



PHYTOCHEMICAL SCREENING AND FOURIER TRANSFORM INFRARED (FTIR) SPECTROSCOPY OF *AVERRHOA BILIMBI* FRUIT POWDER

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Abstract

The present study was aimed to analyse the *A. bilimbi* fruit powder through preliminary phytochemical analysis and Fourier transform infrared (FTIR) spectroscopy. Qualitative preliminary phytochemical investigation of *A. bilimbi* fruit revealed the presence of tannins, saponins, flavonoids, glycosides, triterpenes, phenols, diterpenes and steroids. The FTIR spectrum confirmed the presence of alcohols, phenols, alkanes, alkenes, amines, amides, carboxylic acids, esters, and ether in *A. bilimbi* fruit powder.

Key words: Phytochemical analysis, Fourier transform infrared, Spectroscopy, *Averrhoa bilimbi*

Medicinal plants are the reservoirs of phytochemicals which are chemically and taxonomically extremely diverse compounds and these includes phenolic compounds, tannins, alkaloids, saponins, carbohydrates, terpenoids, steroids and flavonoids. These are derived from barks, leaves, flowers, roots, fruits

and seeds. Knowledge of the phytochemical constituents is desirable because these compounds could serve as lead for future drug development.

Fourier transform-infrared spectroscopy (FTIR) is an analytical technique for detecting functional groups and identifies chemical bonds by producing an infrared absorption spectrum. The spectra produce a profile of the sample, a distinctive molecular fingerprint that can be used to screen and scan samples for many different components.

A. bilimbi Linn. commonly known as bilimbi / irumbanpuli is a small-sized tropical tree belonging to oxalidaceae family. The bilimbi fruit is 5 to 10 cm long, nearly cylindrical and tipped with 5 hair-like floral remnants at the apex. The fruits of the *A. bilimbi* were used in folklore to control obesity and diabetes in some villages in India. It is known to possess antibacterial, antiscorbutic and astringent properties. *A. bilimbi* has been widely used in the treatment of fever, mumps, pimples, itches, boils, rheumatism, cough, syphilis, scurvy,

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whooping cough and hypertension (Gohet *al.*, 1995). In spite of the numerous medicinal uses attributed to this plant, review of the literature revealed that the scientific data on the assessment of bioactive compounds present in *A. bilimbi* is limited.

Hence in the present study, preliminary phytochemical analysis and Fourier transform infrared (FTIR) spectroscopy were carried out in *Averrhoa bilimbi* fruit powder.

Materials and Methods

Preparation of fruit powder of *A. bilimbi*

The fresh fruits of *A. bilimbi* (Irumbanpuli) were collected locally from Thrissur district and were authenticated by taxonomist of St. Thomas, College, Thrissur and deposited the voucher specimen. The fruits were cut into small pieces and shade dried. The dried fruit pieces were pulverized to obtain the fruit powder. and

Phytochemical screening

The fruit powder of *A. bilimbi* was tested for the presence of various active chemical constituents namely steroids, alkaloids, tannins, phenolic compounds, flavonoids, diterpenes, triterpenes and saponins (Harborne, 1991).

Fourier transform infrared (FTIR) spectroscopy

Functional groups present in *A. bilimbi* fruit were identified using Fourier transform infrared (FTIR) spectroscopy (Perkin Elmer, FTIR spectrophotometer). Weighed 1mg of *A. bilimbi* fruit powder and 199 mg of dry fine powder of potassium bromide (KBr) and were transferred into a mortar and mixed well. The KBr sample mixture was transferred to a die that has a barrel diameter of 13 mm and the die was pressed at around 10 tons for one to two minutes in a press. Re-crystallization of the KBr results in a clear glassy disk about 1 mm thick and the infrared spectrum was recorded in the scan range from 4000 cm^{-1} to 400 cm^{-1} on FTIR spectrophotometer with a resolution of 0.5 cm^{-1} (Perumal, and Gopalakrishnan, 2012).

Results and Discussion

The preliminary phytochemical analysis was carried out in the *A. bilimbi* fruit powder to detect the presence of various active principles and the results are tabulated in table 1.

The preliminary phytochemical investigation of *A. bilimbi* fruit revealed the presence of tannins, saponins, flavonoids, glycosides, triterpenes, phenols, diterpenes and steroids which is in accordance with the results of Hasanuzzaman *et al.* (2013) who reported the presence of phytochemical constituents such as alkaloids, tannins, saponins, flavonoids, cardiac glycosides, triterpenes, phenols, carbohydrate and the absence of phytosterols in *A. bilimbi* fruit. The authors also stated that the presence of phenols, flavonoids and tannins is responsible for the free radical scavenging effects observed by the fruit.

