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# FTIR (Fourier transform infrared spectroscopy) spectroscopic analysis of dried leaf and fruit peel extract of *Capparis divaricata lam.*

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***Abstract***— *Capparis divaricata lam commonly known as caper bush, belonging to genus Capparidaceae, found throughout India. In this study, we determine the phytocomponents in dried leaf and fruit peel extract of Capparis divaricata lam (cappardaecea).The FTIR (Fourier transform infrared spectroscopy) spectroscopy is an essential tool for determining the composition and structure of organic compounds. The FTIR spectroscopy is an essential tool for profiling biochemical compounds that exist in herbal extraction, FTIR method was selected because it is a very rapid and economic method for the characterizing of a functional group. The dried sample has been taken for the identification of chemical bonds which are present in the plant sample. The FTIR peaks analyzed in leaf shows the OH, $CH_2$, C=C, C-OH, $CH_3$ and CH, bonds while in fruit peel it shows OH, $CH_2$, C=C, C-OH, $CH_3$, CH and C=O bonds. The presence of C=O bond tells us that they are useful in organic synthesis catalysis and as catalyst precursors in homogenous catalysis. The $CH_3$ bonds suggest that the Methyl containing Amino Acid is present. The C-O-H group indicates the presence of Fatty Acids. Silicones and Sulfones the presence of various biological activities and are therapeutic targets. All the identified phytocomponents are having pharmacological activity and absorbance bond shows strong, stretching, symmetric and asymmetric bonds. So Capparis divaricata lam can be considered as a plant of phytopharmaceutical importance.*

***Keywords***— ***Capparis divaricata lam, fruit peel, leaves, FTIR.***

## I. INTRODUCTION

Medicinal plants are a significant part of natural wealth. They have a large no of bioactive constituents therefore these plants are used to cure many infectious diseases. As per the reports of the world health organization (WHO), almost 80% of the global population depends on traditional medicine for the treatment of various disease and economic advantages. The various bioactive phytochemical constituents available in plants include alkaloids, saponins, glycosides, flavonoids, phenol, terpenes and carboxylic acid. Identification of the chemical present in the medicinal plants will provide some information on the different functional group responsible for their medicinal properties. Fourier Transform Infrared (FTIR) spectroscopy is an essential tool for determining the composition and structure of organic compounds. It is a very rapid and economical method for characterization of functional groups and creates an analytical data which is considered as fingerprinting of that particular sample. The Infrared spectrum which is obtained from the plants may show some small changes in the metabolites. According to Ramamoorthi and Kannan (2007) screened the bioactive group of chemicals in the dry leaf powder of *Calotropis gigantean* by FTIR analysis.

Kareru *et al*. (2008) detected saponins in a crude dry powder of 11 plants using FTIR spectroscopy. Murugananthan *et al.* (2009) carried out the FTIR spectroscopic analysis in the powder samples leaf, stem and root of *Ecliptaalba* and *Ecliptaprostrata.* The FTIR analysis of *Bauhinia racemosa* leaf extract in an aqueous

methanolic solution for phytochemical compounds was done by Gauravkumar *et al.* (2010). Ragavendran *et al.* (2011) detected the functional groups in a various extract of *Aervalanata* using the spectroscopic method. Thangarajanstarlin *et al.* (2012) identified the elements and functional groups in the ethanol extract of the whole plant of *Ichnocarpusfrutescens* using FTIR spectroscopic method. Paraj.A.Pednekar and Bhanu Raman (2013) analyzed the methanolic leaf extract of *Ampelocissuslatifolia* through FTIR spectroscopy for an antimicrobial compound. So far, an FTIR analysis of the leaf and fruit peel extract of *Capparis divaricata* has not been done. Thus, we have attempted to analyse the functional groups of phytoactive compounds present in the leaf and fruit peel of *Capparis divaricata* by FTIR spectroscopic analysis.

