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Spectroscopic analysis *Oliveria decumbens* Vent by Fourier transform infrared spectroscopy

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Abstract

Medicinal plants are useful in perfumery, pharmaceutical, and food industries. Recognition of compounds and functional groups of these plants helps to more understand their structure, medicinal and therapeutic applications. Essential oils and extracts are used to recognition structure. One of these spectroscopic methods for identifying functional groups in medicinal plants is Fourier-transform infrared spectroscopy (FTIR) spectroscopy. This study aimed to identify the functional groups of medicinal plants of Oliveria decumbens native to Ilam by the FTIR method. Based on the results obtained, it was determined that this plant includes 15 spectra including groups O-H, C-H, C = O, C = C, N-O, C-O, C-N, and C-I. So, the present study concluded that the O. decumbens possessed strong functional groups.

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Introduction

In Iran, there is a very fragrant herbaceous with the scientific name *Oliveria decumbens* Vent belongs to the Umbelliferae family. This plant grows in Turkey, Syria, and Iraq, as well as in Iran, Ilam, Kermanshah, Khuzestan, and Shiraz. This plant is known by the local names "den", "denak" and "moshkorak" is widely known and is used to treat infectious and digestive diseases [1]. This annual plant grows to a height of 45 cm and grows on the strong stems of its leaves in the form of buds and petioles. The flowers are pink and the fruit is covered with many hairs. In the inner parts of the stem, secretory channels are observed, which are the place where the essential oil is formed in the plant [2]. In traditional Iranian medicine, this plant is used in the treatment of infection, indigestion, diarrhea, and abdominal pain, mental disorders such as depression, and morphine withdrawal symptoms and fever [3]. Thymol, carvacrol, gamaterpin, and parasimin are the main compounds of this plant in decomposition with GC/MS [4]. Infrared spectroscopy is one of the useful methods in qualitative identification of different molecules, determining the structure of different species, especially organic species and identifying the functional groups in its structure [5]. Because each bond has a specific natural vibration frequency because a bond in two different molecules is in two different environments, therefore, two molecules with different structures never absorb infrared, or in other words the same infrared spectrum. The absorbed frequencies in the two molecules are similar, but two different molecules will never have the same infrared spectrum. Therefore, the red spectrum can be used as a fingerprint in humans to identify molecules [6]. The use of IR spectroscopy for the analysis of biological samples was first proposed in the 1940s, a method that was successfully explored for the study of biological materials. IR spectroscopy has become an accepted tool for characterizing biomolecules [7]. FTIR spectroscopy is one of the useful methods for identifying chemical compounds and elucidating compound structures for presentation in pharmaceutical purposes [5, 6]. The goal of this study was to identify the functional groups of medicinal plants of *O. decumbens* native to Ilam by spectroscopy (FTIR).

Materials and Methods

Plant preparation:

In this study, the medicinal plant *O. decumbens* Vent (Figure 1) is prepared from Zarrinabad area of Dehloran city in Ilam province (Table 1). Identification and approval of plant species were done based on the Atlas of Plant Flora of Ilam Province (Dr. Valiollah Mozafarian).

Figure 1: *O. decumbens* Vent plant

Table 1. Specifications of *O. decumbent* Vent

Plant	Scientific name	Herbal family	Location	Geographical coordinates
Laele kohestan	*Oliveria decumbens*	Apiaceae	Dehloran	32° 41' 28" North, 47° 15' 58" East

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The collected *O. decumbens* plant should be cleaned and dried in the shade at environment temperature. It was then pulverized by a mixer.

The plant is powered by the mixer. Infrared Fourier transform spectroscopy will be used to identify the functional groups of chemical compounds and to qualitatively detect the type of bonds of the said extract. Since the sample used in this study will be in powder form, the method of preparation of KBR (potassium bromide) tablets was used. To prepare the sample by KBR tablet method, the solid sample is completely powdered and mixed with powdered kBR, then under the pressure of 10 tons of the device, this mixture comes out in the form of small tablets. The reason for using it is that it does not create any peaks in the range of 650 to 3900 cm. Finally, the sample is exposed to radiation and the Fourier transform spectrum is obtained [7]. Therefore, only the peaks of plant extracts will be known in spectroscopy (7). Finally, factor groups such as O-H, N-H, C = O, N-O, S = O, C-O, C-Cl, C-Br, C-H, etc. are identified and reported based on the different spectra obtained.

