

Chapter 8

Qualitative phytochemical analysis of leaves of *Santalum album* L.

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ABSTRACT

Present study investigated the presence of bioactive compounds in the leaves of *Santalum album* using different extracts (n-hexane, ethanol, and aqueous). Phytochemical screening revealed diverse bioactive compounds in the leaf extracts. Saponins were consistently detected in all extracts. Ethanol extract exhibited the highest diversity of bioactive constituents, including tannins, terpenoids, phenols, and reducing sugars. These results offer valuable information regarding the phytochemical composition of *Santalum album* leaves and endorse their possible therapeutic and pharmacological uses.

Keywords: Effectiveness, phytochemical composition, therapeutic, pharmacological

INTRODUCTION

Plants have historically been acknowledged as an essential source of medicinal substances, with their bioactive components significantly

contributing to the treatment and prevention of numerous health ailments (Patil et al., 2009; Das et al., 2022). Among these, *Santalum album*, commonly known as Indian sandalwood belongs to Santalaceae family is a well-known plant in traditional medicine, prized not only for its fragrant heartwood but also for its therapeutic properties (Anmol et al., 2024; Pullaiah et al., 2021). While the heartwood has been extensively studied for its essential oils and medicinal value (Moy and Levenson, 2017), the leaves of *Santalum album* remain relatively underexplored despite their potential richness in bioactive compounds.



Figure 1: Leaves of *S. album*

Investigating the phytochemical content of the leaves could provide new understandings into the plant's pharmacological potential and contribute to the development of alternative therapeutic agents. Bioactive compounds such as tannins, saponins, alkaloids, phenols, terpenoids, and flavonoids are

secondary metabolites that possess a wide range of biological activities, including antioxidant, antimicrobial, anti-inflammatory, and anticancer properties (Kaushik et al., 2021). Present study aims to identify the medicinally relevant bioactive compounds and expand the phytochemical understanding of *Santalum album* foliage for possible therapeutic applications.

METHODOLOGY

The leaves of *S. album* were collected from Khordha, Bhubaneswar, Odisha, India. The plant species was identified by the authors (Figure 1 & 2). The Soxhlet extraction was adopted using three different extracts (n-hexane, ethanol and aqueous) for phytochemical screening. Detection of nine secondary metabolites were conducted using standard methods (Jena et al., 2025; Kapil et al., 2025; Lyngdoh et al., 2025; Rani et al., 2025).

Test for tannin: About 1 ml of the leaf extract was added with 4-5 drops of 10% lead acetate solution. Then the formation of gelatinous precipitate confirmed the presence of tannin.

Test for saponin: About 1 ml of the leaf extract was added to 1 ml of distilled water and shaken well. The formation of persistent froth was observed confirming the presence of saponin.

Test for flavonoids: About 1 ml of the leaf extract was taken. Added 2 ml of NaOH solution and 4-5 drops of dilute HCl to it. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless which confirmed the presence of flavonoids.

Test for terpenoids: To 1ml of the leaf extract, added 5-6 drops of concentrated sulphuric acid. Then the reddish-brown interface confirmed the presence of terpenoids.



Figure 2: Collected leaves and dried powder of *S. album*

Test for phenols: About 1 ml of the leaf extract was taken. A few drops of 5% ferric chloride solution were added. The dark bluish-black appearance confirmed the presence of phenolic compounds.

Test for reducing sugars: About 1 ml of the leaf extract was taken. 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept in the water bath for few minutes.

Test for steroids: To 1 ml of the leaf extract, added 1 ml of chloroform followed by 1 ml of concentrated sulphuric acid into it. The appearance of upper red and lower yellow with green fluorescence provides the presence of steroids.

Test for alkaloid: About 1 ml of the leaf extract was taken. Added 3-4 drops of Dragendroff's reagent to it. The formation of a reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds: About 1 ml of the leaf extract was taken in a test tube. Added 3-4 drops of 2,4- Dinitrophenylhydrazine (DNPH) reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

RESULTS AND DISCUSSION

Qualitative phytochemical analysis of *Santalum album* leaves revealed diverse bioactive compounds, indicating several pharmacological potentials. Saponins were detected across all extracts, exhibited hepatoprotective and astringent properties (Aftab et al., 2023). Tannins, phenols, and reducing sugars were present (Table 1; Figures 3-5) in both ethanol and aqueous extracts, highlighting their therapeutical effects including *S. album* has calming and relaxation effect. Also, it is claimed to reduce stress, depression, fear, nervous exhaustion, anxiety and discomfort (Kumar et al., 2015).

