ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 9, Issue 3, 2016

Online - 2455-3891
Print - 0974-2441

Research Article

ULTRAVIOLET - VISIBLE AND FOURIER TRANSFORM-INFRARED SPECTROSCOPIC STUDIES ON *DRYNARIA QUERCIFOLIA* L. RHIZOME

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Received: 05 December 2016, Revised and Accepted: 27 January 2016

ABSTRACT

Objective: The present study has been designed to produce ultraviolet-visible (UV-VIS) and Fourier transform-infrared (FT-IR) spectrum profile of rhizome of *Drynaria quercifolia*.

Methods: The methanol extract was examined under visible and UV light for proximate analysis. The extract was scanned in the wavelength ranging from 100 to 1100 nm. FT-IR spectrum was also used to identify the functional groups of active components based on their peak values in the region of infrared radiation.

Results: The result showed the peaks at 279 and 214 nm with the absorption 0.921 and 2.607, respectively. The result of FT-IR profile confirmed the presence of amines, alkanes, denatured amines, alkynes, carboxylic acids, alkenes, alkanes and alkenes which shows the peaks at 3436, 2197, 2360, 2125, 1772, 1626, 1447 and 815, respectively.

Conclusion: The results of our study generated the UV-VIS and FT-IR spectrum profile of medicinally important plant *D. quercifolia*. In future, it can be used in the pharmaceutical industry for treating various diseases.

Keywords: Active components, *Drynaria quercifolia*, Fourier transform-infrared spectrum, Functional groups, Ultraviolet - visible spectrum.

INTRODUCTION

The phytochemicals are naturally occurring, biologically active chemical compound in plants, which act as a natural defense system for lost plants and provide color, aroma and flavor; they have great potential in treating human disease such as cancer, coronary heart disease, diabetes, and infectious diseases [1,2]. Therefore, the analysis of these constituents would help in determining various biological activities of plants. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for the new drug [3].

A variety of techniques can be used to determine and estimate the presence of such phytoconstituents in medicinal plants. Chromatography and spectroscopic techniques are the most useful and popular tools used for this purpose. The determination of phytoconstituents is largely performed by relatively expensive and often laborious techniques such as gas chromatography and liquid chromatography combined with specific detection schemes or liquid scintillation counting, nuclear magnetic resonance, and erythrocyte sedimentation rate [4,5]. However, simple, cost-effective, and rapid tests for detecting phytocomponents are necessary. Spectroscopic (UV-VIS, fluorescence, FT-IR) methods together or separate can be used in this sense as well as conventional methods [6-9,10-15].

UV-VIS spectrophotometer related to the spectroscopy of photons in the UV-VIS 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 [16]. 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 [9,13]. It is a rapid, non-destructive technique with minimum sample preparation necessary [17]. It allows the qualitative determination of organic compounds as the appearance of the bands in the infrared spectrum at a specific frequency, which is further influenced by the surrounding functional groups [18]. Hence, the present study has been designed to study the UV-VIS and FT-IR profile of the rhizome of *Drynaria quercifolia.*

D. quercifolia (Family: Polypodiaceae) is an epiphytic fern, is used in the medicinal system by different groups of people to treat various kinds of health problems including urinary tract infection [19]. The rhizome paste is applied for the treatment of diarrhea, typhoid, cholera, chronic jaundice, fever, and headache and skin diseases. The whole plant are anthelmintic, expectorant and tonic [20,21]. The rhizome is also reported to have anti-fertility [22], anti-inflammatory [23] and antipyretic [24], antimicrobial [25] and antiulcer [26] properties. Various phytochemicals such as friedelin, epifriedeinol, β amyrin, β-sitosterol, 3-β-glucopyranoside, and naringin have been isolated from the plant [27].

METHODS

Collection of plant material

The rhizome of *D. quercifolia* Linn. was collected from Kollimalai, Namakkal district, Tamil Nadu, India. The collected samples were carefully kept in polythene bags. These plant samples were authenticated by Dr. S. Johnbritto, The Director, The Rabinet Herbarium Centre for Molecular Systematic, St. Joseph's College, Tiruchirappalli, and a voucher specimen was deposited in the Department of Biochemistry, STET Women's College, Mannargudi (Voucher No:001).

