

Experimental Study on Plants Leaves to Identify Better Thermal Transmittance Properties

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ABSTRACT: Objective of our work is to identify the better Thermal transmittance properties from the plants leaves. For this work we used Fourier Transform Infra Red (FTIR) spectrometer and some plants leaves. The plants leaves transmittance properties and wave length derived from FTIR spectrometer is compared with the experimental results. We took plants leaves of Lawsonia Inermislinn, Ocimum tenuiflorum, Hibiscus cannabinus, Millettia Pinnata for our work. Experimental study was conducted with the help of experimental set up. Experimental set up comprised with Aluminum bowl, Thermometer .Through the experimental study and FTIR Spectrum analysis we found the Lawsonia Inermislinn shows the better Thermal transmittance properties.

KEYWORDS: Transmittance, FTIR, Lawsonia Inermislinn, Ocimum tenuiflorum, Hibiscus cannabinus, Millettia Pinnata, Thermometer.

I. INTRODUCTION

Due to the high cost of metals as well as less resource content in earth we couldn't meet the engineering demand. so we are in need to identify the new resources like plants leaves, natural fibers, ceramics to get better thermal properties for engineering application. Transmittance of the surface of a material is its effectiveness in transmitting radiant energy. It is the fraction of incident electromagnetic power that is transmitted through a sample.

A. *Fourier transform infra red spectrometer*

Today identifying the better thermal transmittance properties in the plants leaves is a easier one with FTIR spectroscopy. FTIR can be employed to determine the structure of unknown composition and the intensity of the absorption spectra associated with molecular composition or content of the chemical group [1].For FTIR analysis, infrared radiation comprising a range of frequencies is directed at the sample. A detector reads the intensity of the transmitted radiation at all frequencies scanned and the absorbance or transmittance values are calculated and recorded by the software. These values are subtracted from the background, obtained in the absence of any sample. This is done in order to find the absorbance or transmittance plot specific to the sample only and to eliminate the absorption along the path outside the sample.

The FT-IR method measures the vibrations of bonds within chemical functional groups and generates a spectrum that can be regarded as a biochemical or metabolic "fingerprint" of the sample. By attaining IR spectra from plant samples, it might possible to detect the minor changes of primary and secondary metabolites [2]

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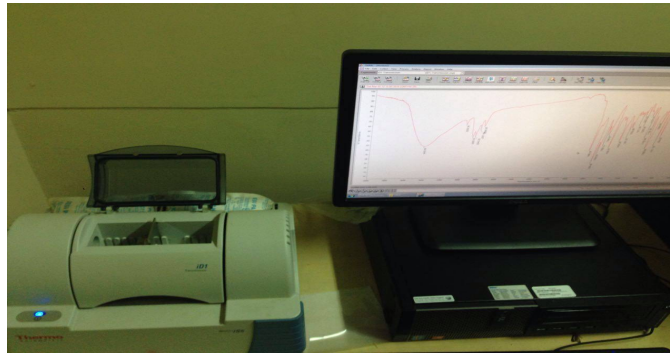


Fig.1.FTIR machine.

II. SAMPLE TEST WITH FTIR

B. Procedure to test specimen with FTIR

Pallet preparation

- Step1- sample is mixed with Potassium Bromide
- Step2- Mixed sample applied to the pallet die
- Step3- inset pallet die into the hydraulic press machine
- Step4- apply the pressure up to 150 bar
- Step5- produce pallet
- Step6- removes the wet from sample pallet

FTIR testing

- Step7- inset the pallet into FTIR spectrometer
- Step8- taking test without sample
- Step9- taking test with sample pallet
- Step10- compares the testing result

Software used:

OMNIC software

III. EXPERIMENTAL WORK

For finding better thermal transmittance in plant leaves we choose standard test set up comprised with similar size of four Aluminum bowl of 50mm diameter, 55mm height and thickness 0.74mm cylindrical shape bowl. Finely powdered dry Lawsonia Inermislinn, Ocimum tenuiflorum, Hibiscus cannabinus, Millettia Pinnata are mixed with water and uniformly coated over the outer surface of each Aluminum bowl. The bowls are filled with water and the coated aluminum bowls are exposed to sun radiation also each bowl is closed with a lid. At the noon all the four lid opened from the bowls and the mercury thermometer placed in the water and temperature of water measured for 5 minutes. The location of the test site is at 11.1186895 latitude and 79.2061114 longitudes.

