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Research Article

# 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-Selinenol (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 phytocomponents with medicinal properties and can be used to reduce the increasing cases of antimicrobial resistance.

**Key words:** *Terminalia arjuna*; phytocomponents; safety; medicine; antimicrobial; resistance

## Introduction

*Terminalia arjuna* is an evergreen shrub from the Combretaceae family (Kapoor et al. 2014). The tree is distributed in India, Sri Lanka, China, Pakistan, Bangladesh, and Malaysia (Pashazanousi et al., 2012). 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 (Saha et al., 2012; Bharani et al., 2004). These phyto-components have a variety of biological functions, including anti-inflammatory (Alagbe et al., 2021), antifungal, antiviral, antimicrobial, immune stimulator, cytotoxic, gastro-protective, anti-ulcer, anti-diabetic, hypolipidemic, antioxidant, osteogenic, anti-helminthic, and cardio-protective properties (Bharani et al., 2004; Paul et al., 2016). 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 (Desai et al., 2015).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 Singh et al. (2022; Alagbe, 2023), the concentration of phytocomponents 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 (Alagbe et al., 2020). 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 (Olujimi et al., 2024).

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 (Olujimi et al., 2024).

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

## Materials and methods

### Description of experimental area

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

### 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.

### 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 (NIST, 2011) database.

| 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 | |

**Table 1:** Bioactive profiling of *Terminalia arjuna* stem bark essential oil by GC/MS

## 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 Kokkiripati et al. (2013), Hafiz et al. (2014), and Chaudhari and Mengi (2006). Cyclohexylhexanoate, β-caryophyllene, β-Linalool, β-sesquiphellandrene, β-selinenol, and α-cadinol have been shown to have antimicrobial, antifungal, antidiarrhea, antibacterial, anticancer, antioxidant, and anti-helminthic properties (Subavathy and Thilaga, 2015; Mangrove et al., 2014). Doughari (2012) and Olajuyige et al. (2011) 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 (Devendran and Ba;asubramanian, 2011; Lima et al., 2010).Trans-2-nonenal, geranyl acetone and ethylbenzene have antifungal and anti-diarrhoea properties (Mamza et al., 2012; Awa et al., 2012). Screening for bioactive chemicals in herbal plants can lead to the development of new medical medicines with effective disease prevention and treatment properties (Soma et al., 2010; Alagbe et al., 2024). The concentrations of phytochemicals in herbal plants can be altered by several factors, including plant age, geographical location, species, and processing methods (Alagbe et al., 2023a; Alagbe et al., 2023b).

## 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.

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