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# Identification of functional groups in *Thymus linearis* ethanol leaf extract through fourier transform infrared spectroscopy (FTIR)

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**Abstract**
The present study aims to identify the functional groups in *Thymus linearis* leaf extract through Fourier Transform Infrared Spectroscopy (FTIR). In the current study, eleven functional groups were identified in *Thymus linearis* leaf extract. The FTIR analysis of ethanol leaf extracts of *Thymus linearis* confirmed the presence of alkyne, aldehyde, aromatic amine, aliphatic ether, anhydride, alkene, 1,2,4 trisubstituted, 1,4-disubstituted and halo compound, which show major peak. Interpretation of FTIR results revealed the presence thymol, carvacrol and phytol. The presence of thymol, carvacrol and phytol provides the ant pathogenic properties to the *Thymus lineraris* plant.

**Keywords:** *Thymus linearis*, FTIR, chemical bond, functional group

## 1. Introduction
A large number of medicinal plants has used for the promotion of health, treatment, prevention, and control of several diseases (Even, 1994) [3]. Medicinal plants are agreat source of herbal drugs. In India, more than 17,000 species of higher plants are available, 7500 species are recognized for their medicinal use, and more than 500 medicinal plant species are being used for the disease treatment. In veterinary and human medicine, Herbs have widely used because they are safe, effective, and available throughout Asia. The phytochemicals found in the plants that mean it have medicinal properties of plant species. Fourier transforms infrared spectroscopy (FT-IR) is a high-spectral resolution analytical technique to recognize the chemical bond, functional group and the structure of compounds. The species *Thymus linearis* belongs to the family Lamiaceae, commonly known as 'Wild ajwain' consists of about 215 species of herbaceous perennials and sub-shrubs. The two species mainly *Thymus linearis* (Native) and *Thymus serpyllum* (exotic) found in India. Thyme is a well-known medicinal plant having diverse pharmacological properties. Recent studies have shown that they have strong antibacterial, antifungal, antiviral, antiparasitic and antioxidant activities (Dababneh, 2007; Davidson & Naidu, 2000; Parajuli *et al.*, 2005) [1, 2, 9]. The aims of the present study is the identification of a functional group in the *Thymus linearis* leaf extract by FT-IR analysis.

## 2. Materials and Methods
### 2.1 Collection of thymus linearis plant
The Fresh *Thymus linearis* (Wild ajwain) plant was collected from Hill of Badrinath, Chamoli district of Uttarakhand. They were authenticated by the Department of Botany, H.N.B. Garhwal University, Srinagar, Uttarakhand, India. First, the plant sample washed with tap water for 2-3 times, and then, this plant was soaked for 30 minutes to remove all the dust. This plant sample dried in the shade for 7 days (Fig.1 & 2).

### 2.2 Preparation of *Thymus linearis* leaf extract
Briefly, the dried leaf of plant was grinding in a fine powder by the grinder and was extract by using ethanol as solvent. According to Jhingran (1975) [6] described that the ration of plant powder and solvent (ethanol) was 1:10. Take 2.8g of dried sample dissolved in 35ml of 70% ethanol and kept for 48 hours in a rotary shaker. The mixture was filtered through Whatman filter (No. 1) paper and centrifuged at 2460g for 10 minutes. The filtrate was evaporated in the rotary evaporated under vacuum at 40°C. At least the extract was dried in the freeze drier for 24 hours. The plant extract was kept in -20°C until further use (Gangwar *et al.*, 1990) [4]

**Fig 1:** Leaf of *Thymus linearis*

**Fig 2:** Collection of *Thymus linearis* leaf

### 2.3 FT-IR spectrum analysis of *Thymus linearis* leaf extract

Fourier Transform Infrared Spectrophotometer (FTIR) is presumably the most powerful spectrometer for recognize the types of functional groups or chemical bonds present in the photochemical. The wavelength of light absorbed is the feature of the chemical bond seen in the annotated spectrum. The chemical bonds or functional group can be determined by interpreting the infrared absorption spectrum *Thymus linearis* ethanol leaf extract was used for FTIR analysis. Aquantity of 5 mg of the dried extract powder was dispersed in Potassium bromide (KBr). The mixture (Leaf extract+ KBr) was thoroughly mixed in a mortar and then, pressed at a pressure of 6 bars within 2 minutes to from a KBr thin disc. Then, this disc was placed in a sample cup. The sample of *Thymus linearis* leaf extract was loaded in Pekin Elmer infrared spectroscope, with a frequency range from 400 to 4000 $cm^{1}$.