Heat is transferred by conduction, convection and radiation or by a combination of all three. Heat always moves from warmer to colder areas; it seeks a balance. In simple terms this is a measure of the capacity of a material to conduct heat through its mass [3]. Thermal conductivity can be used to measure their insulating effectiveness. Thermal conductivity can be defined as the amount of heat (energy) that can be conducted in unit time through unit area of unit thickness of material, when there is a unit temperature difference [4].



Fig.2 Experimental setup.

IV. RESULTS AND DISCUSSION

C. FTIR results

Fig 1. Plotted in the FTIR machine shows the better thermal transmittance properties in the Lawsonia Inermislinn. It shows highest transmittance (75%) properties in wavelength of 1800 to 2000 cm^{-1} region.

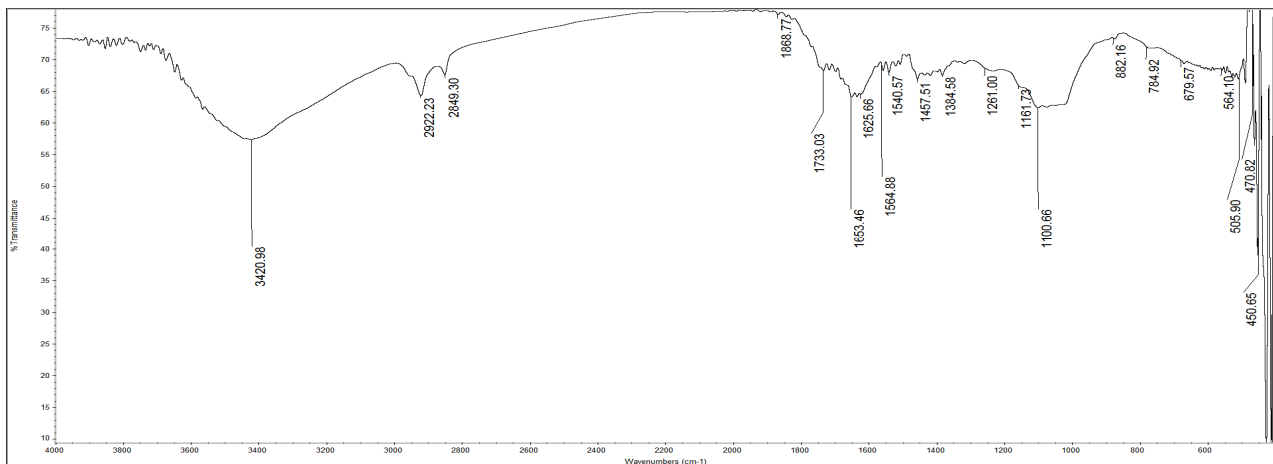


Fig1 .FTIR result of Lawsonia Inermislinn

The Millettia Pinnata shows the highest thermal transmittance (65%) properties in wavelength of 1800 to 2000 cm^{-1} region.

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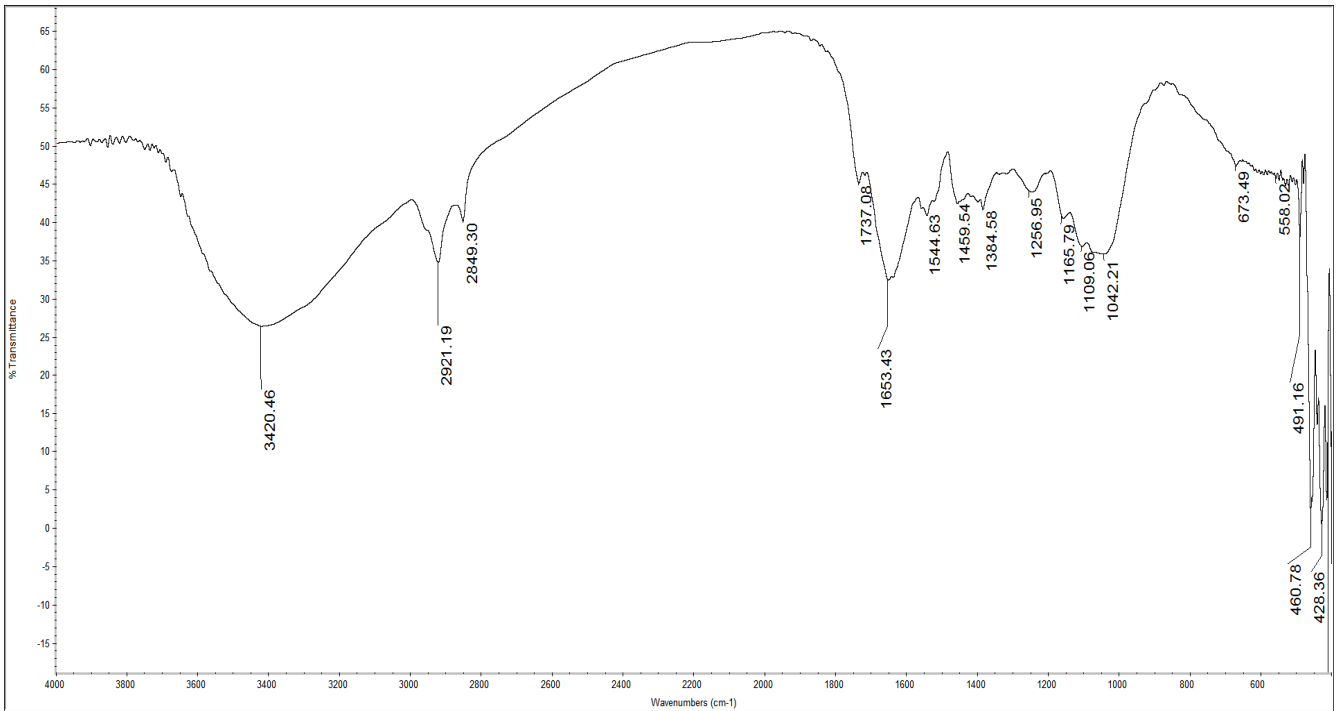


