ISSN 2348 – 8034
Impact Factor- 3.155

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

# SPECTRUM OF ULTRASOUND PRODUCED BY SOME PLANT LEAVES EXPOSED TO NITROGEN LASER

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## ABSTRACT

In this work six samples from ***Bougainvillea spp1***, ***Citrus Sinesis***, ***Canna Indica***, ***Ixora Coccinia, Bougainvillea spp2 and Citrus Paradisi*** living under sun light beside another six samples from the same plants living in shadow were exposed to Nitrogen laser for few seconds. The ultrasound wave emitted by them was detected by ultrasound detectors. It was found that
***Bougainvillea spp1*** leaves produce ultrasound frequencies:
(0.0041and 0.0042X) Hz,
***Citrus Sinesis*** leaves produce frequencies***:***
(0.0040X; 0.0039 X $10^{17;}$ 0.0038X; 0.0043XHz,
***Canna Indica*** leaves produced frequencies:
(0.0040X ; 0.0043X; 0.0039X0.0038Xand 0.0035X )Hz, ***Ixora Coccinia*** leaves produce frequencies:
(0.0041X; 0.0043X; 0.0039X and 0.0038) Hz,
***Bougainvillea spp2*** leaves produce frequencies
(0.0042X;0.0045X;0.0039X,0,0034X,0.0031X
and 0.0043XHz).
***Citrus Paradisi*** leaves produce frequencies
(0,0041X, 0.0042X and 0.0040X) Hz.

**Keywords-** Nitrogen Laser, Spectrum, Ultrasound.*(Bougainvillea spp1*, *Citrus Sinesis*, *Canna Indica*, *Ixora Coccinia, Bougainvillea spp2 and Citrus Paradisi* -local plants).

## I. INTRODUCTION

Sound waves can be produced due to vibration of matter molecules. These vibrations can be heard by our ears when they are in the range of (20-20000 Hz). Below this range is infrasound waves can be produced, while ultrasound can be produced above this range (1, 2, 3).Ultrasound waves were recently used in a wide variety of applications (4, 5)For instance , it can be used in non destructive testing (6, 7), metrology heating, purifying water beside their usual in medical diagnosis (8, 9). These wide applications motivate to search for different techniques to produce ultrasound waves. This work is devoted to produce ultrasound wave from some plant leaves by exposing them to Nitrogen laser.

## II. MATERIALS

The material used are six samples of different plant leaves which live under sun light and six samples which live in shadow were selected .The samples specification are as follows: **Table (2.1) plant types and number of samples**

| Plant type | Number of samples in sun | Number of samples in shadow |
|---|---|---|
| Bougainvillea spp1 | 2 | 1 |
| Citrus sinesis | 3 | 8 |
| Canna indica | 5 | 4 |
| Ixoracoccinia | 7 | 6 |
| Bougainvillea spp2 | 10 | 9 |
| Citras paradise | 12 | 11 |

**The equipments used are:**
1. Laser source: The laser source is continuous nitrogen laser, having power of (4.4mW) and wave length of 450 nm.
2. Ultrasound detector: The ultrasound detector consists of the following components:
A peizo electric transducer: Is a peizo electric crystal.
b. Digital processing unit: Is a computer having a program that can enable to display sound spectrum on the screen

