

Comparative FTIR Spectroscopic Profiling of *Ipomoea carnea* (Jacq.) Leaf Powder and Petroleum Ether Extract

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ABSTRACT

Ipomoea carnea Jacq. (IC) is a vigorous, woody perennial shrub with considerable phytochemical and pharmacological potential despite its invasive nature. The present study aimed to comparatively characterize the FTIR profiles of *I. carnea* leaf powder and its petroleum ether extract. Leaf powder (5 mg) and petroleum ether extract (0.2 mL) were analysed using Fourier Transform Infrared (FTIR) spectroscopy (BRUKER OPTICS, TENSOR27), equipped with a KBr beamsplitter, RockSolid interferometer, 0.4 cm⁻¹ apodized resolution, DigiTect detector and automatic H₂O/CO₂ compensation. Spectral acquisition and analysis were performed using OPUS software with a spectral-search facility. The leaf powder exhibited prominent bands at 3350, 2915, 2845, 1620, 1250 and 1020 cm⁻¹, broadly associated with O–H/N–H, aliphatic C–H, C=C/carbonyl-associated, C–O and C–N functionalities. In comparison, the petroleum ether extract showed bands at 3330, 2940, 2830, 1680, 1448, 1412 and 1020 cm⁻¹. The stronger aliphatic C–H absorptions at 2940 and 2830 cm⁻¹ and the distinct carbonyl-associated band near 1680 cm⁻¹ indicate enrichment of lipophilic and carbonyl-containing constituents following solvent fractionation. Overall, the comparative FTIR profile demonstrates selective extraction of chemically distinct, predominantly non-polar constituents by petroleum ether and provides a preliminary chemical fingerprint of the extract. Further GC–MS/LC–MS studies are warranted for definitive compound identification and correlation with the pharmacological potential of *I. carnea*.

Keywords- *Ipomoea carnea*; FTIR; petroleum ether extract; phytoconstituents; lipophilic compounds; phytochemical characterization.

I. INTRODUCTION

Traditional medicine continues to serve as the principal source of primary healthcare for a substantial proportion of the population residing in developing countries, with the World Health Organisation estimating that approximately four out of every five individuals depend on it for basic healthcare needs ^[1,2]. In recent years, increasing scientific attention has been directed towards medicinal plants and other naturally derived products, primarily owing to their diverse

pharmacological properties and considerable therapeutic potential ^[3]. Ethiopia possesses remarkable plant biodiversity, with an estimated 6000-7000 species of higher plants, approximately 12% of which are considered endemic to the country. Among the diverse flora, more than 800 plant species have a long history of traditional use in the management of various diseases and health conditions ^[4]. Medicinal plants have been used since ancient times for disease prevention and treatment. In India, traditional systems such as Ayurveda and Unani extensively utilise plant-based remedies, with their

therapeutic knowledge documented in classical texts, including the Atharva Veda, Charaka Samhita, and *Sushruta Samhita* [5]. The diverse constituents in plant extracts can be investigated using sophisticated analytical approaches, with chromatographic and spectroscopic methods being particularly valuable for detailed chemical profiling and quantity assessment [6].

Conventional analytical platforms such as HPLC, UHPLC, TLC, and GC remain widely utilised for phytochemical analysis, each offering distinct advantages as well as methodological limitations. More sophisticated approaches, including HILIC, nano-LC, multidimensional LC, and capillary electrophoresis, have further expanded analytical capabilities by enabling enhanced separation, detection and characterisation of complex plant constituents [7]. Advanced chromatographic and spectroscopic techniques, particularly NMR and MS, have significantly improved the identification and structural characterisation of complex phytoconstituents [8]. Fourier-transform infrared (FTIR) is an analytical technique used to characterise the metabolic and chemical constituents present in plant leaves [9,10].

I. carnea (Convolvulaceae) is a vigorous, woody perennial shrub known for its rapid, invasive growth. It bears distinctive heart-shaped leaves and large, funnel-shaped pink to light-purple flowers, typically arranged in terminal or axillary clusters. The plant produces dry capsule fruits containing silky, lightweight seeds that facilitate its dispersal [11,12]. The present study aimed to comparatively characterize the FTIR spectral profiles of *Ipomoea carnea* leaf powder and its petroleum ether extract. The study further evaluated solvent-dependent changes in characteristic functional groups to establish a preliminary phytochemical fingerprint of the extract.

