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FTIR CHARACTERIZATION OF SIDDHA MEDICINE RASHNADI CHOORANAM

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ABSTRACT

Introduction: Siddha polyherbal formulations possess significant therapeutic value, but their molecular characterization remains limited. This study aims to analyze the functional groups present in *Rashnadi Chooranam* using Fourier Transform Infrared Spectroscopy (FTIR). **Methods:** The formulation was prepared following standard Siddha procedures. FTIR analysis was performed in the mid-infrared region (4000–500 cm^{-1}), and spectral peaks were interpreted to identify functional groups. **Results:** The spectrum showed O–H and N–H stretching (phenols and amines), aliphatic C–H groups (lipids and terpenoids), C=C and amide bands (flavonoids and proteins), and C–O/C–O–C stretching (glycosides and carbohydrates). The fingerprint region indicated complex plant-derived compounds. **Conclusion:** The study confirms the presence of diverse bioactive constituents in *Rashnadi Chooranam* and supports the use of FTIR as a reliable method for standardization and quality evaluation of Siddha formulations.

KEYWORDS: This study aims to analyze the functional groups present in *Rashnadi Chooranam* using Fourier Transform Infrared Spectroscopy (FTIR).

INTRODUCTION

Siddha medicine is an ancient South Indian medical system with over 5,000 years of history, using plant, mineral, and animal-based formulations. Despite its widespread use, scientific and molecular-level understanding of these formulations is still limited.

In recent years, there has been increasing interest in validating traditional medicines using modern techniques. Fourier Transform Infrared Spectroscopy (FTIR) is a powerful, non-destructive method used to analyze bioactive compounds by identifying functional groups through their molecular vibrations. It is especially useful for complex herbal formulations due to its sensitivity and reliability.

Applying FTIR to Siddha formulations helps in standardization, quality control, detection of adulterants, and understanding the chemical basis of their therapeutic effects. FTIR analysis is widely applied in siddha research to evaluate drug authenticity, ensure quality control and support further pharmacological studies.[1,2] It also aids in identifying phytochemicals like alkaloids, flavonoids, and polyphenols, which have various pharmacological properties.

Although some studies have used FTIR to analyze Siddha preparations, many formulations remain uncharacterized. This study focuses on FTIR analysis of a Rashnadi Chooranam Siddha formulation to identify its functional groups and phytochemical constituents, contributing to its scientific validation and understanding of its therapeutic activity.

MATERIAL AND METHODS

Ingredients

1. Chittarata - Alpinia officinarum
2. Seendhil - Tinospora cordifolia
3. Amanakku - Ricinus communis
4. Devadaru - Cedrus deodara
5. Chukka - Zingiber officinale

Standard Operative Procedures

The required raw materials will be procured from a reputed indigenous drug supplier. Each ingredient will be purified according to the procedures outlined in the classical Siddha text *Marundhu Sei Iyalum Kalaiyum*. After purification, the ingredients will be finely powdered and blended to prepare the Chooranam formulation. The final product will be stored in an airtight container to preserve its quality and stability.

RESULT

The results of the FTIR data interpretation of Rashnadi Chooranam has been tabulated in table.

Table 1: FT-IR Peak Table.

Approx. Peak / Region (cm^{-1})	Probable Functional Group(s)	Interpretation
~3400–3200	O–H stretching / N–H stretching	Broad band suggesting hydroxyl-containing phytoconstituents such as phenols, alcohols, and possibly amine-containing compounds
~2950–2850	C–H stretching	Aliphatic stretching vibrations of $–CH_2$ and $–CH_3$ groups, indicating lipidic, terpenoid, or hydrocarbon components
~1650–1550	C=C stretching / amide-related vibration	May correspond to aromatic unsaturation, conjugated phytochemicals, flavonoid-related structures, or proteinaceous residues
~1450–1370	C–H bending	Aliphatic deformation bands associated with methyl and methylene groups
~1250–1000	C–O stretching / C–N stretching	Suggestive of ethers, alcohols, phenolics, glycosides, and carbohydrate-associated constituents
~1100–900	C–O–C / glycosidic linkage region	Strong absorption here supports polysaccharides, glycosides, and oxygenated herbal metabolites
~800–500	Fingerprint region	Complex skeletal vibrations that may reflect substituted aromatic systems and other characteristic plant-derived compounds

