



## FTIR analysis on nilavembu kudineer churanam and acetominaphen

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### ABSTRACT

Spectroscopy is the study of the interaction between radiation (electromagnetic radiation, or light, as well as particle radiation) and matter. Spectroscopic methods are generally used to measure the energy difference between various molecular energy levels and to determine the atomic and molecular structures. Vibrational spectroscopy is of unique value as an analytical technique for quantitative determinations. In the present study FTIR (Fourier Transform Infra Red) technique is used for the analysis Nilavembu Kudineer Churanam and Acetominaphen and has been recorded in the region 4000-400  $\text{cm}^{-1}$ . The important vibrational assignments are discussed.

**Keywords:** FTIR, Nilavembu Kudineer Churanam, Acetominaphen.

### INTRODUCTION

Modern spectroscopic techniques find wide application in the field of pharmaceutical science. Vibrational spectroscopy has significant contributions towards the studies of structure and physico chemical properties of crystals and molecular system [1-3]. In the present study, a comparative study using FTIR spectroscopy has been applied to obtain the maximum amount of information from the vibrational spectra of Nilavembu Kudineer Churanam and Acetominaphen.

#### Chikungunya

Chikungunya (Makonde for "that which bends up") is an infection caused by the chikungunya virus. The disease features the sudden onset of fever two to four days after exposure. The fever usually lasts two to seven days, while accompanying joint pain typically last weeks or months but sometimes years. The mortality rate is a little less than 1 in 1,000, with the elderly or those with underlying chronic medical problems most likely having severe complications

The virus is passed to humans by two species of mosquito of the genus *Aedes*: *A. albopictus* and *A. aegypti*. Animal reservoirs of the virus include monkeys, birds, cattle, and rodents. This is in contrast to dengue, for which primates are the only hosts.

Chikungunya is a new emerging disease and it has not received sufficient coverage yet in the medical curricula of member states. Several indigenous drugs have been described in Siddha and Ayurveda for the management of inflammation, fever and other diseases. In the long term treatment of chronic disorders, like rheumatic diseases, combinations of different plants families and species active principles often exhibit remarkable potency and tolerance. It is well documented that the plant possessing anti-inflammatory property also having antipyretic and analgesic activities or vice versa. The nilavembu kudineer choornam (NKC) is a classical preparation used in the treatment of Chikungunya fever as Siddha medicine in Tamilnadu.

Currently, no specific treatment for chikungunya is available. Supportive care is recommended, and symptomatic treatment of fever and joint swelling includes the use of nonsteroidal anti-inflammatory drugs such as naproxen,

non-aspirin analgesics such as paracetamol (acetaminophen) and fluids. Aspirin is not recommended due to the increased risk of bleeding.

### 3. Dengu

Dengue fever is a disease caused by a family of viruses that are transmitted by mosquitoes. Symptoms include severe joint and muscle pain, swollen lymph nodes, headache, fever, exhaustion, and rash. The presence of fever, rash, and headache (the "dengue triad") is characteristic of dengue fever. The prevention of dengue fever requires control or eradication of the mosquitoes carrying the virus that causes dengue.

Nilavembu Kudineer Chooram is effective for all types of fever like malarial fever, chikungunya, Dengue Fever and fevers with shivering. Recently Government of Tamilnadu announced that, Nilavembu Kudineer Chooram is the best medicine for Dengue Fever.

### 4. Nilavembu kudineer

Nilavembu kudineer is a poly herbal formula controls all types of fever associated with body ache. It controls fever in a comprehensive way through its healing effects of temperature regulation, inflammation control and body pain relief. Synergistic action of this herbal combination relieves all types of fever irrespective of the type of causative organism. It exhibits potent antiviral activity against viruses causing Dengue and Chikungunya fever. It is also effective in fevers caused by infective organism such as Typhoid and Malaria. In fevers associated with inflammatory conditions such as abscess it counteracts with the inflammation and reduces body temperature.

#### *Actions of Nilavembu kudineer:*

- **Antipyretic-** Reduces fever and bring backs the normal body temperature
- **Anti-inflammatory-** controls infection caused by the pathogens.
- **Analgesic-** Relieves body aches.
- **Body cleansing-** Detoxes the blood, liver and spleen for pathogenic endotoxins.

#### **Ingredients**

##### **Equal parts of:**

- **Nilavempu** (*Andrographis paniculata*)
- **Vettiver** (*Vetiveria zizanioides*)
- **Vilamiccam ver** (*Vetiveria zizanioides*)
- **Cantanam** (*Santalum album*)
- **Peyputtal** (*Trichosanthes cucumerina*)
- **Koraik kilanku** (*Cyperus rotandus*)
- **Cukku** (*Zingiber officinale*)
- **Milaku** (*Piper nigrum*)
- **Parpatakam** (*Mollugo cerviana*)

#### **4.1 Direction to prepare Kashayam:**

Boil 12.5 gms (2 to 3 tsp Approx.) of powder with 250 ml of water till the decoction is concentrated to 60 ml. Take 30 to 60 ml of this warm decoction twice a day in empty stomach. Add honey or Palm jaggery or sugar candy to enhance the taste.

