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GC-MS ANALYSIS OF BIOACTIVE COMPOUNDS FROM *Tamarindus indica* Linn Bark

S.Subashini*, V.Rameshkannan and P.Mani

Dept. of Medicinal Plant Biotechnology, Sharmila Institute of Medicinal Products Research Academy, Thanjavur, Tamilnadu, India.

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ABSTRACT

The plant *Tamarindus indica* L., is one of the medicinally important plants belongs to the family Leguminosae. The present study was under taken to explore the potential bioactive compounds present in *Tamarindus indicia bark* which have been evaluated using Gas Chromatography- Mass spectrometry analysis. GC-MS analysis confirmed 31 chemical constituents have been identified. The major chemical constituents are 2-Methyl-Z,Z-3,13-octadecadienol (39.31) Glycerin(16.87%) Hexadecanoic acid (12.20%) 1,2-Benzenediol (4.07%) Phenol (3.17%). These compounds are very essential for the treatment of antibacterial, antifungal, hypoglycaemic, cholesterolemic, cytotoxic, anti-inflammatory, gastrointestinal, hypolipomic and antioxidant activities. The results of this study offer a platform of using *T.indica* bark as herbal alternative source for various diseases and disorders.

INTRODUCTION

The plant kingdom is a treasure house of potential drugs and in recent years there has been an increasing awareness about the importance of medicinal plants. Drugs from the plants are easily available, less expensive, safe and efficient.[1] In India, Various parts of several medicinal plants and their extracts have been used for the treatment of various diseases from ancient time[2]. These medicines are very effective, environment friendly and no side effects. Nearly 80% of the world population depends upon traditional systems of health care.[3] Medicinal Plants are rich source of Phytochemicals and it classified as primary or secondary constituents, depending on their role in plant metabolism [4]. Primary constituents include the common sugars, Amino acids, proteins, nucleic acids and chlorophyll's etc. Secondary constituents are the remaining plant chemicals such as alkaloids (derived from aminoacids), terpenes (a group of lipids) and phenolics (derived from carbohydrates) [5]. Plants produce a good deal of secondary metabolites which have benefited mankind in various ways, including treatment of diseases [6].

Tamarindus indica L. (Tamarind) belongs to the dicotyledonous family leguminosae which is the third largest family of flowering plants with a total of 727 genera and 19, 327 species .*T. indica* contains a high level of protein with many essential amino acids which help to build strong and efficient muscles. It is also high in carbohydrate, which provides energy, rich in the minerals, potassium, phosphorus, calcium and magnesium .The leaves are used to cure many skin diseases as well as skin disorders.The seeds are traditionally used to treat diabetes, fevers and intestinal infections [7]. They are also used in the treatment of diarrhoea and as a laxative. Tamarind fruit is useful in gastric disorders, bilious vomiting, scurvy, datura poisoning, alcoholic intoxication, scabies, pharyngitis, otalgia, stomatitis, constipation, haemorrhoids and eye diseases. Hence the present study focused on GC-MS analysis of bioactive compounds from *Tamarindus indica* Linn bark and their application in pharmaceutical

Corresponding Author

Panagal Mani
Email: - master.maniji@gmail.com

industry.

MATERIALS AND METHODS

Collection of Bark

T .indica bark were collected from Thanjavur District, Tamil Nadu. It was peeled and washed with water. The bark was shadow dried and powdered. The powdered materials were packed in aluminum pouch and stored in atmospheric condition.

Plant sample Extraction

10g of the powered samples were packed in thimble and used for extraction by soxhlet apparatus at a temperature below the boiling temperature of ethanol solvent. A portion of the powdered plant samples was soaked in the conical flask containing solvent, wrapped with aluminum foil and placed in rotary shaker at 120-130 rpm for 48 h. The extracts were filtered using Whatman filter paper No. 1. The solvent was evaporated and the residue was dissolved in sterile dimethylsulfoxide (DMSO-9:1) in 50 mg/ml concentration. The extract was filtered using 0.22 micro filters (Type GV- Millipore) and stored at 4°C for further study.

