AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: http://www.ajptr.com/

Fourier Transform Infrared (FT-IR) & Ultraviolet-Visible (U.V.-Vis) Spectroscopic Studies on Curcuma Caesia (Kali Haldi)

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ABSTRACT

The objective of this study was to produce the rhizome of Curcuma caesia's ultraviolet-visible (UV-VIS) and Fourier transform infrared (FTIR) spectrum profiles. For the proximate analysis, the extracts were examined in both visible and ultraviolet light. The C. caesia crude extracts. Using a Perkin Elmer spectrophotometer, the rhizome was scanned at wavelengths between 200 and 800 nm, revealing the characteristic peaks. A Perkin Elmer spectrophotometer system was used for the FTIR method, which was used to identify the characteristic peak values and their functional groups. The C. caesia UV-VIS profile. The rhizome methanolic extract had absorption values of 0.617, 1.235, and 0.557, respectively, at peaks at 256.00 nm, 288.00 nm, and 330.00 nm. The FTIR range was utilized to distinguish the useful gathering of the bioactive parts in light of various pinnacle values in the locale of infrared radiation. The current study's findings confirm the presence of the pyrocatachol derivative.

Keywords: Curcuma caesia, Ultraviolet-visible, Fourier transform infrared.

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Received 10 August 2022, Accepted 20 October 2022

Please cite this article as: Shrivastava N *et al.*, Fourier Transform Infrared (FT-IR) & Ultraviolet-Visible (U.V.-Vis) Spectroscopic Studies on Curcuma Caesia (Kali Haldi). American Journal of PharmTech Research 2022.

INTRODUCTION

Majority of world's population depends on traditional medicine for primary healthcare. Plants have been extensively used as a rich source of medicine [1,2]. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body. The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids, and phenolic compound [3]. Therefore, the analysis of these bioactive constituents would help in determining various biological activities of plants. The determination of phytoconstituents is largely performed by relatively expensive and often laborious techniques such as gas and liquid chromatography combined with specific detection schemes [4,5]. However, simple, cost-effective and rapid tests for detecting phytocomponents are necessary. Spectroscopic ultraviolet-visible, Fourier transform infrared (UV-Vis, FTIR) methods together or separate can be used in this sense as well as conventional methods [6,7]. The FT-IR has proven to be a valuable tool for characterization and identification of compounds or functional groups (chemical bonds) present in an unknown mixture of plants extract [8,9]. UV-Vis spectrophotometry related to the spectroscopy of photons in the UV-visible region. UV-Vis spectroscopy uses light in the visible ranges or its adjacent ranges. The color of the chemicals involved directly affects the absorption in the visible ranges. Molecules undergo electronic transitions in these ranges of the electromagnetic spectrum [10].

The genus Curcuma, a member of the Zingiberaceae family, comprises of 80 species, some of which have been used in traditional systems of medicine (Ayurveda, Siddha, Unani) for a long time [11]. Curcuma caesia Roxb. (Zingiberaceae), called the black turmeric in English, is a perennial herb found throughout the Himalayan region, North-East and Central India. The rhizomes are used in the treatment of hemorrhoids, leprosy, asthma, cancer, epilepsy, fever, wound, vomiting, menstrual disorder, smooth muscle relaxant activity[12]. In addition to this the Preliminary phytochemical screening of crude methanol extract of C. caesia demonstrated strong positive test for phenol, flavonoids and tannin, additionally, alkaloids and saponins were also present [13]. With this knowledge, the present research work was aimed to produce the UV-VIS and FTIR spectrum profile of C. caesia rhizome extract.

MATERIALS AND METHOD

Collection of Plant Material

The rhizomes of Curcuma were collected from Medicinal Garden Apex University Jaipur. All the plant materials were further identified in the Department of Pharmacognosy, Apex University Jaipur Rajasthan, India.

Preparation of Extract

The rhizomes were cut into pieces, and air dried at room temperature. The dried rhizomes were coarsely powdered and successfully extracted with methanol using soxhlet extractor at a temperature of 55-60°C for a period of 7-8 hrs [11]. The solvents was distilled off at lower temperature under reduced pressure and concentrated to dryness (crude extract). The dried extract was weighed and then stored in a freezer.

UV-VIS AND FTIR SPECTROSCOPIC ANALYSIS

The extracts were examined under visible and UV light for proximate analysis. For UV-VIS and FTIR spectrophotometer analysis, the extracts were centrifuged at 3000 rpm for 10 min and filtered through Whatman No. 1 filter paper. The extracts were scanned in the wavelength ranging from 200 to 800 nm using Perkin Elmer Spectrophotometer and the characteristic peaks were detected. FTIR analysis was performed using Perkin Elmer Spectrophotometer system, which was used to detect the characteristic peaks and their functional groups. The peak values of the UV-VIS and FTIR were recorded. Each and every analysis was repeated twice for the spectrum confirmation.