## **EXPERIMENTAL SECTION**

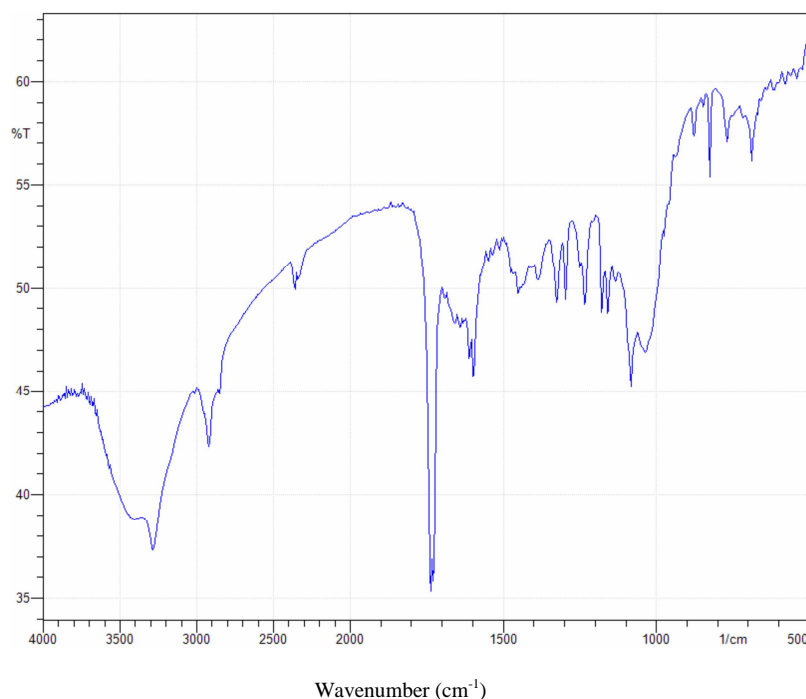
The commercial grade pure sample of Nilavembu Kudineer churnum is procured from Government Hospital, Cuddalore. The analytical grade pure sample of Acetaminophen is procured from Pharma analytical Lab, Puducherry. The FTIR spectrum of both the samples have been recorded in the region 4000 – 400  $\text{cm}^{-1}$  using ABB BOOMEN, series at Pharma analytical lab. The FTIR spectra of Nilavembu Kudineer Churnum and Acetaminophen are shown in Fig.1 and Fig.3 respectively. Also the vibrational band assignments of Nilavembu Kudineer Churnum and Acetaminophen are presented in Table 2 and 3 respectively.

## **RESULTS AND DISCUSSION**

### **6.1 FTIR analysis of Nilavembu Kudineer Churnum**

Infrared and Raman spectroscopic methods are being extensively used to identify the structural groups present in a compound. In analogy [4] with the vibrational band assignments of related compounds and relative intensities of the

bands, satisfactory vibrational frequency assignments have been made for the chosen compound. The observed frequencies along with the band assignments are summarized in Table 1.



**Fig.1 FTIR spectrum of Nilavembu Kudineer Churnum**

**Table 1 The vibrational band assignments of Nilavembu Kudineer Churnum**

Frequency (cm <sup>-1</sup> )	Bond	Functional group
3286	N-H stretch	Aliphatic amines
3014	C-H stretch	Aromatic
2920	C-H stretch	Alkanes
2852	C-H stretch	Alkanes
1738	C=O stretch	Alkyl esters
1728	C=O stretch	Aromatic esters
1657	C=N stretch	Aromatic
1598	C=C stretch	Aromatic
1441	C-H <sub>2</sub> bending	Aromatic bending
1389	N-O stretch	Aliphatic nitro group
1326	N-O stretch	Aliphatic nitro group
1296	C-N stretch	Aliphatic
1084	C-C stretch	Aromatic
877	C-H bending	Aromatic
826	C-H bending	Aromatic
769	C-Cl bending	Alkyl halides
689	C-Br bending	Alkyl halides
617	C-I bending	Alkyl halides

## 7. Acetaminophen

Acetaminophen (Paracetamol) is used to relieve mild to moderate pain from headaches, muscle aches, menstrual periods, colds and sore throats, toothaches, backaches, and reactions to vaccinations (shots), and to reduce fever. Acetaminophen may also be used to relieve the pain of osteoarthritis (arthritis caused by the breakdown of the lining of the joints). Acetaminophen is in a class of medications called analgesics (pain relievers) and antipyretics (fever reducers). It works by changing the way the body senses pain and by cooling the body. Acetaminophen comes in combination with other medications to treat cough and cold symptoms. Acetaminophen may also be used in combination with aspirin and caffeine to relieve the pain associated with migraine headache [5]. The molecular formula of Acetaminophen is C<sub>8</sub>H<sub>9</sub>NO<sub>2</sub>. The molecular structure is presented in Fig.2.

