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FTIR Spectroscopic Analysis of *Mentha spicata* L. (Garden Mint)

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Authors' contributions

This work was carried out in collaboration between both authors. Author MAT managed the literature searches and performed the experiment. Author MSAA designed the study and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.

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Short Communication

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ABSTRACT

The purpose of present research work is to investigate number and types of bioactive compounds present in *Mentha spicata* L. grown in north east Punjab suburban region. Most suitable technique used for this study is FTIR which is nondestructive, cost effective, user and environment friendly. *Mentha spicata* L. or garden mint cultivated under normal atmospheric conditions. The flowers and remaining non-flowering part were plucked and kept in under shade for 40 days to avoid photochemical changes. Flowers and non-flowering parts were grinded to fine powder and were analyzed using FTIR spectroscopic technique. The FTIR spectral lines have shown different characteristic peaks of functional groups. As a result, alkanes, alkenes, alcohols, phenols, and aromatics etc. have been investigated.

Keywords: Mentha spicata Linn; FTIR; terpenoids; flavonoids; garden mint.

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1. INTRODUCTION

Hundreds and thousands plants and their parts have been used as medicine since beginning of human history. All parts of plants i.e. roots, stems, walls, leaves, flowers, fruits, and seeds are used as medicines. These food plants are good source of natural medicines [1]. Natural and herbal medicines [2] are much better than synthetic drugs because of minimum their side and toxic effects.

Mentha spicata L. as shown in Fig. 1, commonly called garden mint, common mint or lamb mint belongs to herb mint family famous for its medicinal/herbal use. It shares important biological activities of other mint herbs members like antioxidant, anti-inflammatory and anticancer. These activities are attributed to the presence of total phenol terpenoids and flavonoids content [3-7]. Niture et al studied the alterations in O-6- methyl guanine DNA methyl transferase (MGMT) activities of the water soluble and alcohol soluble constituents of closely related specie of spear mint (M. *viridis*) in human peripheral blood lymphocyte and cancer cell Lins [8]. Rosamarinic acid, an important constituent of mint is also reported to increase the repair of oxidized nucleotidic bases induced by photosensitizer [R]-1- [(10-chloro-4-oxo-3 phenyl-4H-benzo[a]quinilizin-1-y) carbonyl] -2-pyrrolidine-methanol (Ro 19-8022) by increasing expression of the OGGI repair gene in PC12 cells [9].

The phytochemicals linalool, eucalyptol and myrcene present in mint are observed to prevent oxidant induced genotoxicity and this effect was indicated by their free radical scavenging activities. Luteolin is also reported to prevent the formation of strand breaks and protect PC 12 cells against oxidative DNA damage [10]. Emodin, another important constituent of *Mentha* inhibited the formation of 1- nitropyrene induced DNA adducts in S. typhimurium TA 98 in ^{32}P post labling study, indicating it blocks and or suppress the mutagenicity of 1- nitropyrene [11].

Further before telling about our work it will be good to highlight a head some previous work of this kind too. In literature, Iqbal Ahmad and his colleagues investigated prominent functional groups of medicinal compounds in different plants by FTIR technique [12].

Ramamoorthi and Kannan reported the presence of bioactive functional groups present in leaf powder of *Calotropisgigantea* by FTIR analysis [13]. Kareru & co-workers screened saponins compounds in several different plants using FTIR [14]. Murugananthamand others carried out research work for bio active compounds in dry powder of leaf, stem and roots of *Eclipta Alba* and *Ecliptaprostrata* [15]. Gauravkumar and other team members reported successful FTIR analysis of leaf of *Bauhinia racemosa* [16]. Ragavendran with his team members found bioactive chemicals present in *Aervalanata* using FTIR [17]. K. B. Theng and A. N. Korpenwar conducted FTIR study of *Ampelocissus latifolia* roots and reported the presence of several medicinal compounds [18]. So according to literature survey, FTIR study for functional groups investigation was not carried out for most of medicinal plants such as *Mentha spicata* L.

Fig. 1. *Mentha spicata* L. (Garden mint)

Current work is a simple effort to investigate phytochemicals present in *Mentha spicata L* by using FTIR spectroscopic technique. It is a simple, cost effective and user friendly technique used to investigate functional groups of bioactive compounds in medicinal plants. FTIR spectroscopic technique is becoming more popular and expanding in research areas due to its nondestructive analysis of biological specimens. In FTIR, main focus is cytological diagnosis through spectral images.

Compounds having variable dipole moment owing to natural vibrations are IR active. These modes are detected and measured by FTIR spectroscopy, providing an exclusive, label-free technique for studying molecular dynamics and composition without destroying the sample. For interviewing biological specimens, the most important spectral regions measured are normally the fingerprint region (600-1450 cm^{-1}) and the amide I and amide II (amide I/II) region (1500-1700 cm^{-1}). The higher wavenumber

region (2550-3500 cm^{-1}) is related with stretching vibrations such as S-H, C-H and O-H. Lower wavenumber region used to study bending and carbon skeleton fingerprint vibrations. So combined study using these regions helps to determine functional groups and molecular structure of specimens.

2. MATERIALS AND METHODS

2.1 Plant Parts Selected

Complete flowers head (Inflorescence).