RESULTS AND DISCUSSION

Quantitative Spectrophotometric Analysis

The UV-VIS profile of plant extract was taken at the 200 to 800 nm wavelength due to the sharpness of the peaks and proper baseline. The profile showed the peaks at 256.00 nm, 288.00 nm and 330.00 nm with the absorption 0.617, 1.235 and 0.557 respectively

(Figure 1, and Table 1).

The FTIR spectrum was used to identify the functional group of the active components based on the peak value in the region of infrared radiation. The results of FTIR peak values and functional groups were represented in (Figure 2, and Table 2). When the rhizome extract was passed into the FTIR, the functional groups of the components were separated based on its peaks ratio. The results of FTIR analysis confirmed the presence of phenol, cycloalkane, alkene, aromatic compound.

Hence, the crude extracts subjected to UV-VIS and FTIR analysis is used for the identification of chemical constituents present in C. caesia In addition, UV-VIS and FTIR spectroscopy is proved to be a reliable and sensitive method for detection of bio molecular composition.

Table 1: UV-VIS peak values of extracts of *C. caesia* rhizome.

Wavelength (nm)	Absorption
256.00	0.617
288.00	1.235
330.00	0.557

UV-VIS=Ultraviolet-visible, *C. caesia=Curcuma caesia*

Table 2: FTIR peak values of extracts of *C. caesia* plant.

Frequency (cm^{-1})	Inference
3474.78	OH str.
2927.91, 2855.77	CH str.
1636.99	C=C str.
724.57	Out of plan bending of aromatic H

FTIR=Fourier transform infrared, *C. caesia=Curcuma caesia*

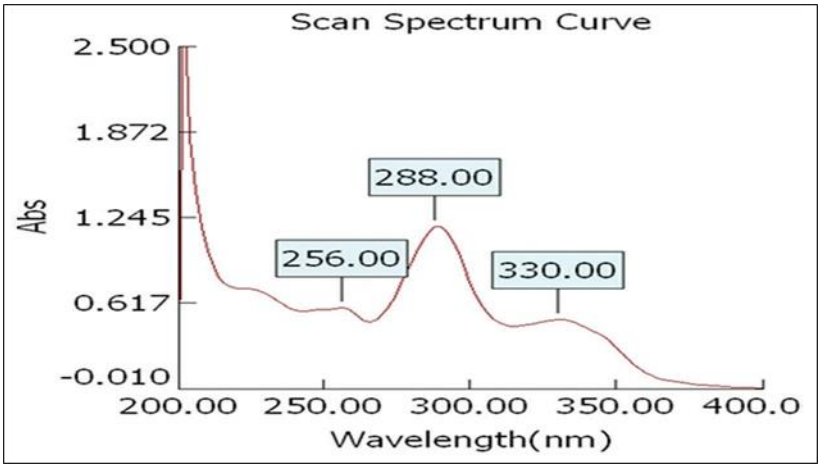

Figure 1: Ultraviolet-visible spectrum of extract of Curcuma caesia rhizome.

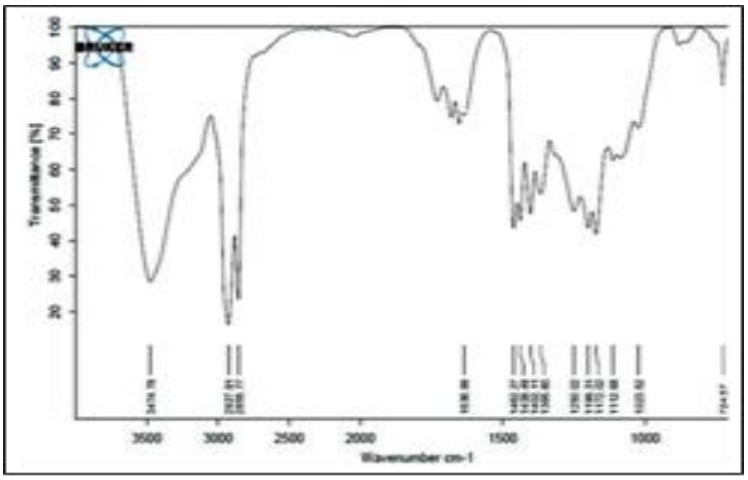

Figure 2: Fourier transform infrared spectrum of extract of Curcuma caesia rhizome

CONCLUSION

Spectroscopic methods have become a powerful tool for secondary metabolite profiling as well as for qualitative and quantitative analysis of the pharmaceutical and biological materials. The

previous research have showed the main constituents of C. caesia are flavonoids and tannin, additionally, alkaloids and saponins were also present [14]. All the earlier reports have focused on the isolation of essential oil from the leave and rhizome. However, the isolation of pyrocatechol derivative from the rhizome of the C. caesia is not reported. Analysis of the methanolic extract of C. caesia rhizome under FTIR and UV-VIS spectroscopic technique showed that the presence of phenol which can be isolated and further screened for different kind of biological activities depending their therapeutic uses Further research will be needed for the structure characterization of isolated phenol compound by use of different analytical methods such as NMR and mass spectrophotometer.

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