

BIOACTIVE PROFILING OF ESSENTIAL OIL OF TERMINALIA ARJUNA STEM BARK COLLECTED FROM ORATHUR VILLAGE, TAMILNADU, INDIA

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Abstract: Bioactive profiling of *Terminalia arjuna* stem bark essential oil by GC/MS intends to showcase the medicinal properties and characterization of bioactive compounds. Bioactive profiling of essential oils from *Terminalia arjuna* stem bark revealed the presence of 31 bioactive compounds with their retention time. Cyclohexylhexanoate (10.78 %), D-limonene (9.57 %), ethyltrans-4-decenoate (9.52 %), α -himachalene (7.21 %), β -sesquiphellandrene (6.09 %), β -caryophyllene (5.66 %), Trans-2-Tetradecen-1-ol (4.09 %), β -Guaiene (4.02 %), 2-methyldecahydronaphthalene (3.72 %), cis-7-hexadecane (3.11 %), α -cadinol (3.04 %), 1-octanal (2.57 %) and ethylbenzene (2.02 %) were the major compounds above 2 % while compounds less than 2.0 % includes, 3-Hexenylhexanoate (0.97 %), 2,6,11-Trimethyldodecane (1.36 %), 2,3,6,7-Tetramethyloctane (0.25 %), β -Selinol (1.77 %), (-) δ -Cadinol (0.01 %), Cubenol (0.03 %), α -Bisabolol (0.04 %), α -Himachalene (1.88 %), 1,3,5,8-Undecatetraene (1.02 %), Ethyltrans-4-Decenoate (0.05 %), α -Terpinolene (0.94 %), Trans-2-Nonenal (0.06 %), Geranyl Acetone (1.67 %), Cis-6-Pentadecen-1-ol (0.51 %) and Hexahydrofarnesol (0.87 %). It was concluded that essential oil from *Terminalia arjuna* stem bark is rich in several phytochemicals with medicinal properties and can be used to reduce the increasing cases of antimicrobial resistance.

Keywords: *Terminalia arjuna*; Phytochemicals; Safety; Medicine; Antimicrobial; Resistance

1 INTRODUCTION

Terminalia arjuna is an evergreen shrub from the Combretaceae family [1]. The tree is distributed in India, Sri Lanka, China, Pakistan, Bangladesh, and Malaysia [2]. The tree may grow up to 30 meters tall and is very therapeutic due to the presence of tannins, alkaloids, flavonoids, saponins, glycosides, and phenolic compounds, among other things [3, 4]. These phyto-components have a variety of biological functions, including anti-inflammatory [5], antifungal, antiviral, antimicrobial, immune stimulator, cytotoxic, gastro-protective, anti-ulcer, anti-diabetic, hypolipidemic, antioxidant, osteogenic, anti-helminthic, and cardio-protective properties [6, 7]. The plant parts (leaves, stem bark, and root extracts) have reportedly been used for the treatment of severe diarrhoea and dysentery, urethral discharge, gastro-intestinal infection, chest, pain, waist pain, irregular menstruation, internal pile, malarial, quick ejaculation, headache, hypertension, dysentery, premature aging, memory improvement, blood cleansing, chronic venous insufficiency, mental function, minor burns, scars, skin ulcers, varicose veins, wound healing.

The stem bark of the plant has sweet, cooling, styptic, tonic, anti-dysenteric, and febrifuge qualities [8]. *Terminalia arjuna* leaf and root extracts have been shown to prevent the growth of pathogenic organisms such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, and *Candida albicans*. According to [9, 10], the concentration of phytochemicals in medicinal plants can be modified by several factors, including plant age, species, geographical location, and extraction process. These phyto-components have been shown to be safe, environmentally beneficial, and require no withdrawal period [11]. However, errors in botanical identification, interference of medicinal plants with conventional pharmaceutical therapy, and a lack of studies on the adverse effects of medicinal plants can lead to toxicity in phytomedicine in humans and animals [12].

However, errors in botanical identification, Interference of medicinal plants and conventional pharmacological therapy and dearth of reports on the side effects of medicinal plants can cause toxicity in phytomedicine in human and animals [12].

Therefore, this study was carried out to determine the bioactive profiling of essential oil of *Terminalia arjuna* stem bark collected from Orathur village, Tamilnadu, India

2 MATERIALS AND METHODS

2.1 Description of Experimental Area

The experiment was carried out at the department of Biochemistry, Sumitra Research Institute, Gujarat located between 28° 20' N and 75° 30' East India in the months of August to October, 2022.

2.2 Collection and Extraction of Essential Oil from Terminalia Arjuna Stem Bark

Fresh mature stem bark from Terminalia arjuna was collected from various areas in Orathur village, Tamil Nadu, India, and delivered to the taxonomy section of the same institute for proper authentication before being granted an identity number (HF/008C/2023). The essential oil was extracted from Terminalia arjuna stem bark using the steam distillation process with the aid of Clevenger apparatus. The extracted oil was forwarded to the laboratory for further investigation.