The animals were humanely treated according to the guidelines of the Michael Okpara University of Agriculture, Umudike, for the use of animals for laboratory study. The Ethical Committee of the Department of Physiology, Biochemistry and Pharmacology approved the student a reference number: MOUAU/VPP/EC/18/004.

Results

Based on the results obtained from spectroscopy of *O. decumbens* plant, it was determined that this plant has 15 points for the functional groups. Details of the functional groups obtained from this plant are specified in Table 2 and Figure 2.

Table 2. Spectroscopy of *O. decumbens* Plant, wave number, Functional group vibration, and Its Type

Type	Functional group vibration	Range	(cm−1)
Stretching - alcohol	O-H	3550-3200	3418
Stretching - Alkan	C-H	3000-2840	2924
Stretching - Amino salt	C-H	3000-2840	2853
Stretching- Ester	C=O	1740-1720	1736
Stretching - Alkene kanjuge	C=C	1650-1600	1619
Stretching - Nitro composition	N-O	1550-1500	1510
Bending - Carboxylic acid	O-H	1440-1395	1423
Bending - alcohol	O-H	1420-1330	1377
Bending - Phenol	O-H	1390-1310	1324
Stretching - Aromatic ester	C-O	1310-1250	1251
Stretch - Alkyl Aryl Ether	C-O	1075-1020	1075
Stretching - Amine	C-N	1250-1020	1031
Bending - Alkene	C=C	840-790	811
Bending	C-H	880±20	775
Stretching - Halide compound	C-I	600-500	595

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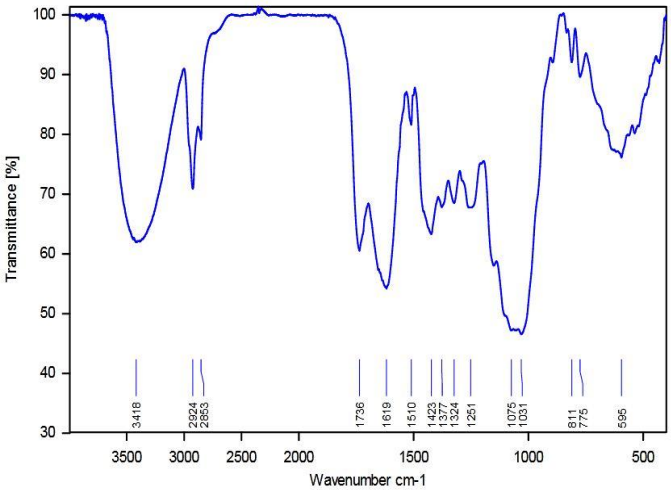

Figure 2. Chromatogram of *O. decumbens* Vent plant

Discussion

As can be seen from Table 2 and its chromatogram, the *O. decumbent* Vent plant has 15 points for the functional groups. Region 1 Wavenumber with 3418 (OH), region 2 with Wavenumber 2924 (CH), region 3 with Wavenumber 2853 (CH), 4 with Wavenumber 1736 (C = O), region 5 with Wavenumber 1619 (C = C) Zone 6 with Wavenumber 1510 (NO), Zone 7 with Wavenumber 1423 (OH), region 8 with Wavenumber 1377 (OH), region 9 with Wavenumber 1324 (OH), region 10 with wavelength 1251 (CO) region 11 with Wavenumber 1075 (CO), region 12 with Wavenumber 1031 (CN), region 13 with Wavenumber 811 (C = C), region 14 with Wavenumber 775 (CH) and region 15 with Wavenumber 595 (CI). There are reports of antimicrobial and antifungal effects of mountain pomegranate (8). Also, its antiviral and antioxidant effects have been studied (9, 10). In this study, it was found that *O. decumbens* Vent plant has chemical compounds such as alcoholic compounds, alkanes, amine salts, esters, conjugated alkenes, nitro, phenolic, and halide compounds, aromatic esters, carboxylic acids, and amines. Using the FT-IR spectrum, the presence of various functional compounds can be confirmed to be extracted and used to produce herbal medicines. The medicinal effects of mountain pomegranate are due to the presence of the mentioned secondary compounds. The results of the present study show the phytochemical of this plant. The present study concludes that FTIR analysis shows that this plant can be used as an herbal medicine for many diseases due to its composition. The results of this study highlight the fact that this plant is very important from a medicinal point of view and it can be used for further study to locate bioactive compounds to find its importance in the pharmaceutical industry. Further advanced studies are recommended to determine the composition of this plant.

Authors' contribution

All authors contributed equally to the manuscript.

Conflicts of interest

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication and etc.) have been completely observed by author.

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