Fig2.FTIR result of Millettia Pinnata

The Hibiscus cannabinus shows the highest thermal transmittance (14.5%) properties in wavelength of 3800 to 4000cm⁻¹ region.

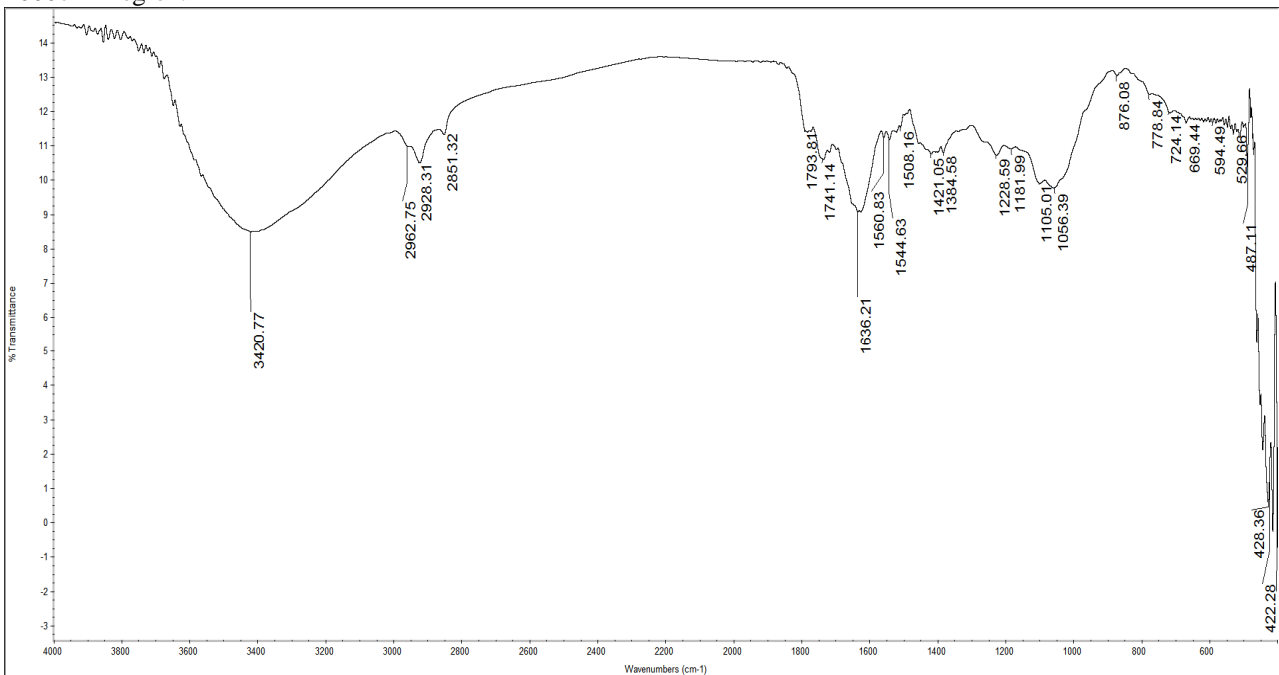


Fig3. FTIR result of Hibiscus cannabinus

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The *Ocimum tenuiflorum* shows the highest thermal transmittance (13%) properties in wavelength of 3800 to 4000cm⁻¹ region.