GC-MS spectra

The GC-MS analysis was carried out using a Clarus 500 Perkin- Elmer Gas Chromatograph equipped and coupled to a mass detector Turbo mass ver5.2.0 – Perking Elmer Turbomas 5.2 spectrometer with an Elite-(5%Phenyl 95% dimethylpolysiloxane), 30 m, 250 µm capillary column. The oven temperature was raised upto 280°C, Injection port temperature was ensured as 280°C and Helium flow rate as 1 ml/min. The ionization voltage was 70 eV. The samples were injected in split mode as 1:10. Mass Spectral scan range was set at 40-450 (mhz). Transfer line and source temperature: 200ºC, 160ºC, Library : NIST 2005,Sample injected : 1.0µL

RESULTS AND DISCUSSION

Medicinal plants are nature's gift to human beings for disease free healthy life. Medicinal plants contain bioactive compounds which are used for curing of various human diseases and also play an important role in healing [8]. In India, many indigenous plants are widely consumed as food or home remedies especially in the treatment or management of common diseases [9]. *T.indica* contains a high level of Secondary metabolites which helpful to treat the various diseases and disorders .These Secondary metabolites was detected by Gas Chromatography and Mass Spectrophotometry (GC–MS) analysis.

GC-MS is one of the best techniques to identify the constituents of volatile matter, long chain, branched chain hydrocarbons, alcohols acids, esters etc [10]. The present study carried out GC-MS chromatogram of the ethanolic extract of *T.indica* showed 31 major peaks (Table-2.) were identified after comparison of the mass spectra with NIST library which indicating the presence of various phytocomponents. From the results, it was observed that presence of 2-Cyclopenten-1-one, 2-hydroxy-,2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one, Glycerin ,1-Amino-2,6-dimethylpiperidine , Hydrouracil, 1-methyl-, Cyclohexaneethanethiol, thiolacetate , 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-,1,2-Benzenediol, 3-Methyl-4-isopropylphenol, 2-Methoxy-4-vinylphenol, Phenol, 2,6-dimethoxy-, Phenol, 3-propyl-,1,4-Benzenediol, 2-methoxy- Phenol, 3,4-dimethoxy-, Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-,3-Furanacetic acid, 4-hexyl-2,5- dihydro-2,5-dioxo-,1,3-Cyclohexadiene, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-, [S-(R*,S*)]-, D-Allose, 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl-, (R)-, n-Decanoic acid, Diethyl Phthalate, Phenol, 3,4,5-trimethoxy-, Myo-Inositol, 4-C-methyl-, Phenol, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-,(R)-,7H-Furo[3,2-g][1]benzopyran-7-one, 7H-Furo[3,2-g][1] benzopyran-7-one, n-Hexadecanoic acid, Phenol, 4-(3,7-dimethyl-3-ethenylocta-1, 6-dienyl)-, 2-Methyl-Z,Z-3,13-octadecadienol, Octadecanoic acid, Octadecanal.

The majority of the phytoconstituents identified in the extracts is attributed with various biological activities. Stearic acid, also known as octadecanoic acid ($C_{18}H_{36}O_2$), is a saturated, wax-like, fatty acid commonly used in the production of pharmaceutical tablets and capsules. It is made by extraction from animal or vegetable fats and oils. It has antiviral and anti-inflammatory activities. In epidemiologic and clinical studies, stearic acid was found to be associated with lowered LDL cholesterol in comparison with other saturated fatty acids.[11] And also contain decreasing LDL Anti-inflammatory, hypocholesterolemic cancer preventive, hepatoprotective, nematicide, insectifuge, antihistaminic antieczemic, antiacne, 5-Alpha reductase inhibitor, antiandrogenic, antiarthritic, anticoronary, insectifuge activity.

Palmitoleic acid, or (9*Z*)-hexadec-9-enoic acid, is an omega-7 monounsaturated fatty acid that is a common constituent of the glycerides of human adipose tissue. It is present in all tissues but, in general, found in higher concentrations in the liver. It is a beneficial fatty acid and it enhances the insulin sensitivity by suppressing inflammation, as well as inhibits the destruction of insulin-secreting pancreatic beta cells [12].