2.2 Identification Protocol

The identification among different species of genus *Mentha* is quiet difficult because of close resemblance, frequent hybridization occurring both in wild and cultivated varieties [19] . Based on leaf morphology and flowering body structure (inflorescence) the plant is recognized as *Mentha spicata* L. (garden mint).

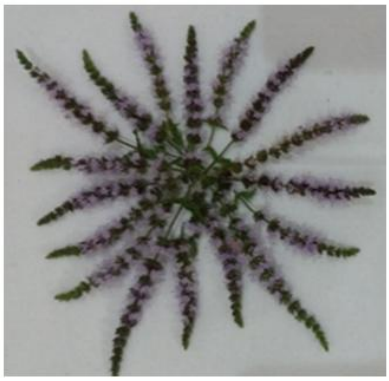

Fig. 2. Flowers and flowering bodies of *M. spicata* L.

The plant cultivated in month of May, flowers blooming were at its climax till start of August. The elongated flowering body were separated from main plant and set for drying as shown in Fig. 2. The collected flowering bodies were kept under shade for forty days to ensure that their drying process is completed.

The flowers were isolated from shade dried main flowing body manually. Flowers and the remaining parts were pulverized to find powdered form as shown in Fig. 3. The powders were contained in plastic vials and were subject to FTIR spectroscopic analysis taken on Varian 640-IR using KBr pellet techniques.

Fig. 3. Shade dried flowers and flowering bodies of *M. spicata* L.

3. RESULTS AND DISCUSSION

The FTIR spectroscopic results of flowers and remaining flowering plant body are presented in Fig. 4 (a, b).

Both spectra confirm the complete drying nature of plant sample free from moisture. Absence of strong absorption band in the region of spectrum between 3400 cm^{-1} and 3100 cm^{-1} indicates the absence of hydrogen bonded OH.

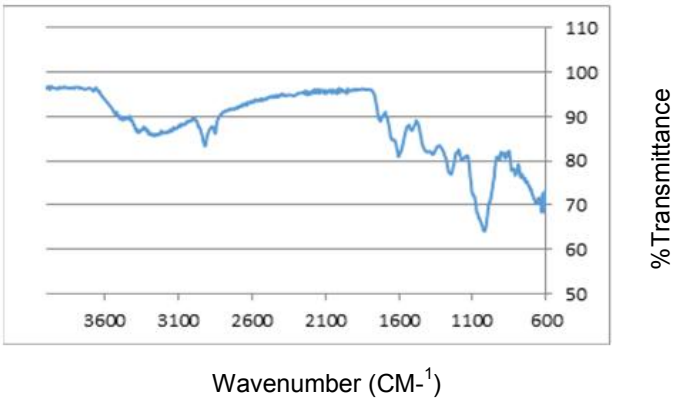

Fig. 4 (a). FTIR spectrum of flowers of *M. spicata* L.

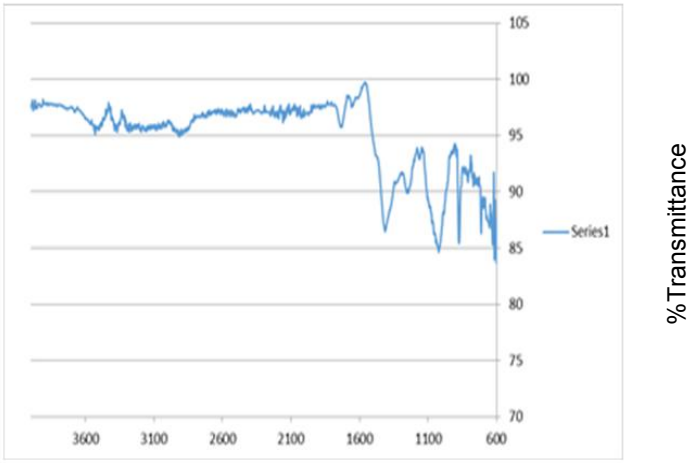

Fig. 4 (b). FTIR spectrum of non-flowering part of *M. spicata* L.

The spectrum of powdered flowers was found different from spectrum of non-flowering part as no IR absorption signal was appeared in the higher frequency region of spectrum between 3600 cm^{-1} and 2100 cm^{-1} [20], contrary to that a broad but weak signal was observed in case of spectrum of dried flowers powder that indicates the presence of non-hydrogen bonded –OH along with weak but sharp signals between 2900 cm^{-1} and 2842 cm^{-1} characteristic of sp^3–CH stretch [21]. In addition appearance of medium to lower peaks around 1000 cm^{-1} corresponds to RCH = CH_2 characteristic of alkenes. Weak signals between the regions 1550 to 1650 cm^{-1} corresponds to alkene of cyclic nature [20].

4. CONCLUSION

The plant species belong to genus *Mentha* or mint family are known to contain important phytochemicals which belong to family of acyclic, *mono cyclic aliphatic and monocyclic aromatic terpenoids* e.g. *Carvone*, *Menthol, Menthone* and *Perrillyl alcohol, linalool, Rosamarinic* etc. Presence of active functional groups like non-conjugated and conjugated alkenes, mono and ortho-dihydroxy units and carbonyl moieties on such parent molecular skeletons is in close agreement with the signals of their IR thus making FTIR as an instrumental marker technique for analysis of crude medicinal/biological samples qualitatively.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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