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Assessment of Functional Group in Herbal Formulation *Thathuviruthi Kuligai* through Fourier Transform Infrared Spectroscopy

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***Abstract*: *Background:* The *Thathuviruthi kuligai* is an herbal preparation used for the treatment of premature ejaculation, erectile dysfunction, oligospermia, asthenozoospermia and teratozoospermia. *Objective:* The objective of the present study is to characterize and assess the functional groups in the medicinal preparation "*Thathuviruthi kuligai*". *Materials and Methods:* The ingredients were collected & purified and the drug was prepared as per Siddha literature "*Noigalukana siddha parigaram part-2*". Here, the drug was subjected into characterization through FT – IR analysis. *Result:* FT – IR characterization shows that the presence of functional groups like O-H Stretch (Alcohol), N-H Stretch (Amines), C=C Stretch (Alkene), C=O Stretch (Carbonate ions), C-F Stretch (Alkyl & Aryl Halides), NO2 Stretch (Nitro compounds), C-Cl Stretch (Alkyl & Aryl Halides), C-H Bend (Alkene) and C-I Stretch (Alkyl & Aryl Halides) which ensure the efficacy and therapeutic effect of the drug. *Conclusion:* This study forms the base for the pharmaceutical analysis of *Thathuviruthi kuligai* which will be followed by safety and efficacy studies later.**

***Keywords*: FT–IR, *Thathuviruthi kuligai*, Siddha herbal formulation, Functional groups.**

1. Introduction

According to the Siddha system, the individual is a microcosm of the universe. The human body consists of the five primordial elements-earth, water, fire, air and space, the three humours-vatha, pitta and kapha and seven physical constituents. Food is the basic building material of the human body and gets processed into humours, tissues and wastes. The equilibrium of humours is considered as health and its disturbance or imbalance leads to a diseased state. is one of the most conservative medical systems in the world. In the field of medicine, Siddhars enlightened the world to save the human lives from various diseases. *Thathuviruthi kuligai* has been mentioned in Siddha texts for the management of Premature ejaculation, Erectile dysfunction, oligospermia, asthenozoospermia, and teratozoospermia.

Siddha Herbal formulations are gaining popularity worldwide due to the presence of nano and micro size particles which have properties like increased bioavailability, minimal side effect and longer shelf-life period and need less therapeutic dosage. Therapeutic activity of an herbal formulation depends on its phytochemical constituents. Standardization is a system that ensures a predefined amount of quantity, quality and therapeutic effect of ingredients in each dose. Standardization is an important step for the establishment of a consistent biological activity, a consistent chemical profile or simply a quality assurance program for the manufacturing of a herbal drug.

For the development of a new drug or the standardization of the traditional Siddha formulations through characterization, usage of modern sophisticated equipments is an emergency need to strengthen the field of Siddha Pharmacology. FT - IR is one of the important analytical techniques which is used to determine the organic compounds, including chemical bond, as well as organic content (eg., protein, carbohydrate and lipid). In this article the drug *Thathuviruthi kuligai* is subjected to access the functional groups present in the drug, with the help of FT – IR instrument.

2. Materials and Methods

In the present study, Siddha herbal preparation (*Thathuviruthi kuligai*) has been selected to establish its standardization status from the classical Siddha literature. The key ingredients used in the formulation were listed below. Purification and preparation of the *Thathuviruthi kuligai* was carried out as per classical text literature mentioned.

Ingredients of Drug:

Boomisarkarai kizhangu (Ipomoea batatas)
Poonaikali vithai (Mucuna pruriens)
Aadutheendapalai (Aristolochia bracteolata)
Cow milk – Q.S

Preparation:

Above mentioned herbals are purified, dried and powdered. Take Boomisarkarai kizhangu chooranam (35g), Poonaikali chooranam (35g), and Aadutheendapalai chooranam (17.5g) rubbed in kalvam with cow milk for 3 days and then made into pills of 5-10 grains. These are dried in the shade and bottled up.

Usage:

One pills taken twice a day for about 20 days.

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Indications:

Premature ejaculation, Erectile dysfunction, oligospermia, asthenozoospermia, teratozoospermia.