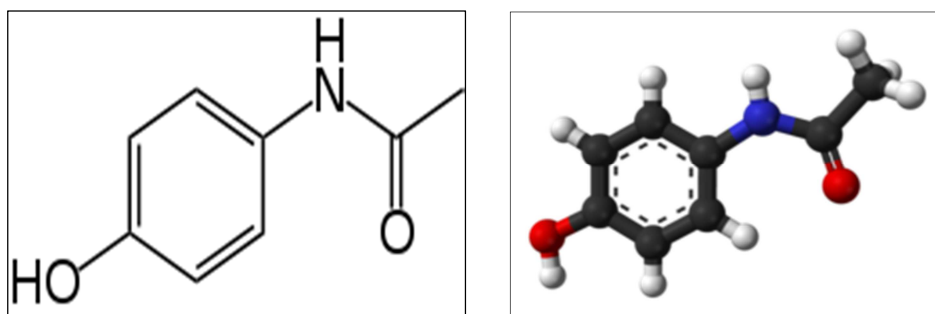


Fig.2.Molecular structure of Acetaminophen

## RESULTS AND DISCUSSION

### 7.1.1 Vibrational analysis of Acetaminophen

Based on the related structure of molecules, the vibrational band assignments have been made and the important vibrations are discussed as follows.