Use of glycerin may increase the chance of dehydration (loss of too much body water) Type 2 diabetes mellitus. According to the FDA, synthetic glycerin is produced by the hydrogenolysis of carbohydrates [13] and must be included in the grams of total carbohydrate listed in the Nutrition Facts panel. When the label has a statement regarding sugars, the FDA requires the glycerin content per serving to be declared as sugar alcohol [14]. Hexadecanoic acid a very common saturated fatty acid is known as an anti-inflammatory phytoconstituents as it is a

phospholipase inhibitor [15] and it's also known for its antibacterial activity [16]. And also contain cosmetics/antipsychotic medication/ Antioxidant, hypocholesterolemic nematicide, pesticide, anti-androgenic flavor, hemolytic, 5- Alpha reductase inhibitor.

1,2-Benzenediol is an organic phenol. It is also known as catechol or pyrocatechol. Literature survey showed catechol possesses anticancer (breast), antioxidant and pesticides properties [17]. The all-cis aldohexose D-allose has turned out to be the most effective promoter of the hexose transport curb. This curb can be released by various metabolic inhibitors, such as malonate or cycloheximide (Chx). In general, the biochemical literature on D-allose seems rather sparse. In an important study about 10 years ago [18] it was found that D-allose (3H-labeled) acts as a transport ligand in the hexose transport system of adipose fat cells.

Table 1. Phytochemical screening

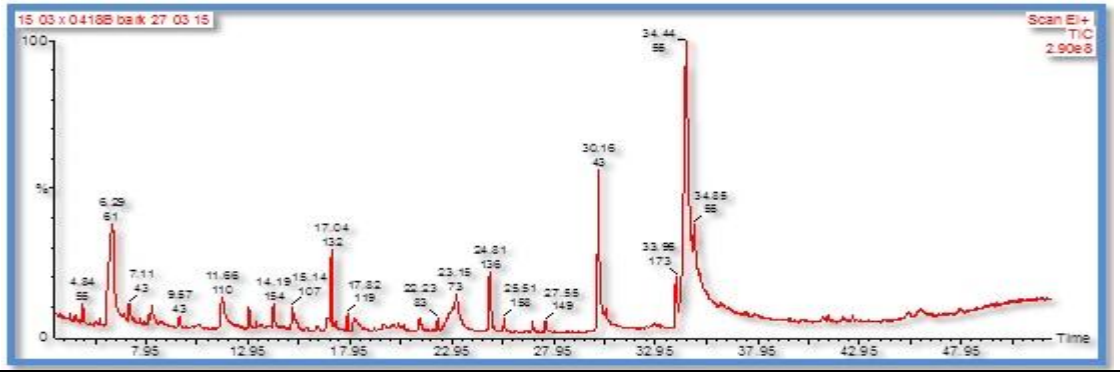
S No	Chemical Tests	Result
1	Alkaloids	+
2	Flavonoids	+
3	Tannins	+
4	Proteins	+
5	Carbohydrates	+
6	Mucilage	+
7	Saponins	-