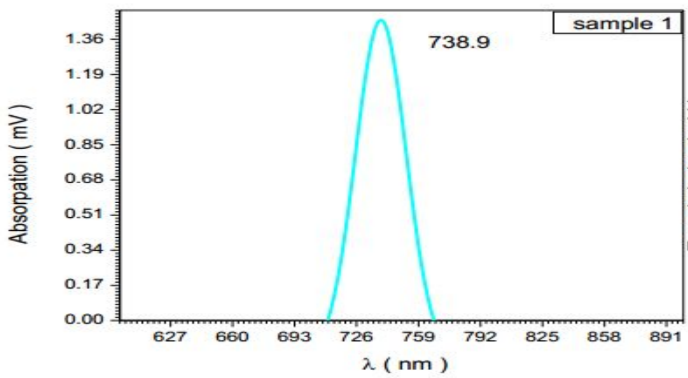
## III. METHODOLOGY

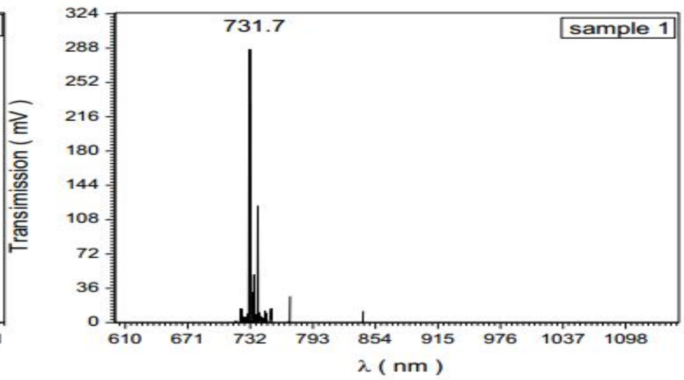
To determine the sound frequency emitted by leaves, the following steps were made.
1. Each leave is exposed few seconds to laser beam.
The photons of laser were absorbed by leaves atoms which cause them to vibrate. The vibrating atoms emit ultrasound waves to the surrounding. Thus it passes through air to the detector.
2. The transducer unit receipts the emitted sound and produces an electric pulse
3. The digital unit converts this pulse to a suitable sound spectra relating ultrasound wave length to sound intensity as shown in figures below:

*Fig (3.1): Setup of Experiment*

## IV. RESULTS

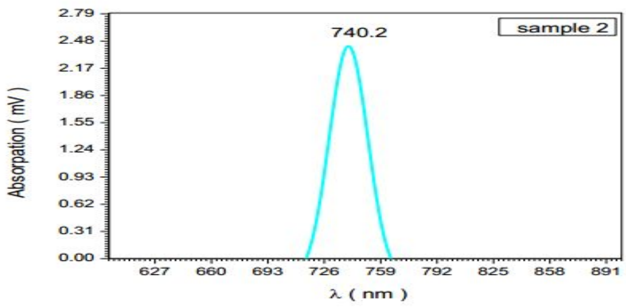
The following figures show the spectrum of the 12 leave samples which relate the

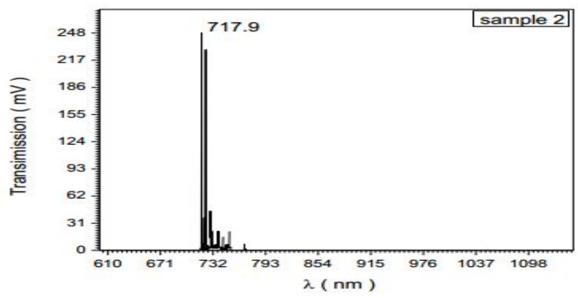


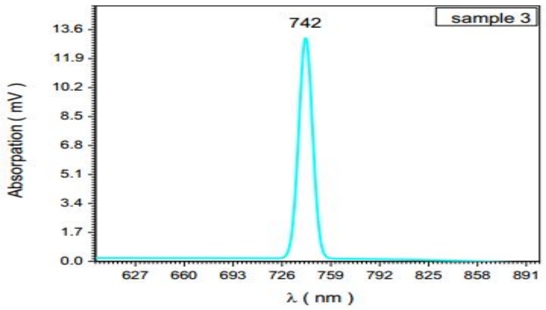



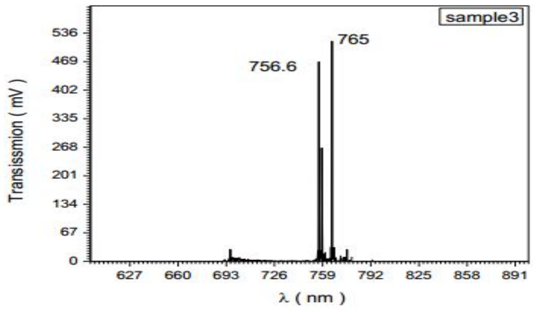

sound wave length (λ) to the sound intensity (I).