## II. MATERIALS AND METHODS

### 2.1 Collection of plant

Leaf and fruit sample of *Capparis divaricata* species were collected from Shingadgaon, Solapur, Maharashtra (India) in July. The specific plant species were identified with the help of Dr.Gore, Assistant professor of Walchand College of arts commerce and science Solapur.

### 2.2 Plant material

The leaf and fruit peel were washed thoroughly with running water and then with distilled water. The plant material was dried in shade dried for a couple of days and then dried in an incubator at $37^0$C for 2-3 days. The dried leaves were then crushed in a mechanical grinder till it becomes a fine powder and then it was stored in an airtight container at room temperature.

### 2.3 Fourier transform infrared spectroscopy

A dry leaf and fruit peel powder of *Capparis divaricata* was taken. The dried leaf and fruit peel powder subjected to Fourier transform infrared (FTIR, IRA finite- university of Solapur, Solapur) spectroscopy measurement using the potassium bromide (KBr) pellet technique diffuse reflection mode at a resolution of $4cm^{-1}$. The powder was mixed with KBr and exposed to an infrared source of 500 to 4000 $cm^{-1}$. A similar process was used for the FTIR studies of *Capparis divaricata* extract before and after bio-reduction.

## III. FTIR ANALYSIS

Characterization of the biochemical molecules extracted from *Capparis divaricata* leaves and fruit peel depending on FTIR spectrum analysis is represented in fig. 1 and 2.

FTIR result revealed presence of hydroxyl group (OH) by peak at $3276.48cm^{-1}$,$3292.24cm^{-1}$ $1417.74cm^{-1}$,while frequency peak at $2918.24cm^{-1}$ ,$2920.35\ cm^{-1}$ , $2851.42\ cm^{-1}$ refers to stretching of C-H aliphatic group, vibration peak (C=C aromatic) at,$1621.48\ cm^{-1}$ , $1615.67\ cm^{-1}$ structure stretching frequency peak recorded at $1737.48\ cm^{-1}$ assigned to presence (C=O), while (C-H and C-O) seems at $1019.22cm^{-1}$,$1153.35\ cm^{-1}$, $1119.36\ cm^{-1}$, $1392.39cm^{-1}$,$1239.33\ cm^{-1}$. The $1579.82\ cm^{-1}$ shows (N-H bond). , $1007.00\ cm^{-1}$, $1330.59cm^{-1}$, seems(S=O) bond. $1243.99cm^{-1}$, $1320.99cm^{-1}$ seems (C-N) bond is present.

## IV. RESULT AND DISCUSSION

The frequency of vibrational peak (ν) depends on two factors i.e., force constant and reduced mass, which can be explained by following equation.

$$\nu = 1/2\pi c \sqrt{(k/\mu)}$$

Here, c is the speed of light, k is force constant and μ is reduced mass.

If the reduced mass is constant, then the frequency is directly proportional to the force constant; therefore, increase in the frequency of any bond suggested a possible enhancement in force constant of the respective bond.

*Table* No. 1

| Leaf extract of *Capparis divaricate* | | | | | |
|---|---|---|---|---|---|
| Sr no. | Peek | Bonds | Bond strength | Bond vibrations | Functional groups |
| 1. | 3276.48 | O-H | Strong | Stretching | Alcohol |
| 2. | 2918.24 | C-H | Medium | Stretching | Alkene |
| 3. | 1621.48 | C=C | Strong | Stretching | α,β unsaturated ketone |
| 4. | 1579.82 | N-H | Medium | Bending | Amine |
| 5. | 1417.74 | O-H | Medium | Bending | Alcohol |

| | | | | | |
|---|---|---|---|---|---|
| 6. | 1320.99 | C-N | Strong | Stretching | Aromatic amine |
| 7. | 1243.99 | C-N | Medium | Stretching | Amine |
| 8. | 1153.35 | C-O | Strong | Stretching | Aliphatic ether |
| 9. | 1119.36 | C-O | Strong | Stretching | Secondary alcohol |
| 10. | 1007.66 | S=O | Strong | Stretching | Sulfoxide |