Processing and preparation of plant extract

The rhizome is covered with small brown-colored hair like structures. They were removed using sterile scalpel and washed with sterile distilled water. They were cut into small pieces and shade dried and made into coarse powder, using blender, and stored in air tight containers. 50 g rhizome powder of *D. quercifolia* was weighed and macerated in methanol in the ratio of 1:6. They were kept at room temperature

for 72 h. The mixture was stirred every 24 h using a sterile glass rod. Then it was filtered through the Whatmann No: 1 filter paper. The extraction procedure was done further twice for complete extraction of bioactive compounds. The obtained filtrate was combined together and concentrated in vacuum using rotary evaporated. The dried residue was used for spectrum analysis.

Spectroscopic analysis

Spectroscopic analysis such as UV-VIS and FT-IR was performed in the methanol extract of *D. quercifolia* rhizome. To detect the UV-VIS spectrum profile, the extract was scanned with the wavelength ranging from 100 to 1100 nm by using lamda 35 model spectrum. FT-IR analysis was also performed to detect the characteristic peaks and their functional groups using Perkin Elmer Spectrophotometer system at the range of 400 to 4000/cm. Peak values for both UV-VIS and FT-IR were recorded [28].

RESULT AND DISCUSSION

By using FT-IR, we can confirm the functional constituents present in the plant extract, and identify the medicinal materials from the adulterants and even evaluate the qualities of medicinal materials [29]. Both UV-VIS and FT-IR spectroscopy are proved to be a reliable and sensitive method for detection of biomolecular composition [30]. In the present study, UV-VIS spectrum profile of methanol extract of *D. quercifolia* rhizome was taken at the wavelength of 100-1100 nm due to sharpness and proper baseline. The result profile showed the peaks at 214 and 279 nm with the absorption of 2.60 and 0.92, respectively. FT-IR spectrum was used to identify the functional group of active components present in the extract. The result profile showed the presence of amines (C-N str), alkanes (C-H ben), denatured amines, alkynes (C=C str), carboxylic acids (C-O str, OH str, and C=O str), alkenes (C-H ben) alkanes (C-H ben) and alkenes (C-H ben) at the peak value 3436, 2917, 2360, 2125, 1722, 1626, 1447 and 815, respectively (Fig. 1 and 2, Tables 1 and 2).

Alkynes have been isolated from a wide variety of plant species, fungi, corals, bacteria, marine sponges. Some pharmaceuticals are also alkynes such as the contraceptive norethynodrel. Some acids like tartaric acid contain alkynes. Alkynes are highly bioactive nematicides. They possess antifungal, antitumor, and antiviral properties [31]. The alkanes are found in the plant cuticle and epicuticular wax of many species. They protect the plant against water loss, prevent the leaching of important minerals by rain and protect against micro-organisms and harmful insects [32]. Alkenes are important in the manufacture of plastics, e.g., polythene and as fuel and illuminant. They serve as raw materials for the manufacture of alcohols and aldehydes. They are used for artificial ripening of fruits, a general anesthetic, making poisonous mustard gas and ethylene-oxygen flame. Amines and amides are the main groups of protein synthesis. Carboxylic acids are biologically very important in the formation of fat in the body and act as strong antibacterial agents. They serve as main pharmaceutical products in curing ulcers, jaundice, headache, fever, pain in liver, wound in cattle, treatment of edema and rheumatic joint pains. Aldehydes are used in the production of resins when combined with phenols [33].

CONCLUSION

The results of the present study showed that *D. quercifolia* rhizome displayed novel phytochemical markers which can be isolated and to check their quality and identity. Hence, further advanced analytical techniques are needed for the structural elucidation and identification of compounds.

ACKNOWLEDGMENT

The authors are thankful to ACIC, St. Joseph College, Tiruchirappalli, for providing infrastructure facility to carry out this work successfully.

Table 1: UV-VIS spectrum of rhizome extract of *Drynaria quercifolia* L.

Wave length (nm)	Absorption
279.76	0.92186
214.00	2.6079

D. quercifolia: Drynaria quercifolia, UV-VIS: Ultraviolet - visible

Table 2: FT-IR spectrum of rhizome extract of *Drynaria quercifolia* L.

