diethyl ester	C <sub>12</sub> H <sub>14</sub> O <sub>4</sub>	64.37	Plasticizer compound	Antimicrobial Antifouling
3	10.190	Butanoic acid, 2-hydroxy-3-methyl-, ethyl ester	C <sub>7</sub> H <sub>14</sub> O <sub>3</sub>	1.08	Ester compound	No activity reported
4	13.550	Butanoic acid	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1.06	Saturated fatty acid	No activity reported
5	13.758	Benzodioxol-2-one, hexahydro-, trans-	C <sub>7</sub> H <sub>10</sub> O <sub>3</sub>	0.93	Ketone compound	No activity reported
6	15.232	trans-3-methylcyclohexanol	C <sub>7</sub> H <sub>14</sub> O	1.15	Alcoholic compound	Antimicrobial
7	16.483	Benzyl 2-Pyrrolidinecarboxylate.	C <sub>12</sub> H <sub>15</sub> NO <sub>2</sub>	3.56	Alkaloid	Antimicrobial Anti-

						inflammatory Antioxidant
8	18.09 2	Ethane, isocyanato-	C <sub>3</sub> H <sub>5</sub> NO	2.16	Insecticide	Antimicrobial insecticide
9	18.65 0	Cyclopentanemethanamine, 2-amino-	C <sub>6</sub> H <sub>14</sub> N <sub>2</sub>	1.97	Amino compound	Antimicrobial Anti- inflammatory
1 0	20.55 6	Cyclohexanepropanoic acid	C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	0.93	Acidic compound	Antimicrobial
1 1	20.66 7	Cyclobutane, 1,2,3,4-Tetramethyl-	C <sub>8</sub> H <sub>16</sub>	0.92	Cyclic compound	No activity reported
1 2	20.94 2	2-Propanol, 1,3-dichloro-	C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub> O	1.05	Chlorine compound	Antimicrobial
1 3	21.46 7	1-Hexene, 2-methyl-	C <sub>7</sub> H <sub>14</sub>	1.92	Alkene compound	No activity reported
1 4	22.05 0	1,4-Pentadiene, 3-ethenyl-	C <sub>7</sub> H <sub>10</sub>	1.41	Alkene compound	No activity reported
1 5	22.18 3	Cyclopentanemethanol, 3-methylene	C <sub>7</sub> H <sub>12</sub> O	1.16	Alcoholic compound	Antimicrobial
1 6	22.27 4	2-(trimethylsilyl)726esearch726 acid	C <sub>6</sub> H <sub>14</sub> O <sub>2</sub> Si	4.00	Silica compound	No activity reported
1 7	22.43 3	Isopropyl hydrogen Methylphosphonate	C <sub>4</sub> H <sub>11</sub> O <sub>3</sub> P	1.90	Phosphorus compound	Antimicrobial
1 8	22.57 6	1,1-DIMETHOXYDECANE	C <sub>12</sub> H <sub>26</sub> O <sub>2</sub>	2.66	Ether compound	No activity reported
1 9	22.88 7	1-Hexene, 3,5,5-trimethyl-	C <sub>9</sub> H <sub>18</sub>	5.82	Alkene compound	No activity reported
2 0	23.30 0	Cyclohexanol, 2-(trimethylsilyl)-, cis-	C <sub>9</sub> H <sub>20</sub> Osi	1.04	Silica compound	No activity reported

The results revealed that 1, 2-Benzenedicarboxylic acid, diethyl ester (64.37%) was found as the major compound in aqueous extract with antimicrobial and antifouling activities. Alkaloid, Amino compound, Alcoholic compound, Acidic compounds, Chlorine and Phosphorous compounds were minor compounds. Out of twenty compounds, ten compounds were bioactive with medicinal activities.

## CONCLUSION

In the present study, *Abutilon indicum* in ethanol and water extracts were isolated and separated. These substances were investigated using GCMS. Ethanolic extract of *Abutilon indicum*

GCMS study revealed the presence of twenty active chemical constituents. One of the major active compound present in the ethanolic extract was 1, 2-Benzene dicarboxylic acid, diethyl ester. It was a Plasticizer compound and having Antimicrobial and Antifouling activity. The compounds Palmitic acid, Palmitic acid ethyl ester, Myristic acid, Phytol, Linoleic acid ethyl ester, Linolenic acid ethyl and methyl esters and Oleic acid were having antioxidant activities with anti-inflammatory and anticancer properties.,

In the aqueous extract twenty active chemical constituents were identified. Ten compounds have potential as bioactive compounds with medicinal properties. One of the major active compounds is 1, 2-Benzenedicarboxylic acid, diethyl ester. It is a Plasticizer Compound and has antimicrobial and antifouling activity. Other active compound identified were Alkaloid, Amino compound, Alcoholic compound, Acidic compounds, Chlorine and Phosphorous compounds were minor compounds identified. Out of twenty compounds, ten compounds were bioactive with medicinal activities.

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