II. MATERIALS AND METHODS

Collection of plant materials

Plant samples were collected from the New Raipur region of Palaud, Raipur District, Chhattisgarh, India. Taxonomic Identification and authentication of the plant specimen were carried out by K. Karthigeyan, Scientist, Botanical Survey of India (BSI), Kolkata, India, and the specimen was documented under voucher number CNH/Tech.II/2026/78. The entire plant was shade-dried, coarse powdered, and preserved in an airtight container under suitable conditions.

Preparation of extract

The *I. carnea* plant materials were collected and rinsed with distilled water for removal of impurities and then shade-dried at room temperature. The dried material was ground into coarse powder using a mechanical grinder. The extraction method was performed using a Soxhlet Apparatus with solvents in increasing polarity. The extract was concentrated under reduced pressure and stored at low temperature for future analysis [13].

FTIR analysis of *I. carnea*

The samples (powder, 5mg; liquid, 0.2mL) were analysed using Fourier Transform Infrared (FTIR) Spectroscopy (BRUKER OPTICS, TENSOR27). It features 0.4 cm⁻¹ apodized resolution, a KBr beamsplitter, and a permanently aligned RockSolid Interferometer. The instrument supports Mid-IR, Near-IR, and Far-IR analysis, with the quicklock sample compartment, automatic H₂O and CO₂ compensation with an advanced DigiTect detector system. It also includes pre-defined, instrument-specific user interfaces for routine and research applications, along with OPUS software featuring a spectral search facility [14].

III. RESULTS

FTIR analysis of *I. carnea* powdered leaves

The FTIR spectral analysis of *I. carnea* plant powdered leaves exhibited several absorption bands, indicating the presence of diverse functional groups. A medium-intensity peak at 3350 cm⁻¹ corresponds to N-H stretching, suggesting the presence of a secondary amine group. Medium-intensity absorption bands at 2915 and 2845 cm⁻¹ are attributed to C-H stretching vibrations, indicating alkane groups. A strong peak at 1620 cm⁻¹ is assigned to C=C stretching, suggesting the presence of an α , β -unsaturated ketone. The strong absorption band at 1250 cm⁻¹ corresponds to C-O stretching, indicative of an aromatic ester group. A medium-intensity band at 1020 cm⁻¹ is attributed to C-N stretching, confirming the presence of an amine group. An additional absorption band at 680 cm⁻¹ suggests the presence of benzene derivatives (Fig. 1 and Table 1).

FTIR analysis of petroleum ether extract of *I. carnea* leaves

The FTIR spectrum of the petroleum ether extract of *I. carnea* leaves revealed distinct absorption bands corresponding to various functional groups. The medium-intensity band at 3310 cm⁻¹ was assigned to N-H stretching, indicating a secondary amine. Absorption at 2940 cm⁻¹ showed C-H stretching associated with alkane groups, whereas the strong band at 2830 cm⁻¹ was attributed to N-H stretching, suggesting to an amine salt. The prominent peak at 1680 cm⁻¹ represents C=O stretching, characteristic of a secondary amide. A medium band at 1448 cm⁻¹ was related to O-H bending, indicating a carboxylic acid group. Furthermore, the 1020 cm⁻¹ band was associated with C-N stretching, supporting the presence of amine functionality. The lower-frequency absorption at 687 cm⁻¹ was indicative of benzene derivatives. Overall, the observed FTIR bands suggest the presence of amine, amide, alkane, carboxylic acid, and aromatic functionalities in the petroleum ether extract (Fig. 1 and Table 2).

