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INTERPRETATION OF HYDROALCOHOLIC (50%-50%) EXTRACT OF HARITAKI (*TERMINALIA CHEBULA* RETZ.) FRUIT PERICARP POWDER BY FOURIER TRANSFORM INFRARED SPECTROSCOPY

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ABSTRACT

Approximately 347 million people are diabetic worldwide, among which 90% are suffering with Type 2 diabetes mellitus. In 2011, India had 62.4 million people with Type 2 diabetes, compared with 50.8 million the previous year, according to the International Diabetes Federation and the Madras Diabetes Research Foundation. It has also been reported by the WHO that in 2014, the global population suffering from diabetes is 9% among adults aged 18 and more years (Singh *et al.*). Our aim was launched to explore the possibility of a better control over diabetes by *Haritaki* (*Terminalia chebula* Retz.) fruit pericarp powder. Thus, the present study is focused to Interpret Hydroalcohalic (50%-50%) extract of *Terminalia chebula* Retz. fruit pericarp powder by Fourier transform infrared spectroscopy as well as to identify the contained phytoconstituents. For sample characterization we used Fourier transformed infrared (FT–IR) spectrometer (Perkin Elmer spectrum 65, FT–IR spectrometer; Perkin Elmer). FT-IR was in mid infrared region 4000-400 cm^{-1} was used to discriminate and to identify various functional groups present in *Haritaki*. FT–IR spectra showed the presence of various characteristic functional groups of different phytoconstituents present in it.

KEYWORDS: Diabetes mellitus, Fourier transform infrared spectroscopy, *Haritaki*, phytoconstituents.

INTRODUCTION

Approximately 347 million people are diabetic worldwide, among which 90% are suffering with Type 2 diabetes mellitus. In 2011, India had 62.4 million people with Type 2 diabetes, compared with 50.8 million the previous year, according to the International Diabetes Federation and the Madras Diabetes Research Foundation. It has also been reported by the WHO that in 2014, the global population suffering from diabetes is 9% among adults aged 18 and more years. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs especially the eyes, nerves, kidneys, heart, and blood vessels (Guideline for Type 2 diabetes mellitus ICMR publication). *Ayurveda* is being used since a long time ago for curing of many of the diseases and as well as it has treated people suffering from *madhumeha*.[1]

Infra-red spectrum is an important record which gives sufficient information about the structure of a compound. Unlike ultraviolet spectrum which comprises of relatively few peaks, this technique provides a spectrum containing a large number of absorption bands from which a wealth of information can be derived about the structure of an organic compound. The absorption of Infra-red radiations (quantised) causes the various bands in a molecule to stretch and bend with respect to one another.[2]

MATERIAL AND METHODS

A variety of techniques can be used to determine and estimate the presences of phytoconstituents in medicinal plants. Spectroscopic methods have been firmly established as a key technological platform to identify and to characterize the biomolecules presents in medicinal plants. The phytoconstituents always resemble their fingerprints (unique signature) under spectroscopic characterizations *viz.* UV-Vis, Photoluminescence, FT-IR and Raman studies.[3] The present study is focused to Interpret Hydroalcohalic (50%-50%) extract of *Terminalia chebula* Retz. fruit pericarp powder by Fourier transform infrared spectroscopy as well as to identify the contained phytoconstituents. For sample characterization we used Fourier transformed infrared (FT–IR) spectrometer (Perkin Elmer spectrum 65, FT–IR spectrometer; Perkin Elmer). FT-IR was in mid infrared region 4000-400 cm^{-1} was used to discriminate and to identify various functional groups present in *Haritaki*.

Principle of Infra-red Spectroscopy

The absorption of Infra-red radiations causes an excitation of molecule from a lower to the higher vibrational level. We know that each vibrational level is associated with a number of

closely spaced rotational levels. Clearly, the Infra-red spectra is considered as Vibration-rotational spectra. All the bonds in a molecule are capable of absorbing infra-red energy but only those bonds which are accompanied by a change in dipole moment will absorb in the infra-red region. On the other hand, the vibrational transitions which are not accompanied by a change in dipole-moment of molecule are not directly observed and these are infra-red inactive. It is important to note that since the absorption in infra-red region is quantized, a molecule of the organic compound will show a number of peaks in the infra-red region.[5]

Description

Haritaki (*Terminalia chebula* Retz.) is a moderate sized or large deciduous tree, attaining 25-30m in height. The youngest leaves with soft, shining, generally rust-coloured hairs, 7-20cm x 4-8cm, glabrous when mature, not clustered, distant, alternate or sub opposite, elliptic-oblong, acute, rounded or cordate at the base, penninerved, petioles 2-5 cm Long, pubescent, usually with glands near the top. Flowers all hermaphrodite 4 mm across sessile, dull-white or yellow, an offensives smell. Bark 6mm thick, dark brown with many generally shallow vertical cracks. Flowers appear from April-August and fruits ripen from October-January. Intact fruit yellowish-brown, ovoid, 20-35 mm long, 13-25 mm wide, wrinkled and ribbed longitudinally, pericarp fibrous, 3-4 mm thick, non-adherent to the seed, taste, astringent[5].

Collection, Identification and Extraction of Fruit pericarp

- The total amount of *Haritaki* was purchased from the vicinity of Varanasi (Mohanlal Rajnish kumar shop, Goladinanath, Varanasi).
- Drug was identified by Prof. K.N. Dwivedi (Professor) and Dr. B. Ram (Associate Professor), department of *Dravyaguna*, faculty of *Ayurveda*, IMS, BHU.
- Sample of collected raw drug was kept in the museum of the department of *Dravyaguna*, faculty of *Ayurveda*, IMS, BHU, with specimen accession number DG/17/135.
- Hydro-Alcoholic (50%-50%) extract of air dried 100 gm coarse powder of the fruit pericarp of *Haritaki* was extracted by Soxhlet apparatus with Ethanol : Distilled water (1:1) and continuous heat for 40 hours. The extract was concentrated to get dry residue and weighed[6]. This extract was used for subsequent study.