Peak value	Functional groups
3436	Amines
2917	Alkanes
2360	Denatured amines
2125	Alkynes
1722	Carboxylic acids
1626	Alkenes
1447	Alkanes
815	Alkenes

FT-IR: Fourier transform-infrared

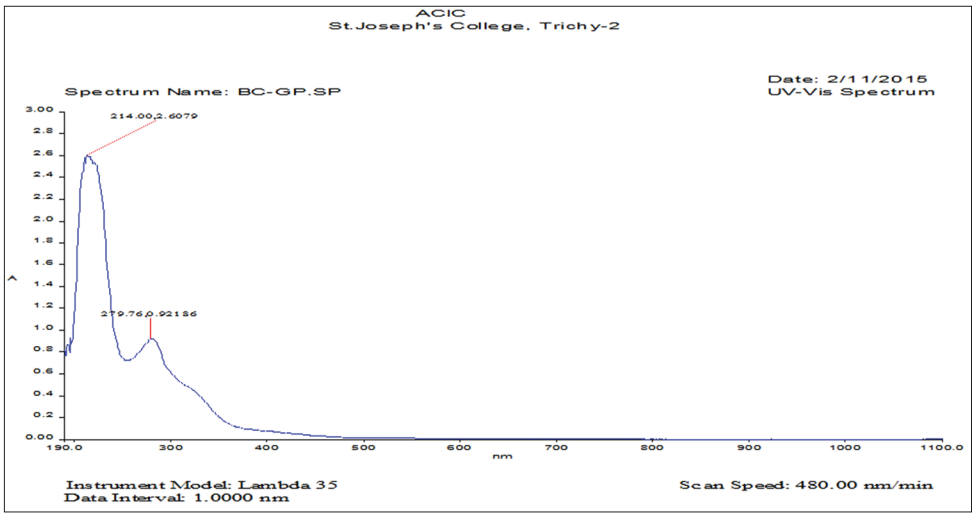

Fig. 1: Ultraviolet-visible spectrum of rhizome extract of *Drynaria quercifolia L.*

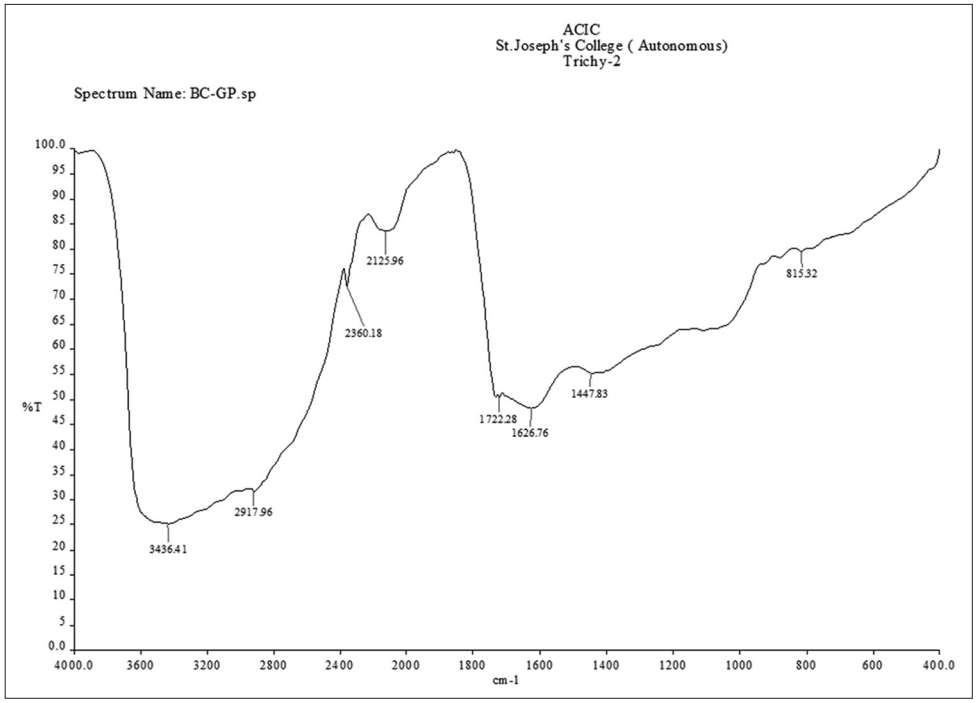

Fig. 2: Fourier transform-infrared spectrum of rhizome extract of *Drynaria quercifolia* L.

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