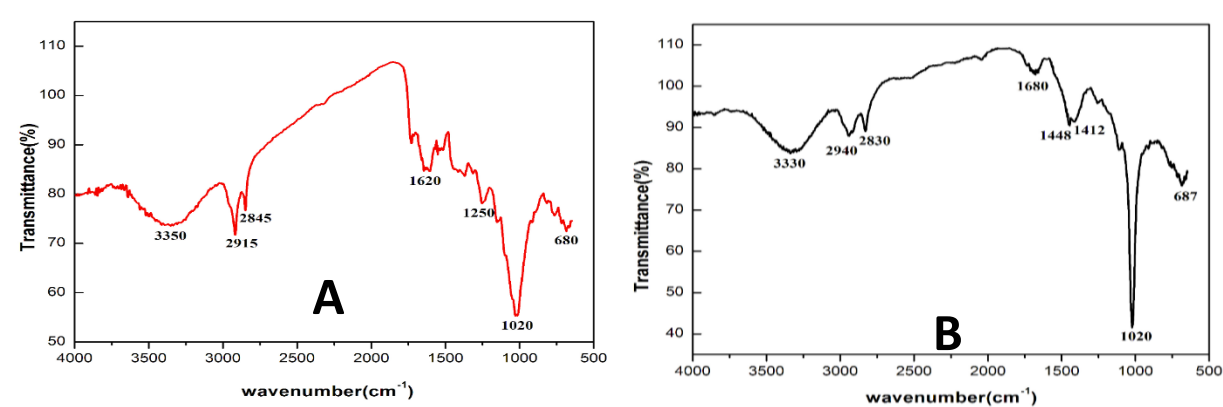


Fig. 1: FTIR spectral analysis of (A) powder and B) petroleum ether leaves extract.

Table 1: FTIR spectral analysis of *I. carnea* plant powdered leaves

Peak No.	Wave Number (cm ⁻¹)	Bond type	Vibration mode	Intensity	Functional group
1	3350	N-H	Stretching	Medium	Secondary amine
2	2915	C-H	Stretching	Medium	Alkane
3	2845	C-H	Stretching	Medium	Alkane
4	1620	C=C	Stretching	Strong	α, β- unsaturated ketone
5	1250	C-O	Stretching	Strong	Aromatic ester
6	1020	C-N	Stretching	Medium	Amine
7	680	-	-	-	Benzene derivatives

Table.2: FTIR spectral analysis of pet. ether extract *I. carnea* plant leaf

Peak No.	Wave Number (cm ⁻¹)	Bond type	Vibration mode	Intensity	Functional group
1	3330	N-H	Stretching	Medium	Secondary amine
2	2940	C-H	Stretching	Medium	Alkane
3	2830	N-H	Stretching	Strong	Amine salt
4	1680	C=O	Stretching	Strong	Secondary amide
5	1448	C-H	Bending	Medium	Alkane
6	1412	O-H	Bending	Medium	Carboxylic acid
7	1020	C-N	Stretching	Medium	Amine
8	687	-	-	-	Benzene derivatives

IV. DISCUSSION

The FTIR profiles revealed clear differences between *Ipomoea carnea* leaf powder and its petroleum ether extract, indicating solvent-dependent enrichment of specific phytochemical constituents. The leaf powder showed prominent bands at 3350, 2915, 2845, 1620, 1250 and 1020 cm⁻¹, corresponding broadly to O–H/N–H, aliphatic C–H, C=C/carbonyl-associated, C–O and C–N functionalities. Plant FTIR spectra commonly show these regions for hydroxyl/amine, lipid/aliphatic, carbonyl, aromatic and oxygenated constituents.

In contrast, the petroleum ether extract exhibited bands at 3330, 2940, 2830, 1680, 1448, 1412 and 1020 cm⁻¹. The stronger signals around 2940 and 2830 cm⁻¹ suggest enrichment of aliphatic/lipophilic constituents, while the distinct 1680 cm⁻¹ band indicates enhanced carbonyl-containing functionalities. Similar FTIR profiles of petroleum ether plant extracts have been

associated with lipophilic compounds containing aliphatic C–H and carbonyl groups.

Notably, the shift from the 1620 cm⁻¹ band in the leaf powder to a stronger 1680 cm⁻¹ band in the extract, together with changes around 1250–1412 cm⁻¹, indicates selective extraction and enrichment of chemically distinct constituents by petroleum ether. Overall, the FTIR findings confirm that the petroleum ether fraction possesses a comparatively more lipophilic and carbonyl-rich chemical fingerprint than the unfractionated leaf powder. However, FTIR provides functional-group information and should be complemented with GC–MS/LC–MS for definitive compound identification.

V. CONCLUSION

The FTIR study illustrates that the petroleum ether extraction of *I. carnea* leaves selectively enriched aliphatic, lipophilic, and carbonylic groups, indicating solvent-dependent separation of phytoconstituents by the

method. The results confirm the suitability of petroleum ether extraction as an initial technique to isolate the non-polar constituents of the plant. Although FTIR is useful to identify the functional groups, the identification of specific compounds needs further techniques like GC–MS/LC–MS.

Conflict of interest

The authors declare that they have no conflicts of interest.

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