Fig. 1: Dried Fruits. **Fig.2: Extract.**

Sample characterization

For sample characterization we used Fourier transformed infrared (FT–IR) spectrometer (Perkin Elmer spectrum 65, FT–IR spectrometer; Perkin Elmer). FT-IR in mid infrared region 4000-400 cm^{-1} was used to discriminate and to identify various functional groups present in *Terminalia chebula* Retz.

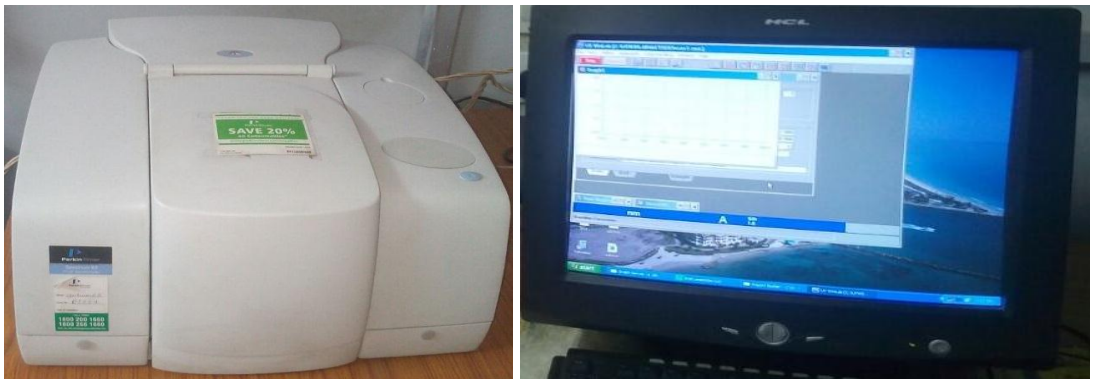

Fig.3: Fourier Transformed Infrared Spectrometer.

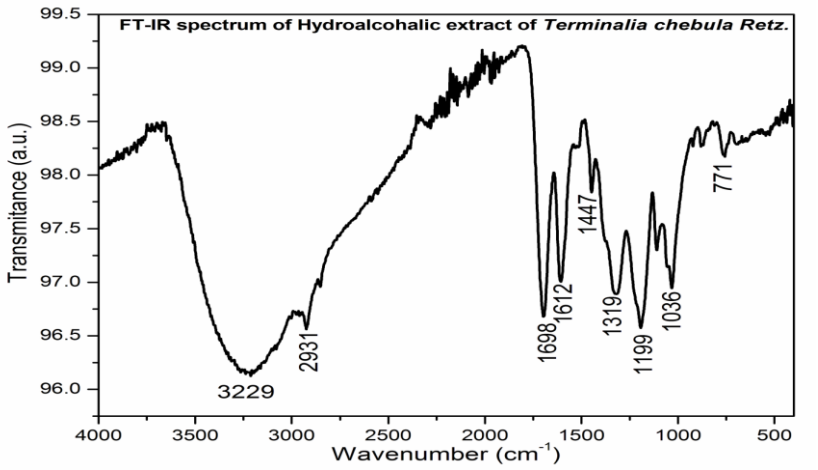

Fig. 4: FT-IR spectrum of hydro-alcoholic extract of *Terminalia chebula* Retz.

Peak positions in wave number (cm^{-1}) with assignments

Peak positions in wave number (cm^{-1})	Assignments
3229	Stretching mode of O-H (water/Alcohol/ flavonoids/ tannins etc.)
2931	ν (C-H) stretching mode
1698	C=O (amide I) vibration
1612	C=C stretching
1447	C-H bending mode of lignin / Carboxylic acid
1319	Bending mode of O-H
1199	Still remained unassigned
1036	Carbon ring in cyclic compounds
771	C-H out of plane bending vibrations

RESULTS AND CONCLUSION

The results obtained in FT–IR spectra showed the presence of various characteristic functional groups of different phytoconstituents present in *Terminalia chebula* Retz. IR active absorption bands of *Terminalia chebula* Retz. are enlisted along with their assignments in fig. 4. Absorption bands at 3229 cm^{-1} may be present due to stretching mode of O-H of water / Alcohol / flavonoids/ tannins etc.). However, absorption at 2931 cm^{-1} are due to V (C-H) stretching mode. The Strongest band at 1698 may be due to C=O (amide I) vibration. The absorption bands at 1612 cm^{-1} is due to C=C stretching. A weak absorption peak appearing at 1447 cm^{-1} is due to C-H bending mode of lignin / carboxylic acid. A strong band at 1319 cm^{-1} is recorded due to bending mode of O-H. Strong band at 1199 cm^{-1} is still unassigned. The absorption peak at 1036 cm^{-1} is noticed due to carbon ring in cyclic com. A weak peak at 771 cm^{-1} appears due to C-H out of plane bending vibrations.

Hence UV-Vis. Spectroscopy and FT-IR spectroscopy of hydro-alcoholic extract of *Haritaki* (*Terminalia chebula* Retz.) supports the phytochemical study of extract i.e. presence of tanic acid, flavonoids, chebulic acids, proteins. For more explanation further study is required.

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