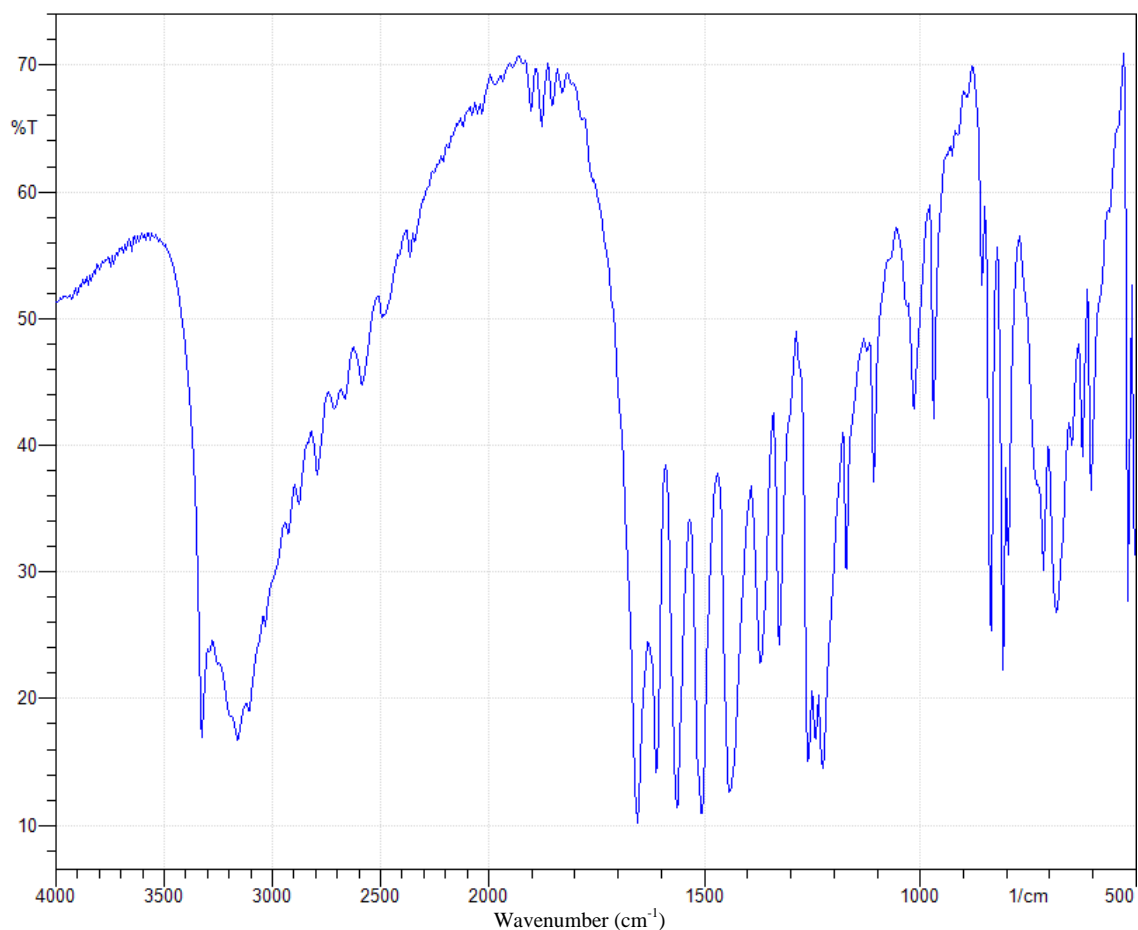


Fig.3 FTIR spectrum of Acetaminophen

#### *C-H Vibrations*

The heterocyclic aromatic compounds and its derivatives are structurally very close to benzene. The C-H stretching vibrations of aromatic and hetero aromatic structures occur in the region  $3000 - 3100 \text{ cm}^{-1}$ . This permits the ready identification of the structure. Further in this region, the bands are not much affected due to the nature and position of the substituents [6]. Neville and Shurvell [7] have identified the FTIR bands at  $3023$ ,  $3056$  and  $3073 \text{ cm}^{-1}$  in Fourier transform Raman and infrared vibrational study of Diazepam and four closely related 1,4-benzodiazepines due to the C-H stretching vibrations. Hence in the present investigation the band observed at  $3036 \text{ cm}^{-1}$  in the FTIR spectrum is due to the C-H stretching vibrations respectively.

*O-H Vibrations*

Alcohols and phenols, in vapour state or in dilute solution in non-polar solvents exhibit a sharp rather weak O-H stretching absorption due to non-bonded or free OH groups. These non-bonded O-H stretching bands appear near 3650  $\text{cm}^{-1}$  in alcohols and near 3600  $\text{cm}^{-1}$  in phenols. Inter - molecular hydrogen bonding increases as the concentration of the solute in solution increases and additional bands start to appear at lower frequencies near 3550-3200  $\text{cm}^{-1}$  at the expense of the free hydroxyl band [8]. Based on this in the present investigation the IR band observed at 3325  $\text{cm}^{-1}$  is assigned to O-H stretching vibrations.

*C-C vibrations*

Benzene has two doubly degenerate modes and two non-degenerate modes due to stretching of C-C bonds. The ring carbon-carbon stretching vibrations occur on region 1236 – 1091  $\text{cm}^{-1}$  in the FTIR spectrum. In the present case, the FTIR bands at 1171 and 1107  $\text{cm}^{-1}$  are assigned to C-C stretching vibrations respectively. They are in good agreement with the literature values [9].

*C-N Vibrations*

The identification of C-N stretching frequency is a very difficult task since mixing of bands is possible in this region. The C-N stretching absorption of primary aliphatic amines is weak and occurs in the region 1090 -1020  $\text{cm}^{-1}$ . The secondary aliphatic amines have two bands of medium intensity in the region 1190 -1170  $\text{cm}^{-1}$  and 1145-1130  $\text{cm}^{-1}$ . For aromatic and unsaturated amines, two bands are observed at 1360-1250  $\text{cm}^{-1}$  and 1280-1180  $\text{cm}^{-1}$ . Based on this in the present investigation the IR bands observed at 1259 and 1227  $\text{cm}^{-1}$  are assigned to C-N stretching vibrations. Similarly the other vibrations are assigned in the characteristic range.

**Table 2 Vibrational band assignments of Acetaminophen**

Frequency ( $\text{cm}^{-1}$ )	Vibrational band assignments
3325 (vs)	O-H stretching
3109 (vs)	N-H stretching
3036 (vs)	C-H stretching
2928 (vs)	CH <sub>3</sub> asymmetric stretching
2880 (vs)	CH <sub>3</sub> symmetric stretching
1655 (vs)	C=O stretching
1610 (vs)	C-C stretching
1564 (vs)	C-C stretching
1506 (vs)	C-C stretching
1441 (vs)	CH <sub>3</sub> asymmetrical bending
1369 (s)	C-O stretching/CH <sub>3</sub> symmetrical bending
1259 (s)	C-N stretching
1227 (s)	C- N stretching
1171 (s)	C-C stretching
1107 (m)	C-C stretching
1015 (m)	C-C-C in plane bending
968 (m)	C-H in plane bending
837 (m)	C-H out of plane bending
808 (m)	C-H out of plane bending
797 (s)	C-H out of plane bending
714 (s)	C-H out of plane bending
685 (m)	C-H out of plane bending
648 (m)	C-C-C out of plane bending
625 (m)	C-C-C out of plane bending
604 (m)	C-C-C out of plane bending

vs-very strong, s-strong, m-medium

**CONCLUSION**

Hence in the present investigation, the herbal powder Nilavembu Kudineer Churanum and Acetaminophen have been analysed using FTIR spectroscopy. The infrared spectroscopic analysis gives the information about the possible functional groups of chosen samples. FTIR spectroscopy is an important investigatory tool in the field of pharmaceutical science for the structural elucidation.

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