Wahabet *al.* (2009), Karonet *al.* (2011) and Patilet *al.* (2013) also reported the presence of flavonoids, saponins, tannins and terpenes in the fruit powder of *A. bilimbi*.

The characteristic absorption band exhibited at 3424.28 cm^{-1} corresponds to O-H group of phenols. These absorption bands are characteristic for flavonoids and its derivatives. The band at 2926.89 cm^{-1} and 1402.75 cm^{-1} are due to the C-H stretching of carbon

Table 1. Phytochemical analysis of fruit powder of *A. bilimbi*

Active principle	Result
Steroids	Present
Alkaloids	Absent
Glycosides	Present
Phenolic compounds	Present
Tannins	Present
Flavonoids	Present
Diterpenes	Present
Triterpenes	Present
Saponins	Present

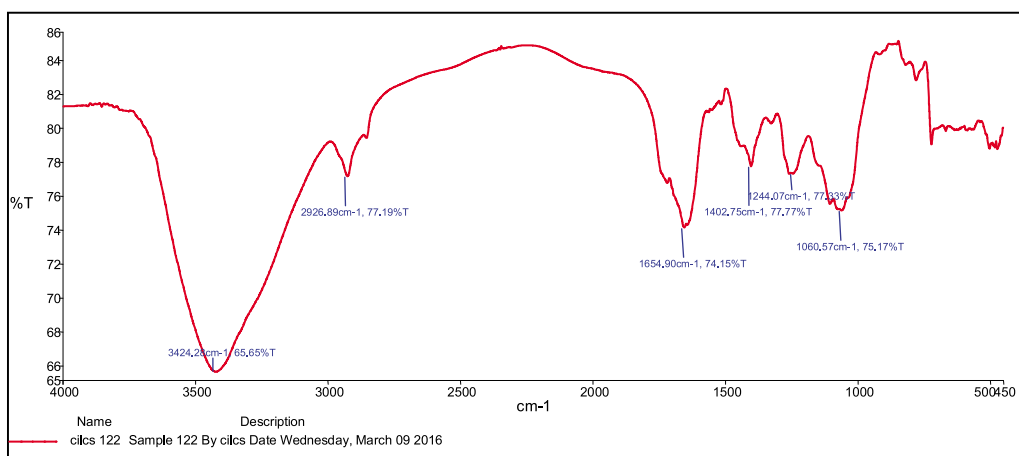


Fig 1. FTIR spectroscopy of *A. bilimbi* fruit powder

Fourier transform infrared spectroscopy is an important analytical tool for identifying functional groups of the phytochemicals as the wavelength of light absorbed is characteristic of the chemical bond present in the plant sample.

indicating the presence of alkanes. The bands between 3000 and 2800 cm^{-1} represent C-H stretching vibrations that are mainly generated by lipids arising from phospholipids, neutral lipids and partly from carbohydrates. (Wolkers *et al.*, 1995). The band at 1654.90 cm^{-1} is due to C=O stretching of amines. Infrared spectrum showing peaks at 1244.07 cm^{-1} corresponds to C-O stretching of aromatic ethers. The band at 1060.57 cm^{-1} is due to C-O bond of alcohols, carboxylic acids, ethers and esters.

These findings were similar to Mohamed *et al.* (2014) who obtained the FTIR spectra of freeze dried *A. bilimbi* fruit with characteristic absorption bands at 3420, 1661 and 1263 cm^{-1} . Isaac *et al.* (2013) observed that the FTIR spectra of the *A. bilimbi* fruit extract showed absorption bands at 3353, 1633, and

1225 cm^{-1} assigned to O-H stretching vibration of alcohols and phenols, C=O stretching of tertiary amines and C-O stretching of aromatic ethers.

The results of the present study generated the FTIR spectrum profile for the medicinally important plant *A. bilimbi* and can be used to identify the plant in the pharmaceutical industry.

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Table 2. Wave number (cm^{-1}) of dominant peak obtained from absorption spectra

Wave number (cm^{-1})	Bond	Functional Group
3424.28	O-H	Hydrogen bonded Alcohols, Phenols
2926.89	C-H	Alkanes
1654.90	C=C	Alkenes
1402.75	C-H	Alkanes
1244.07	C-N	Amines, Amides
1060.57	C-O	Alcohols, Carboxylic Acids, Ethers, Esters

Fourier transform infrared spectroscopy identified the functional groups present in the fruit powder of *A. bilimbi* fruit. The results of FTIR analysis confirmed the presence of alcohols, phenols, alkanes, alkenes, amines, amides, carboxylic acids, esters, and ether which showed major peaks at 3424.28, 2926.89, 1654.90, 1402.75, 1244.07 and 1060.57 cm^{-1} respectively (Fig. 1 and Table 2).

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