2.3 Bioactive Profiling of Essential Oil from Terminalia Arjuna Stem Bark

Bioactive profiling of essential oil from Terminalia arjuna stem bark was carried out using Lauret gas chromatography - mass spectrometry (Model FG/008, Netherlands). Identification of each bioactive compound was carried out by comparing their mass spectra with those of reference compounds from the Library of National Institute of Standard and Technology database(See Table 1)[13].

Table 1 Bioactive Profiling of *Terminalia Arjuna* Stem Bark Essential Oil by GC/MS

S/N	Compounds	Reaction time (min)	% Area
1	3-Hexenylhexanoate	5.62	0.97
2	2,6,11-Trimethyldodecane	6.27	1.36
3	β -Caryophyllene	6.33	5.66
4	Cyclohexylhexanoate	7.07	10.78
5	γ -Cadinene	7.55	2.67
6	β -Sesquiphellandrene	7.92	6.09
7	β -Linalool	8.09	2.51
8	D-Limonene	8.47	9.57
9	2,3,6,7-Tetramethyloctane	8.84	0.25
10	β -Selinenol	8.93	1.77
11	α -Cadinol	9.62	3.04
12	(-) δ -Cadinol	9.95	0.01
13	α -Bisabolol	10.50	0.04
14	Cubenol	11.10	0.03
15	α -Himachalene	11.55	7.21
16	β -Guaiene	12.35	4.02
17	α -Himachalene	12.67	1.88
18	1,3,5,8-Undecatetraene	12.85	1.02
19	Ethyltrans-4-Decenoate	13.06	0.05
20	α -Terpinolene	14.54	0.94
21	1-Octanal	15.12	2.57
22	1,8-Cineole	15.76	3.5
23	Ethyltrans-4-Decenoate	16.27	9.52
24	2-methyldecahydronaphthalene	17.16	3.72
25	Ethylbenzene	18.09	2.02
26	Trans-2-Nonenal	19.22	0.06
27	Geranyl Acetone	19.85	1.67
28	Cis-6-Pentadecen-1-ol	20.06	0.51
29	Trans-2-Tetradecen-1-ol	21.38	4.09
30	Cis-7-Hexadecane	22.40	3.11
31	Hexahydrofarnesol	22.75	0.87
	Total	91.51	
	Number of compounds		
	Monoterpenes	27.51	
	Diterpenes	7.96	
	Triterpenes	1.03	
	Sesquiterpenes	-	
	Non-terpenes	55.01	

3 RESULTS AND DISCUSSION

Bioactive profiling of essential oils from Terminalia arjuna stem bark identified 31 bioactive components and their retention times. Cyclohexylhexanoate (10.78%), D-limonene (9.57%), ethyltrans-4-decenoate (9.52%), α -himachalene (7.21%), β -sesquiphellandrene (6.09%), β -caryophyllene (5.66%), Trans-2-Tetradecen-1-ol (4.09%), β -Guaiene (4.02%), 2-methyldecahydronaphthalene (3.72%), cis-7-hexadecane (3.11%), α -cadinol (3.04%). It is worth noting that all of these

bioactive molecules, often known as phytochemicals, have medical or therapeutic characteristics. This result is consistent with prior research by [14-16]. Cyclohexylhexanoate, β -caryophyllene, β -Linalool, β -sesquiphellandrene, β -selinenol, and α -cadinol have been shown to have antimicrobial, antifungal, antidiarrhea, antibacterial, anticancer, antioxidant, and antihelminthic properties [17, 18]. [19, 20] found that 2, 6, 11-trimethyldodecane, 2, 3, 6, 7-tetramethyloctane, α -himachalene, α -terpinolene, and cis-6-pentadecen-1-ol have antibacterial and gastro-protective properties. α -bisabolol, 2-methyldecahydronaphthalene, and ethyltrans-4-decenoate have been shown to have antibacterial and cardio-protective effects [21, 22, 29]. Trans-2-nonenal, geranyl acetone and ethylbenzene have antifungal and anti-diarrhoea properties [23, 24, 31]. Screening for bioactive chemicals in herbal plants can lead to the development of new medical medicines with effective disease prevention and treatment properties [25, 26, 30]. The concentrations of phytochemicals in herbal plants can be altered by several factors, including plant age, geographical location, species, and processing methods [27, 28, 32, 33].

4 CONCLUSION

Naturally, medicinal plants contain phytochemicals with therapeutic effects. These chemicals have a wide range of biological functions, including antibacterial, antifungal, antihelminthic, hepatoprotective, immune-stimulatory, cytotoxic, antioxidant, and antiviral properties.

CONFLICT OF INTEREST

The authors have no relevant financial or non-financial interests to disclose.

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