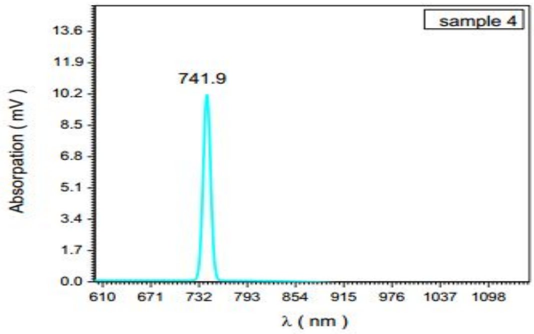
DOI-10.5281/zenodo.51578
Impact Factor- 3.155

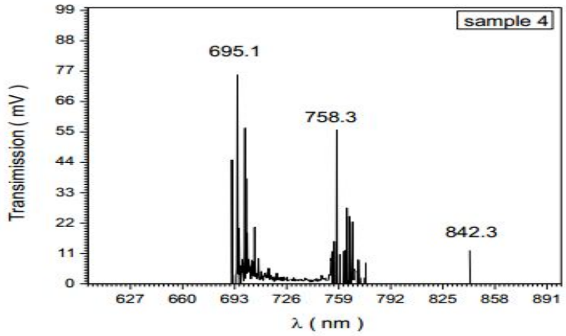


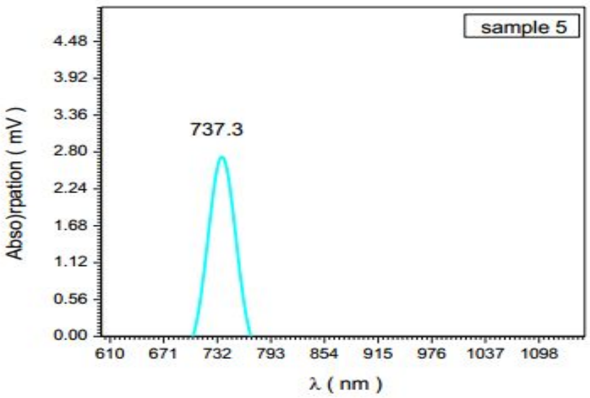



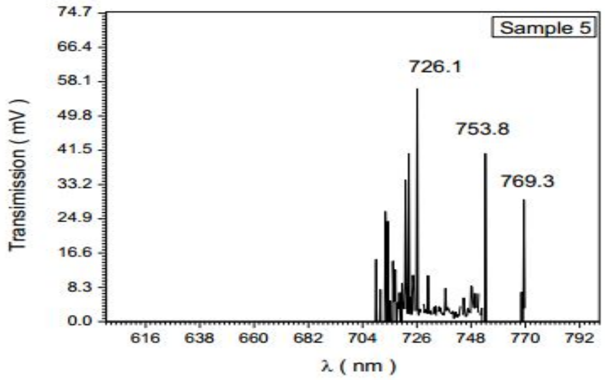



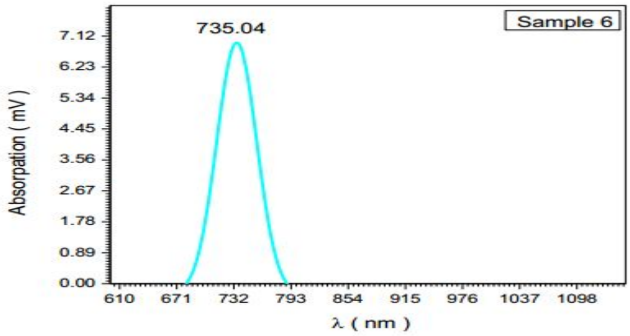



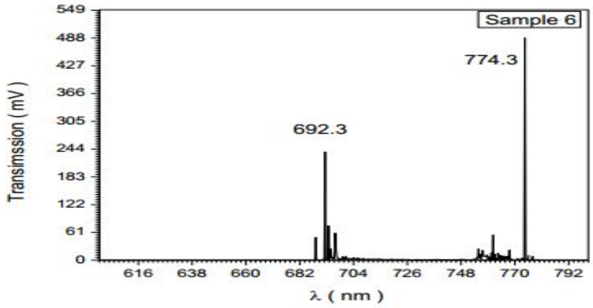



