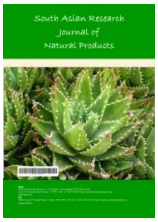

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Phytochemical Analysis of *Portulaca pilosa & Portulaca quadrifida* Linn through FTIR

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Authors' contributions

The authors declare that this work was done by mutual contribution and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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Short Communication

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ABSTRACT

Current research work comprises Fourier Transform Infrared (FTIR) study of two members of Portulaca Family namely, *Portulaca pilosa & Portulaca quadrifida Linn*. *Portulaca pilosa* is well known ornamental plant whereas *Portulaca quadrifida Linn*. is a weed. Both are known for their herbal importance and were grown in March last year in self-built herbal garden. In June last year, twigs of both herbs were plucked and kept under shade for drying. After one month, dry twigs were ground to fine powder and then analyzed using FTIR technique. Functional groups of phytochemicals were identified through FTIR spectral lines. Appropriate correlations of absorption peaks to medicinal compounds have been discussed. As a result, both herbs are found to be rich source of bioactive compounds like alkaloids, flavonoids, fatty acids, tannins, triterpenoids, amino acids and saponins. In conclusion of current study, importance of herbal plants for development of medicines is also highlighted.

Keywords: Flavonoids; FTIR; medicinal compounds; saponins; Portulaca pilosa; Portulaca quadrifida Linn; terpenoids.

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1. INTRODUCTION

Herbal plants are well known sources of medicinal compounds since the beginning of human history [1]. In almost every health care system herbal plants have remained as the low cost and easily available source of treatment. The local people of under developed countries still prefer traditional plant for medicinal purposes [2]. With the passage of time presence of bioactive compounds in medicinal plants were studied. These medicinal plants are the basis of indigenous medical system in the world [3]. All parts of medicinal plants i.e. roots, stems, bark, leaves, flowers, fruits and seeds are rich source of bioactive compounds [4]. Herbal medicines are still important in spite working slowly due to their minimum side effects [5].

Currently, research on herbal plants for medicinal information (natural products) has again received significant interest [6]. This high level research interest in medicinal plants can be attributed due to so many factors [7]. For research purpose, we have analyzed *P. Pilosa & P. Quadrifida Linn* by using FTIR spectroscopic technique which is simple, cost effective and user friendly. FTIR is most powerful and versatile analytical technique used to study the qualitative information of samples. It provides fundamental group frequencies which are the basics to explaining the structure–spectral relationships of phytochemicals [8].

1.1 *Portulaca pilosa*

It is a diverse herbal plant, grows in warm-climate belongs to Portulacaceae family. It is a plant of tropical and subtropical region of the world. *P. Pilosa* is very beautiful annual herb, thick, heavy emerging numerous branches of average length 35-40 cm long as shown in Fig. 1. Its leaves are soft, rounded and spiral shaped covering the branches all around. Shape of leaves have close resemblance with rice but large dimensions. Attractive pink flowers of petals similar to rose comes on it in the month of May-June [9].

People of tropical Asian countries used as salads and is added to soups [10]. *P. pilosa* also a rich source of omega-3 fatty acids and antioxidant properties [11,12].

P. pilosa has been reported as a traditional folk medicine for its use as anti-rheumatic, febrifuge, antiseptic and so forth [13].

It is graded as most used medicinal herb due to anti-bacterial, anti-ulcer genic, anti-inflammatory, antioxidant, diuretics, analgesic, and wound-healing, properties [14,15].

1.2 *Portulaca quadrifida* Linn

It is also known as chicken weed belongs to the Portulacaceae family, and is found in tropical regions of Asia and Africa. It is a small, tasty, annual, mat-forming species as shown in Fig 2. The plant is lenient and adaptive to a wide range of soil like plain patches, in rocks and sandy or stony soils but is best grown in sandy soils. Its seed are easily distributed by wind, water, or through bird droppings [16].

People use this herb as food (salad and chutney) in African and Indo-Pak regions [17,18]. Therapeutic and medicinal use of *P. Quadrifida* is similar to *P. Oleracea Linn* [19].

Current work is a simple effort to correlate FTIR absorption peaks with bioactive compounds already reported in literature.

Fig. 1. Snapshots of *Portulaca pilosa* plants (A), dry twigs (B) and powder (C)

Fig. 2. Snapshots of *Portulaca quadrifida* Linn plants (A) dry twigs (B) and powder (C)

2. MATERIALS AND METHODS

Based on leaf morphology, the herbs were recognized as *Portulaca pilosa* and *Portulaca quadrifida Linn*. *Portulaca pilosa* herb was purchased from local nursery form and was re-grown in May in self herbs garden for study purpose. *Portulaca quadrifida Linn* was collected from the wild in the sub-urban region of capital city Islamabad. For study purpose elongated body parts (branches) with petals of both herbs were plucked and set for drying. After one-month, shade dried main stem and remaining body part were ground to powder manually. The powdered samples were isolated in sample collection plastic vials.