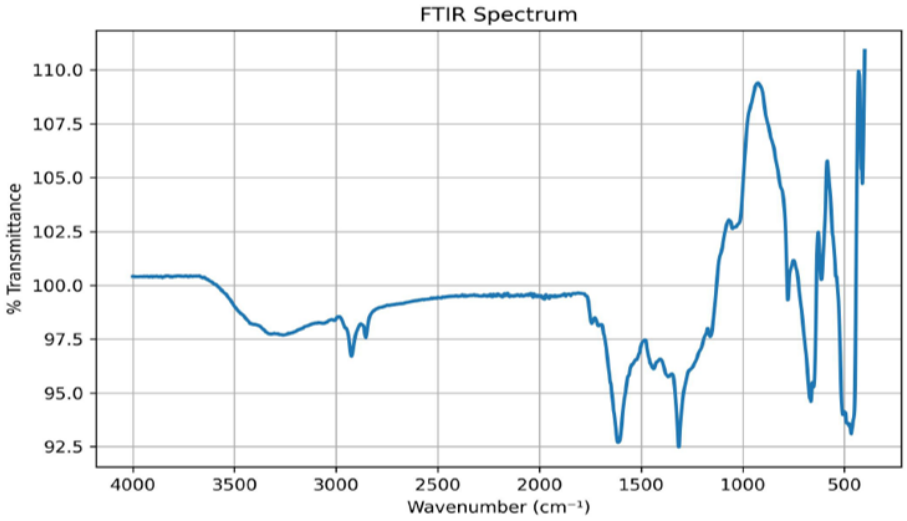

Fig 1: FTIR Spectrum Of Sample Rc.

DISCUSSION

Fourier Transform Infrared (FTIR) spectroscopy was used to identify the functional groups present in the polyherbal formulation Rashnadi Chooranam. The spectrum obtained shows a complex pattern, which reflects the wide variety of phytochemicals present in the formulation.

A broad band observed in the region of 3400–3200 cm^{-1} indicates O–H and N–H stretching vibrations. This suggests the presence of compounds such as phenols and alcohols, which are known for their antioxidant, anti-inflammatory, and antimicrobial properties. The possible presence of amine groups also points toward alkaloidal or protein-related components that may contribute to the drug's therapeutic effects.

The peaks between 2950–2850 cm^{-1} correspond to aliphatic C–H stretching, confirming the presence of methyl and methylene groups. These are commonly found in lipids and terpenoids, which play an important role in enhancing biological activity and drug absorption.

In the region of 1650–1550 cm^{-1}, the observed bands are associated with C=C stretching and amide vibrations. These are typical of aromatic and conjugated compounds such as flavonoids and polyphenols, which are well known for their pharmacological activities, especially antioxidant and anti-inflammatory effects. The presence of amide bonds may also indicate minor protein or peptide components.

The peaks in the range of 1450–1370 cm^{-1} are due to C–H bending vibrations, further supporting the presence of aliphatic structures within the formulation.

Strong absorption bands in the region of 1250–1000 cm^{-1} indicate C–O and C–N stretching vibrations. These suggest the presence of ethers, alcohols, phenolic compounds, and glycosides, pointing toward carbohydrate-related components and other secondary metabolites that may enhance therapeutic efficacy.

Similarly, the region between 1100–900 cm^{-1} shows characteristic C–O–C stretching vibrations, confirming the presence of glycosidic linkages and polysaccharides. These compounds are often associated with immunomodulatory effects and improved bioavailability in herbal medicines.

The fingerprint region (800–500 cm^{-1}) displays complex and overlapping peaks, which is typical for plant-based formulations. These bands represent various structural vibrations and further confirm the presence of multiple bioactive compounds.

Overall, the FTIR analysis clearly demonstrates the presence of important functional groups such as hydroxyl, aliphatic, aromatic, and glycosidic groups. This confirms that Rashnadi Chooranam contains a wide range of bioactive constituents, including phenols, flavonoids, terpenoids, and carbohydrates. The complexity of the spectrum reflects the synergistic nature of the formulation, which likely contributes to its therapeutic effectiveness.

CONCLUSION

The FTIR spectrum of the sampler reveals the presence of several important functional groups, including hydroxyl, aliphatic, aromatic, and ether or glycosidic moieties. The weak broad band in the higher wavenumber region indicates hydroxyl-bearing compounds such as phenols and alcohols, while the absorptions near the aliphatic stretching region support the presence of methyl and methylene groups from terpenoid or lipid-like constituents. The bands in the mid-infrared region suggest aromatic or conjugated phytochemicals, and the prominent fingerprint-region absorptions, particularly below 1200 cm^{-1}, are indicative of C–O and C–O–C vibrations associated with glycosides, carbohydrates, and related oxygenated metabolites. Overall, the spectrum confirms the chemically complex nature of the sample and supports the presence of diverse bioactive constituents typical of a polyherbal preparation.

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