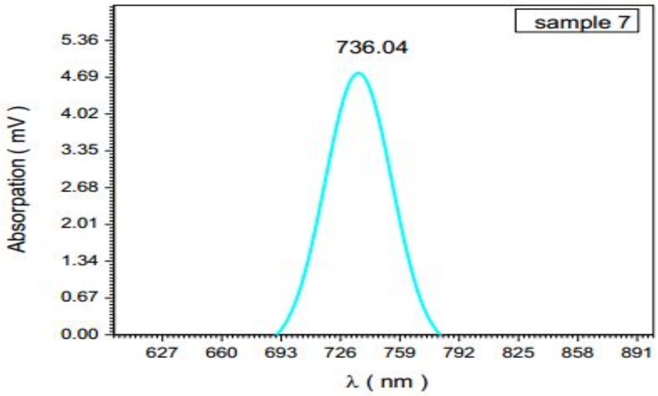



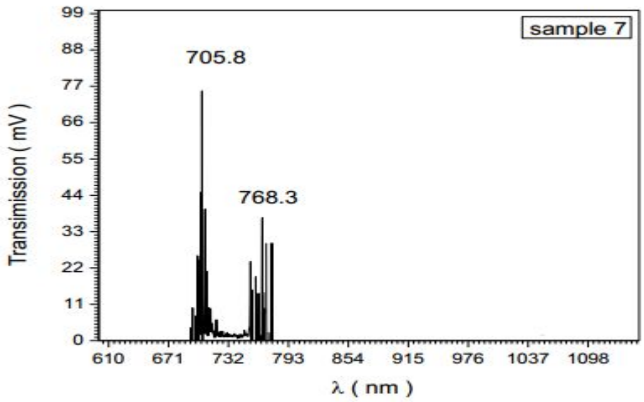



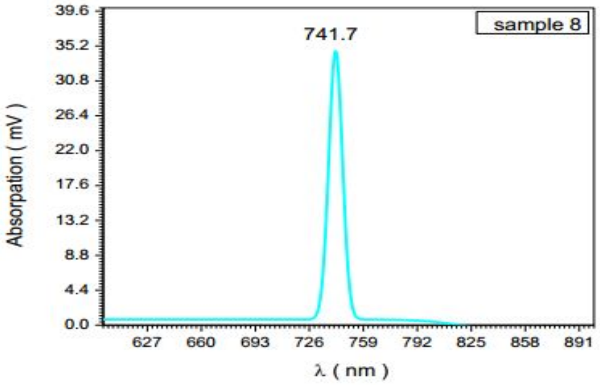
ISSN 2348 – 8034
Impact Factor- 3.155

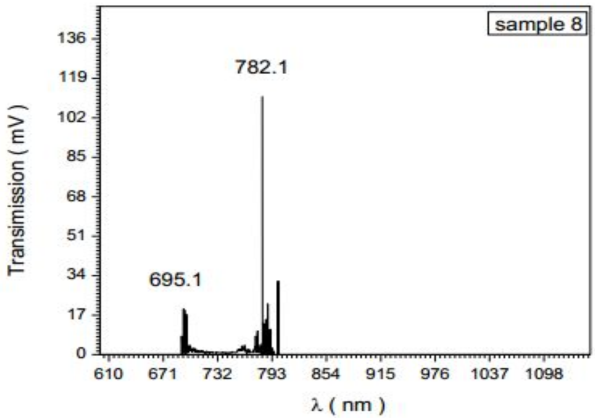


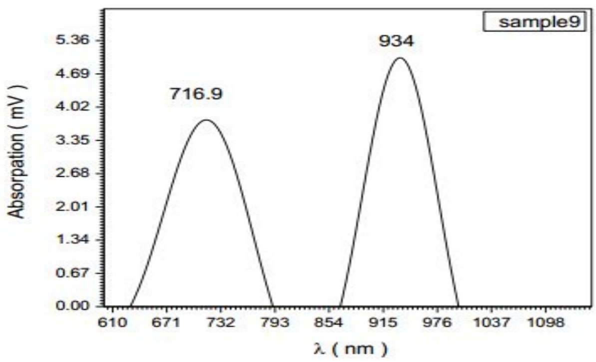