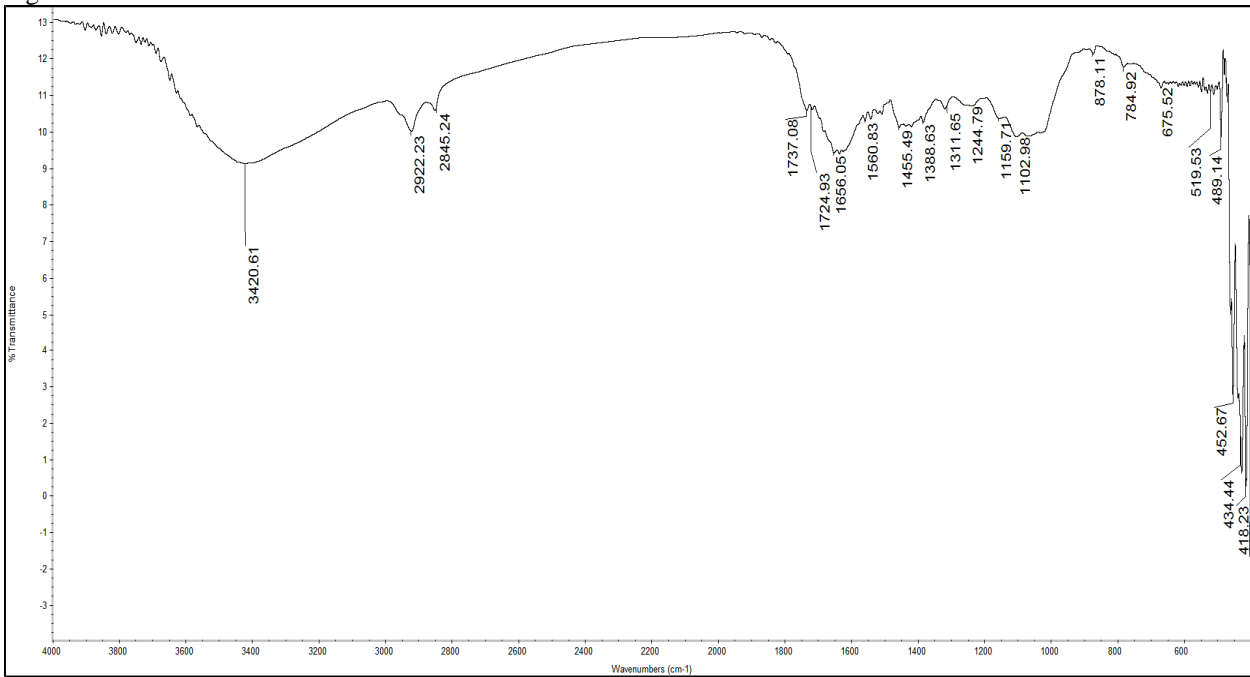


Fig4. FTIR result of *Ocimum tenuiflorum*

We can characterize thermal transmittance of all the four plants leaves from the FTIR data. Among the four plants leaves *Lawsonia Inermislinn* shows the better thermal transmittance properties. Also it shows the lowest thermal absorbing properties. The *Hibiscus cannabinus* shows the highest thermal energy absorbing character.

D Experimental results

The experimental results show that the heat absorption capacity of *Ocimum tenuiflorum* is high. It means it shows the highest thermometer reading 48°C and the heat absorption capacity of *Lawsonia Inermislinn* is low that is 41°C.

Table.1 Thermal transmittance (heat absorption) properties of plant leaves

Sl.No	Name of the plant leaves	Temperature Measured on 9 th March(°C)	Temperature Measured on 10 th March (°C)	Temperature Measured on 11 th March (°C)	Temperature Measured on 12 th March (°C)
1	<i>Lawsonia Inermislinn</i>	41	42	44	44
2	<i>Millettia Pinnata</i>	43	45	46	45
3	<i>Hibiscus cannabinus</i>	45	46	47	46
4	<i>Ocimum tenuiflorum</i>	45	46	48	47

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The graph 1 is drawn from the data derived by the experimental work it shows that the heat transfer through the Lawsonia Inermislinn coated Aluminum bowl is low. The heat transfer through the Ocimum tenuiflorum coated Aluminum bowl is high.

Graph.1. Temperature measured for 5 minutes from March 9th to 12 March.

V. CONCLUSION

From the FTIR test and experimental study we can conclude that the Lawsonia Inermislinn shows the better thermal transmittance properties (i.e. low heat absorption) among the four test samples. The Ocimum tenuiflorum shows the high heat energy absorption properties (i.e. low transmittance).

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