Table 2. List of compounds

S.No.	Peak Name	Retention Time(min)	Peak Area	% Peak area
1.	Name: 2-Cyclopenten-1-one, 2-hydroxy- Formula: $C_5H_6O_2$ MW: 98	4.84	1085558	0.7699
2.	Name: 2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one Formula: $C_6H_8O_4$ MW: 144	5.70	183116	0.1299
3.	Name: Glycerin Formula: $C_3H_8O_3$ MW: 92	6.29	23788804	16.8711
4.	Name: 1-Amino-2,6-dimethylpiperidine Formula: $C_7H_{16}N_2$ MW: 128	7.11	1074525	0.7621
5.	Name: Hydrouracil, 1-methyl- Formula: $C_5H_8N_2O_2$ MW: 128	8.07	563721	0.3998
6.	Name: Cyclohexane ethanethiol, thiolacetate Formula: $C_{10}H_{18}OS$ MW: 186	8.21	2435710	1.7274
7.	Name: 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- Formula: $C_6H_8O_4$ MW: 144	9.57	889886	0.6311
8.	Name: 1,2-Benzenediol Formula: $C_6H_6O_2$ MW: 110	11.66	5746680	4.0756
9.	Name: 3-Methyl-4-isopropylphenol Formula: $C_{10}H_{14}O$ MW: 150	12.98	1470752	1.0431
10.	Name: 2-Methoxy-4-vinylphenol Formula: $C_9H_{10}O_2$ MW: 150	13.35	470897	0.3340
11.	Name: Phenol, 2,6-dimethoxy- Formula: $C_8H_{10}O_3$ MW: 154	14.19	1959006	1.3893
12.	Name: Phenol, 3-propyl- Formula: $C_9H_{12}O$ MW: 136	15.14	2364520	1.6769
13.	Name: 1,4-Benzenediol, 2-methoxy- Formula: $C_7H_8O_3$ MW: 140	15.83	423140	0.3001
14.	Name: Phenol, 3,4-dimethoxy- Formula: $C_8H_{10}O_3$ MW: 154	16.33	471000	0.3340

15.	Name: Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl- Formula: $C_{15}H_{22}$ MW: 202	17.04	3868672	2.7437
16.	Name: 3-Furanacetic acid, 4-hexyl-2,5-dihydro-2,5-dioxo- Formula: $C_{12}H_{16}O_5$ MW: 240	17.26	397366	0.2818
17.	Name: 1,3-Cyclohexadiene, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-, [S-(R*,S*)]- Formula: $C_{15}H_{24}$ MW: 204	17.82	893733	0.6338
18.	Name: D-AlloseFormula: $C_6H_{12}O_6$ MW: 180	18.20	2244152	1.5916
19.	Name: 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl-, (R)- Formula: $C_{10}H_{10}O_3$ MW: 178	19.15	137256	0.0973
20.	Name: n-Decanoic acid Formula: $C_{10}H_{20}O_2$ MW: 172	19.58	212298	0.1506
21.	Name: Diethyl Phthalate Formula: $C_{12}H_{14}O_4$ MW: 222	20.30	241572	0.1713
22.	Name: Phenol, 3,4,5-trimethoxy- Formula: $C_9H_{12}O_4$ MW: 184	21.35	1442775	1.0232
23.	Name: Myo-Inositol, 4-C-methyl- Formula: $C_7H_{14}O_6$ MW: 194	23.15	1700889	1.2063
24.	Name: Phenol, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-, (R)- Formula: $C_{15}H_{22}O$ MW: 218	24.81	5402655	3.8316
25.	Name: 7H-Furo[3,2-g][1]benzopyran-7-one Formula: $C_{11}H_6O_3$ MW: 186 Ficusin	25.51	563543	0.3997
26.	Name: 7H-Furo[3,2-g][1]benzopyran-7-one Formula: $C_{11}H_6O_3$ MW: 186	26.91	627695	0.4452
27.	Name: n-Hexadecanoic acid Formula: $C_{16}H_{32}O_2$ MW: 256	30.16	17212174	12.2070
28.	Name: Phenol, 4-(3,7-dimethyl-3-ethenylocta-1,6-dienyl)- Formula: $C_{18}H_{24}O$ MW: 256	33.95	4480335	3.1775
29.	Name: 2-Methyl-Z,Z-3,13-octadecadienol Formula: $C_{19}H_{36}O$ MW: 280	34.44	55437384	39.3165
30.	Name: Octadecanoic acid Formula: $C_{18}H_{36}O_2$ MW: 284	34.83	2455813	1.7417
31.	Name: Octadecanal Formula: $C_{18}H_{36}O$ MW: 268	42.17	757367	0.5371

Figure 1. Chromatogram



CONCLUSION

In the present study 31 chemical constituents have been identified from ethanolic extract of the whole plant of *Tamarindus indica* by Gas Chromatogram Mass spectrometry (GC-MS) analysis.The presence of various bioactive compounds justifies the use of whole plant various ailments by traditional practitioners.

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