*Table No. 2*

| Fruit peel extract *Capparis divaricata* | | | | | |
|---|---|---|---|---|---|
| Sr no. | Peek | Bonds | Bond strength | Bond vibration | Functional groups |
| 1. | 3292.24 | O-H | Medium | Stretching | Alcohol |
| 2. | 2920.35 | C-$H_2$ | Strong | Stretching | Mainly lipids |
| 3. | 2851.42 | C-$H_2$ | Medium | Stretching | Mainly lipids |
| 4. | 1737.48 | C=O | Strong | Stretching | δ- lactone |
| 5. | 1615.67 | C=C | Strong | Stretching | α,β- unsaturated ketone |
| 6. | 1392.39 | C-$H_3$ | Medium | stretching | Phenol |
| 7. | 1330.59 | S=O | Strong | Stretching | Sulfone |
| 8. | 1239.33 | C-O | Strong | Stretching | Aliphatic ether |
| 9. | 1019.22 | C-C, C-OH, CH ring and side group | Strong | Vibration | Anhydride |

## V. FTIR ANALYSIS

Presented data of FTIR strongly indicated the existence of phenolic compounds in *Capparis divaricata* leaves and presence of O-H group along with aromatic ring which consisting the basic unit of phenolic active components.

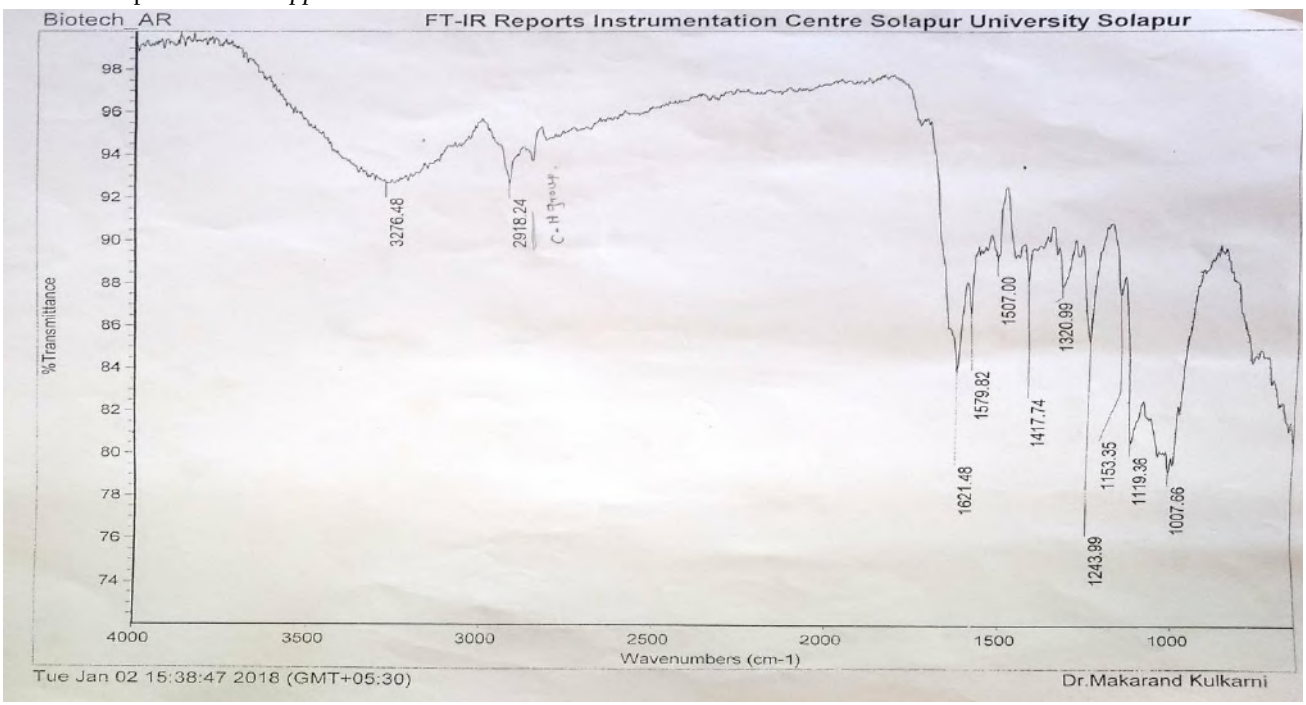


*Fig.1: Leaf Extract (FTIR report of leaf extract of Capparis divaricata)*

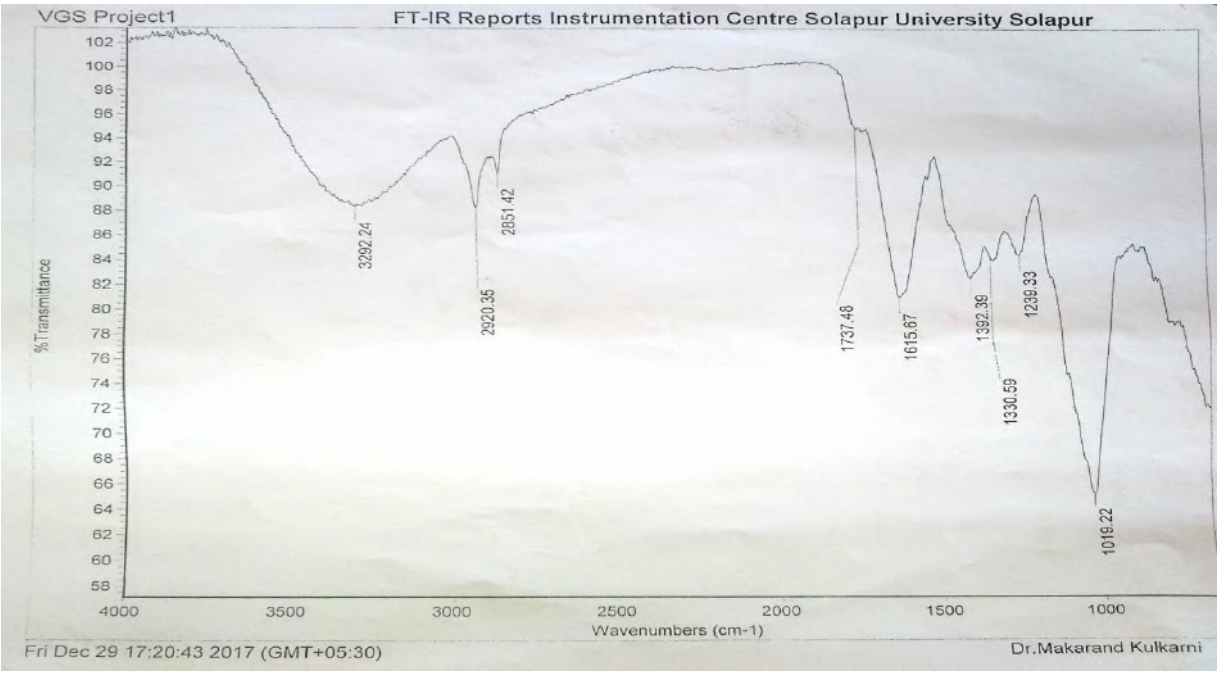


*Fig.2: Fruit Peel (FTIR report of fruit peel extract of Capparis divaricata)*

## VI. CONCLUSION

The FT-IR data of *Capparis divaricate* plant extract i.e., fruit peel and leaves shows us the various active pharmaceutical ingredients. Characterization of biochemical molecule extracted from *Capparis divaricata* leaf and fruit peel depending on FT-IR spectrum analysis reveals the presence of hydroxyl group, absorption bond stretching peaks and vibrational aromatic ring. Present data of FT-IR strongly indicated the existence of phenolic compounds in *Capparis divaricata* leaves by the presence of OH group along with aromatic ring which consisting the basic unit of phenolic acetone components.

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