Table 1: Qualitative phytochemical screening of *S. album* leaves using different extracts

Bioactive compounds	Extracts		
	n-hexane	Ethanol	Aqueous
Tannin	Not detected	Detected	Detected
Saponin	Detected	Detected	Detected
Flavonoid	Not detected	Not detected	Not detected
Terpenoid	Not detected	Detected	Not detected
Phenols	Not detected	Detected	Detected
Reducing sugar	Not detected	Detected	Detected
Steroid	Not detected	Not detected	Not detected

Alkaloid	Not detected	Not detected	Detected
Carbonyl compounds	Not detected	Not detected	Not detected

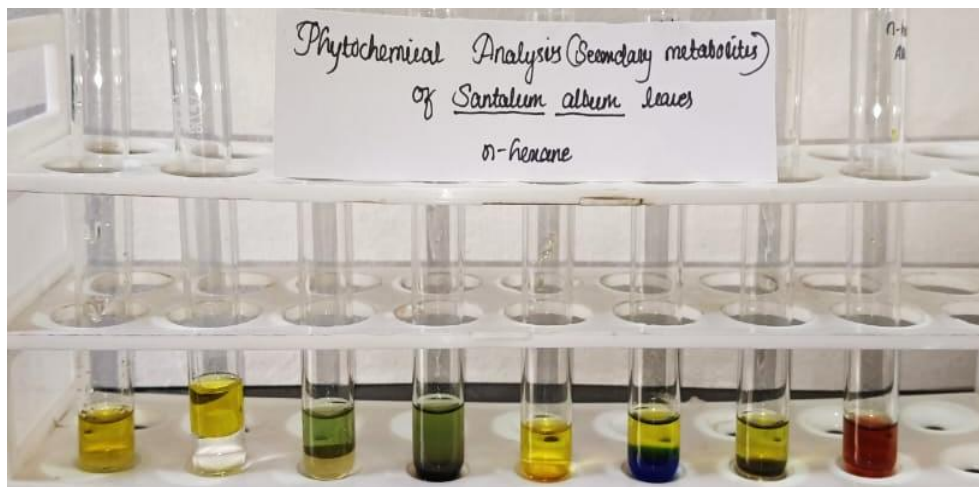


Figure 3: Detection of secondary metabolites of *S. album* leaves using n-hexane extract



Figure 4: Detection of secondary metabolites of *S. album* leaves using ethanol extract

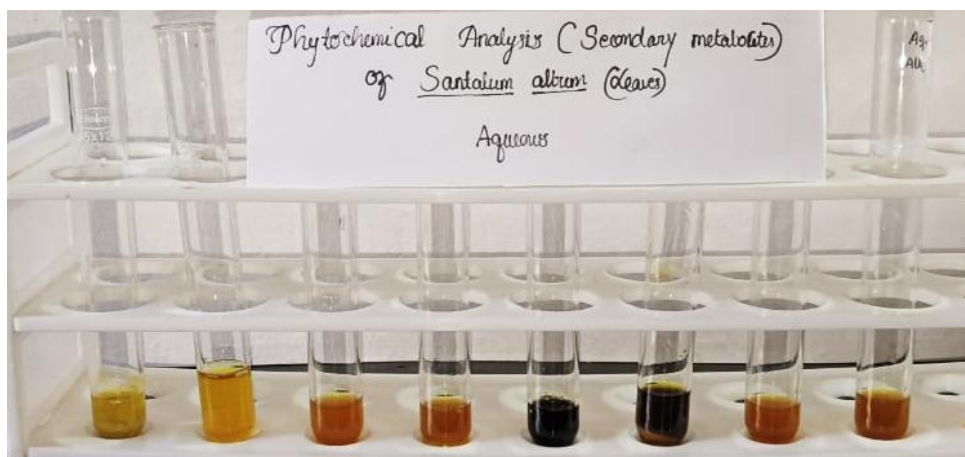


Figure 5: Detection of secondary metabolites of *S. album* leaves using aqueous extract

CONCLUSION

Present study demonstrated that *S. album* contains several bioactive compounds possesses significant medicinal properties, particularly found in its leaves and essential oil. The leaves are rich in bioactive compounds that exhibit antimicrobial, anti-inflammatory, and antioxidant activities, making them valuable for therapeutic applications. These pharmacological attributes highlight the potential of *S. album* as a natural source for drug development and traditional remedies. Harnessing these properties could contribute to the formulation of novel pharmaceuticals and support sustainable use of medicinal plants in modern medicine.

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