The analysis was performed by KBr pellet method using Varian 640 IR keeping scan range between 4,000 – 400 cm^{-1}. FTIR absorption spectrum indicates functional groups of compounds which are the backbone of structural features of the molecule. The FTIR spectrum of a molecule is unique and characteristic of the molecule. Thus can be used as a fingerprint for identification of unknown sample by the comparison with previously recorded reference spectra [8].

FTIR is becoming a plain and expanding technique in research areas due to its nondestructive exploration of biological specimens. In FTIR, main focus is cytological analysis through spectral pictures. Compounds having dipole moment due to natural vibrations are measured in FTIR, providing an exclusive study to understand molecular composition. In FTIR higher wave number region (2550-3500 cm^{-1}) is associated with stretching vibrations such as S-H, C-H, N-H and O-H. Middle region deals with carbonyls, aromatics and unsaturated compounds. Fingerprint region (600-1450 cm^{-1}) is considered the most important spectral regions, characteristic for molecules. So comprehensive study of a molecule comprises information bases on all these regions.

3. RESULTS AND DISCUSSION

The FTIR spectroscopic results are presented in Fig. 3. The absorption spectral lines of *P. Pilosa* and *P. Quadrifida L.* were very similar. The reason could be due to common family background of both herbs. So it may be assumed that quality analysis of phytochemical in both herbs are common. The spectra confirm the complete drying nature of plant samples free from moisture.

Very weak absorption signals observed at 3525-3515 cm^{-1} indicates the presence of –OH stretching and the absorption value depends upon its environment and is characteristic of polyphenolic (quercetin, rutin, isoquercitrine, chlorogenic acid, cinnamic acid, p-coumaric acid) compounds with benefits on health and usefulness in the food industry [20]. Signals are not prominent due to very low concentration of compounds. This region also indicates the presence of alkaloids which are a group of natural products known for their anti-oxidative, anti-inflammatory, anti-mutagenic and anti-carcinogenic properties and are being used in variety of pharmaceutical, medicinal and cosmetic applications [21].

Though the absorption peak at 3470 cm^{-1} indicates the presence of phenolic and flavonoids, it also suggests that there are also amines, acids (oxalic acid, succinic acid, citric acid, propionic acid, lactic acid and butyric acid) and amino acids which are precursors in the production of secondary metabolism molecules like peptides and proteins [22]. This signal is also very weak due to same reason as discussed before. Both classes of compounds play vital role for regularization of metabolism and proper

Fig. 3. FTIR spectra's of *Portulaca pilosa* and *Portulaca quadrifida* Linn

functioning of body. Amino acids (protein) are potent candidates to prevent humans from diseases like cancer and bacterial inflammation [23].

Absorption peak at 3250 cm^{-1} may be attributed to saponins which are a diverse group of natural products widely distributed in the plants. Saponins structure contains a triterpenoids or steroid sugar chains. Saponins are important due to their physicochemical properties and biological activities against cancer and cholesterol [24]. Spectral lines at 2850-2950 cm^{-1} are the indication of flavonoids, aromatics, unsaturated and conjugated compounds as afore discussed.

Rear absorption at 2156 cm^{-1} is related to unsaturated compounds and amino acids [25]. Absorption spectra's at 1625 cm^{-1} and 1616 cm^{-1} are referred to amides, flavonoids, aromatic and hydrocarbons [25]. Spectral lines at around 3400 cm^{-1}, 2900 cm^{-1} and 1600 cm^{-1} is indicate the presence of triterpenoid saponins [26]. Peaks at 1400-1500 cm^{-1} are related to C–O alcohols and C–H alkanes (flavonoids) which are five or six membered rings containing compounds along with methylene -(CH_2) n and thiol comp etc.

Peaks 1300 to 1400 cm^{-1} indicates poly sulfer and polyphenolic compounds [27]. Similarly, 800 to 1200 cm^{-1} are of flavonoids, poly sulfer and thiol compounds as discussed before. In general, flavonoids are complex structure depending upon source [27]. Absorption peaks at 688 cm^{-1} indicates protein, fatty acids and aromatic compounds as discussed before [28].

In general, qualitative and quantitative analysis of bioactive compounds extracted from plants depends upon various factors such as ecological factors (temperature, light, humidity, soil state, etc.), gathering period, assortment, maturity at harvest and method of extraction etc [29].

4. CONCLUSION

FTIR study of *P. Pilosa* and *P. Quadrifida Linn* samples have shown the presence of important classes of phytochemicals like alkaloids, flavonoids, fatty acids, tannins, triterpenoids, amino acids and saponins etc. Pharmacological significance of large number of bioactive compounds belonging to these classes have already been established. However, amount of particular compound per unit weight of herbal plant may vary depending upon habitat of plant. The result of this study shows that both plants have bioactive potential and may be useful in drug development for the treatment of various diseases.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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