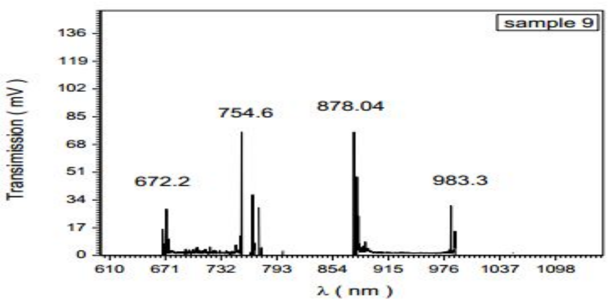



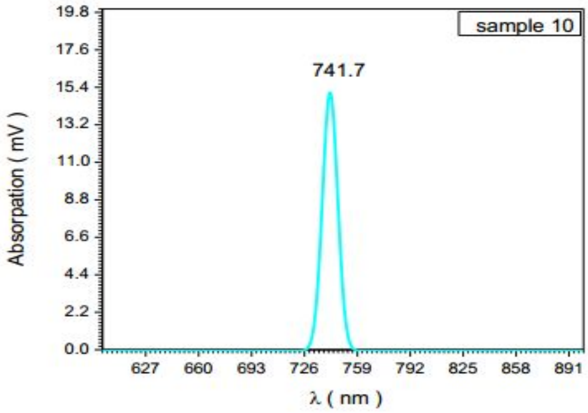



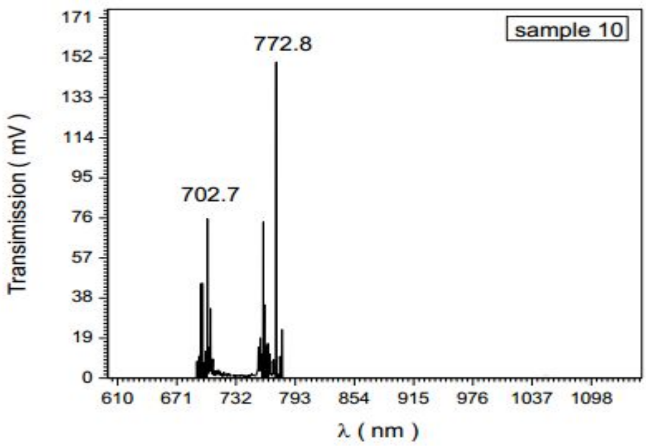



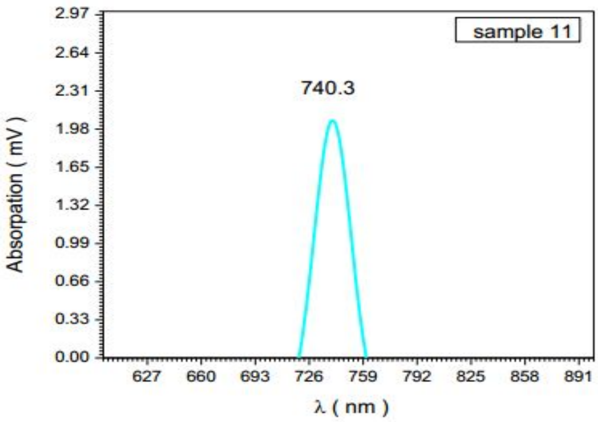



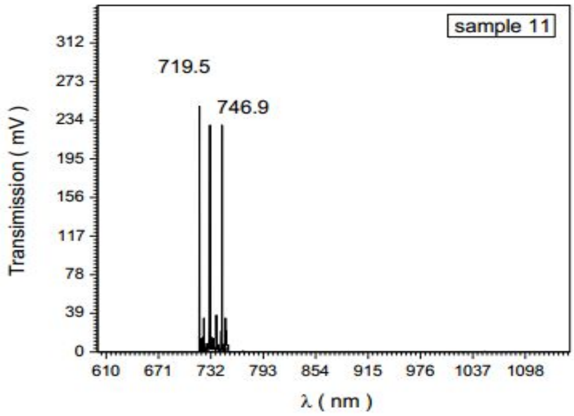



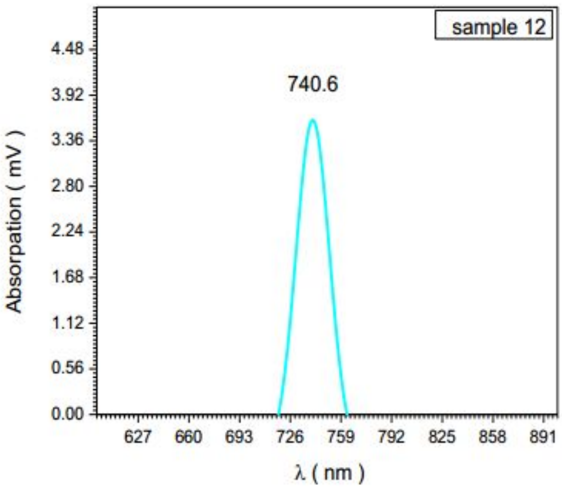
DOI-10.5281/zenodo.51578 Impact Factor- 3.155