### 3.1 Results

The *Thymus linearis* leaf ethanol extract was exposed to the FTIR analysis. The present results show the presence of 11 functional groups and chemical bond recognized from the *Thymus linearis* leaf extract in Table 1 and Figure 3. The FTIR analysis of ethanol leaf extracts of *Thymus linearis* confirmed the presence of alkyne, aldehyde Aromatic amine, aliphatic ether, anhydride, alkene, 1,2,4 trisubstituted, 1,4-disubstituted and halo compound, which show major peak. The FTIR gives strong instance peak obtained at leaf extract 3325.36 $cm^{-1}$ which the presence of alkyne (C-H stretching). The medium peak obtained at leaf extract 2972.43 and 2884.78 $cm^{-1}$ which indicates the presence of alkyne (C-H stretching). The medium instance peaksare recognized at 1380.46 $cm^{-1}$ which areassigned to the aldehyde (C-H bending). The strong peak at ethanol extracts 1271.17 $cm^{-1}$, which indicate the presence of aromatic amine (C-N stretching). The strong peak identified at 1086.94 $cm^{-1}$ which are assigned to the aliphatic ether (C-O stretching).The strong peak at a frequency of 1045.62 cm-1, which indicate the presence of anhydride (CO-O-CO stretching). The strong peak at a frequency of 955.92 $cm^{-1}$, which indicate the presence of alkene (C=C bending). The strong peak at a frequency of 879.8$cm^{-1}$, which indicate the presence of 1, 2, 4 trisubstituted (C-H bending). The strong peak at a frequency of 803.35 $cm^{-1}$, which indicate the presence of 1, 4-disubstituted (C-H bending). The peak at a frequency of 619.73 $cm^{-1}$, which indicate the presence of halo compound (C-Br stretching).

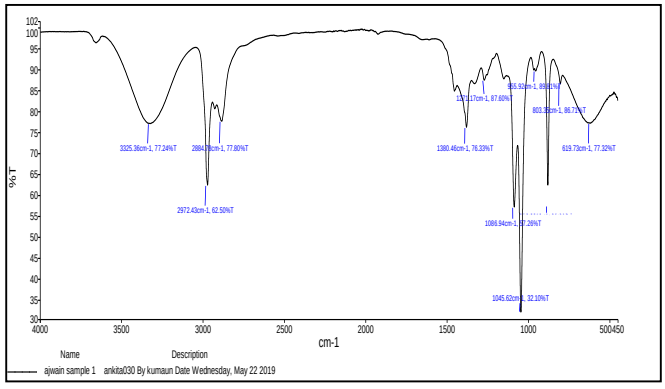


**Fig 3:** FTIR Spectrum analysis of *Thymus linearis* leaf extract

**Table 1:** FTIR spectral wavenumber's values, chemical bonds and functional groups obtained from the *Thymus linearis* leaf extract

| S. No | Wave Number cm $l^{-1}$(Test Sample) | Frequency range $cm^{-1}$(Reference number) | Chemical bond | Functional Group |
|---|---|---|---|---|
| 1. | 3325.36 | 3333-3267 | C-H stretching | Alkyne |
| 2. | 2972.43 | 3000-2840 | C-H stretching | Alkyne |
| 3. | 2884.78 | 3000-2840 | C-H stretching | Alkyne |
| 4. | 1380.46 | 1390-1380 | C-H bending | Aldehyde |
| 5. | 1271.17 | 1342-1266 | C-N stretching | Aromatic amine |
| 6. | 1086.94 | 1150-1085 | C-O stretching | aliphatic ether |
| 7. | 1045.62 | 1050-1040 | CO-O-CO stretching | Anhydride |
| 8. | 955.92 | 915-905 | C=C bending | Alkene |
| 9. | 879.8 | 880-860 | C-H bending | 1,2,4trisubstituted |
| 10. | 803.35 | 810-790 | C-H bending | 1,4-disubstituted |
| 11. | 619.73 | 690-515 | C-Br stretching | halo compound |

## 4. Discussion

The present study was identified the functional group and chemical bond in *Thymus linearis* leaf extract through Fourier Transform Infrared Spectroscopy (FTIR). To recognize the chemical constituents, functional groups and elucidate the chemical structure as bio active constituents for the treatment of various diseases. Indhumathi and Arunprasath, (2019) [5] reported that the identification of functional group in *C. decumbens* extract by FT-IR and reported that the aromatic amines present in the extract. The similar results found by Pillai and Nair, (2014) [10] who reported that the functional groups of alkenes that are responsible for medicinal properties of *Cleome viscosa* methanol extract. Presence of C-H, C-O, and C=C bonding structures were responsible for the presence of Alkyne groups, ether, and Alkene. The supported of our results by Kamble and Gaikwad, (2016) [8] studied that the functional groups of aromatic amine presence in extracts of *Embelia ribes* leaves. According to Ekhlas *et al.*, (2016) [7] investigated that the identification of functional group in *Capsicum annuum* L. by FT-IR and reported that the anhydride present in the plant. Based on our results, it is evident that *Thymus linearis* plant does not consist of anytoxic compounds.

## 5. Acknowledgements

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