FT-IR Analysis:

FTIR (Fourier Transform Infra-red Spectroscopy) is a sensitive technique particularly for identifying organic chemicals in a whole range of applications although it can also characterise some inorganics. Examples include paints, adhesives, resins, polymers, coatings and drugs. FTIR is an effective analytical instrument for detecting functional groups. FTIR analysis was done at International Research Centre, Noble Research Solutions, Perambur, Chennai-11. IRTracer – 100 Fourier Transform Infrared (FTIR) Spectrophotometer was used to derive the FT – IR Spectra of *Thathuviruthi kuligai.*

It was the preferred method of infrared spectroscopy. FT-IR was an important and more advanced technique. It was used to identify the functional group, to determine the quality and consistency of the sample material and can determine the amount of compounds present in the sample. It was an excellent tool for quantitative analysis.[5]

Making a sandwich to prepare a powdered sample to IR analysis, firstly place a small amount of powder on the face of a highly polished salt plate (such as NaCl, AgCl or KBr), then place a second plate on top of the first plate so as to spread the powder in a thin layer between the plates, and clamps the plates together.[6]

In FT-IR, infrared was passed from a source through a sample. This infrared was absorbed by the sample according to the chemical properties and some are transmitted. The spectrum that appears denotes the molecular absorption and transmission. It forms the molecular fingerprint of the sample. Like the finger print, there were no two unique molecular structures producing the same infrared spectrum. It was recorded as the wavelength and the peaks seen in the spectrum indicates the amount of material present.[7]

3. Results

Sample –ID Thathuviruthikuligai – TVK

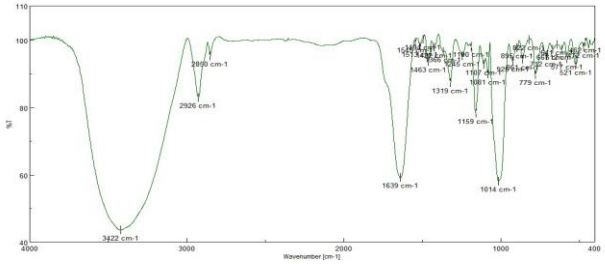

Fig. 1. FTIR spectra of PT

4. Discussion

In FT-IR spectra analysis, this sample *Thathuviruthi kuligai* exhibits the peak value at 3422, 2926, 1639, 1319, 1159, 1014, 779, 521, 462 having O-H stretch, R-COOH derivatives, C=N stretching vibration, NCO wagging, aromatic O-H deformation, C-O stretching, C-H vibration stretch, C-C vibration stretch, N=N bending vibration respectively. This peak indicates the presence of some organic functional groups such as alcohols, carboxylic acids, Nitriles, Isocyanate, Carboxylic acid, Alkynyl, Aldehyde, alkane, aromatic compounds, alkene and amine. These compounds have some pharmaceutical properties and are briefly discussed below.

Alcohol - Alcoholic group of substances acts as antimicrobial and antiseptic agents. It is also used as an antidote, disinfectant and an anti- inflammatory agent.

Carboxylic acids – They have anti-microbial activity.

Isocyanate-no medical uses.

Nitriles-Antidiabetic, Antipsychotic and anti-cancer activity.

Amines - Amines are inorganic derivatives of ammonia, they play a very significant role in the creating aminoacids. Amines have anti-microbial activity, anti-viral, anti-inflammatory activity.

Alkyne - It is a biological and chemical functional moiety found in numerous natural products. Alkyne derivatives have anti-fungal activity. They play an important role in pharmaceutical industry.

Aldehyde-Diarrhoea and common cold.

Alkane – It is used to enhance the antioxidant activity of the drug.

Aromatic compounds – they have anti-bacterial, anti-diabetic and anti-oxidant activity.

Alkene - This is used as a general anaesthetic. This is also used to prepare some organic compounds such as, ethyl alcohol, acetic acid and acetaldehyde.

Amine-This is used for analgesic, anesthetics and anti-cancer and Antipsychotic.

Anhydrides – they have anti-microbial activity.

Alkyl halides – Alkyl halides have little biological activity. They protect against bacteria and fungi.

Aryl halides – Several aromatic chloro compounds are used as insecticides, fungicides and bactericides.

5. Conclusion

The instrumental analysis FTIR shows the presence of functional groups through their stretch and bends which are responsible for its functional activity. It will be subjected to

Table 1
FTIR interpretation of PT

S. No.	Wave Number (cm^{-1})	Vibrational Modes of PT in IR Region	Functional groups
1	3422	O-H stretch	Alcohols
2	2926	R-COOH stretch	Carboxylic acid
3	1639	C=N stretch	Nitriles
4	1319	NCO stretch	Isocyanate
5	1159	Aromatic O-H stretch	Carboxylic acid
6	1014	C-O stretch	Alkynyl, Aldehyde
7	779	C-H stretch	Alkane, Aromatic compounds
8	521	C-C stretch	Alkene
9	462	N=N stretch	Amine

further many studies to validate its efficacy and safety through proper standardization procedure. Thus this drug can be taken to the next level of isolation of the active principles which is responsible for the therapeutic effect.

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