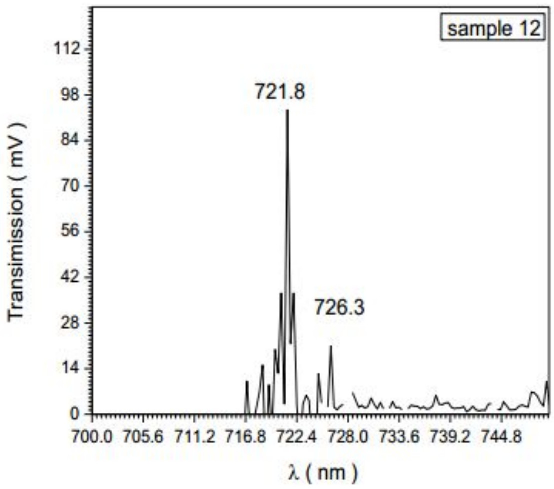



*Table (4.1)*

| Sample | Absorption Beak ( nm ) | Transmission Beak ( nm ) |
|---|---|---|
| 1 | 738.9 | 731.7 |
| 2 | 740.2 | 717.9 |
| 3 | 742 | 756.6 - 765 |
| 4 | 741.9 | 695.1 - 758.3 - 842.3 |
| 5 | 737.3 | 726.1 - 753.8 - 769.3 |
| 6 | 735.04 | 692.3 - 774.3 |
| 7 | 736.04 | 705.8 - 768.3 |
| 8 | 741 | 695.1 - 782.1 |
| 9 | 716.9-934 | 672.2-754.6-878.04-983.3 |
| 10 | 702.7 | 702.7-772.8 |
| 11 | 740.3 | 719.5-746.9 |
| 12 | 740.6 | 721.8,726.3 |

## V. DISCUSSION

The spectrum of plant leaves shows high frequency ultrasound waves produced. Fig(4.1)for ***Bougainvillea spp1*** in shadow the frequency produced shows absorption peaks at 738.9nm.Fig(4.2)for transmission of ***Bougainvillea spp1*** in shadowthe peaks at 731.7nm.In Fig (4.3) ***Bougainvillea spp1*** in sun light the absorption peak at 740.2nm.Fig(4.4) ***Bougainvillea spp1*** in sun light the transmission peaks at 717.9 nm . Fig(4.5) Citrus Sinesis in sun light the absorption peak at 742nm. Fig(4.6) ***Citrus Sinesis*** in sun light the transmission peaks at756.6,765nm.In Fig (4.7)***Canna Indica*** in shadow the absorption peak at 741.9nm.In Fig (4.8)***Canna Indica*** in shadow the transmission peaks at 695.1,758.3 and 842.3nm.Fig (4.9) ***Canna Indica*** insun light the absorption peak at 737.3nm.Fig(4.10) ***Canna Indica*** in sun light the transmission peaks at 726.1,753.8 and 769.3nm.Fig (4.11) ***Ixora Coccinia*** in shadow the absorption peak at 737.04nm.Fig (4.12) ***Ixora Coccinia*** in shadow the transmission peaks at 692.3 and 774.3nm. Fig (4.13) ***Ixora Coccinia*** in sun light absorption peak at 736.04nm.Fig (4.14) ***Ixora Coccinia*** in sun light transmission peaks at 705.8nm and 768.3nm.Fig (4.15) ***Citrus Sines*** is in shadow absorption peak at 741.7 nm. Fig (4.16) ***Citrus Sines*** is in shadow transmission peaks at 695.1 nm and 782.1 nm.Fig (4.17) ***Bougainvillea spp2*** in shadow absorption peak at 716.9 nm and 934 nm.Fig (4.18) ***Bougainvillea spp2*** in shadow transmission peaks at 672.2, 754.6, 878.04and983.3nm. Fig (4.19) ***Bougainvillea spp2*** in sun light absorption peak at 702.7 nm .Fig(4.20) ***Bougainvillea spp2*** in sun light absorption peak at 702.7and772.8nm. Fig (4.21) ***Citrus Paradisi*** in shadow absorption peak at 740.3nm. Fig (4.22) ***Citrus Paradisi*** in shadow transmission peaks at 719.5 and 746.9nm.Fif (4.23) ***Citrus Paradisi*** in sun light absorption peak at 740.6nm. Fig (4.24) ***Citrus Paradisi*** in sun light transmission peaks at 721.8 and 726.6nm.It is very interesting to note that all these emitted sound waves are much higher than 20000Hz.

## VI. CONCLUSION

This work shows that Nitrogen laser can cause some plant leaves to produce a high frequency ultrasound waves.

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