

Ultrasonic Velocity And Acoustical Parameter Determination Of *Andrographis Paniculata*

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ABSTRACT : *Andrographis Paniculata*, popularly known as Nilavembu, in Tamil, is a small plant that has got magnificent medicinal uses. It is called as "Ruler of Bitters" in English. Nila means soil and vembu means neem. Nilavembu kashyam is found to be successful in curing all types of fevers, such as Dengue, bird flu etc. It is beneficial for patients suffering from cancer, arthritis etc. In our present study ultrasonic velocity, density and viscosity of various concentrations of nilavembu in water are determined. Using this, various acoustical parameters are calculated. From these data, the type of molecular interaction existing between the specimen and water can be established.

Index Terms : Nilavembu, Ultrasonic Velocity

I INTRODUCTION

Andrographis paniculata is an annual herbaceous plant in the family Acanthaceae. Its stem is slender dark green, square in cross section with longitudinal furrows and wings along the angles. The lance – shaped leaves have hairless blades measuring up to 8 centimeters long. It is widely cultivated in Southern and Southeastern Asia, where it has been traditionally used to treat infections and some diseases. Mostly the leaves and roots were used for medicinal purposes (Chao et al). The whole plant is also used in some cases. *Andrographis paniculata* is an erect annual herb extremely bitter in taste in all parts of the plant body. It is also known as Nila-Vembu, in Tamil language, meaning "neem of the ground", since the plant, though being a small annual herb, has a similar strong bitter taste as that of the large Neem tree. *Andrographis paniculata* has been used in traditional Siddha and Ayurvedic systems of medicine as well as in tribal medicine in India (kuppusamy c murugan et al). This plant is a major ingredient of the polyherbal formulation by the name "Nilavembu kudineer choornam" in Siddha medicine. Andrographolide is the major constituent extracted from the leaves of the plant. Some other known constituents are (Traded Medicinal plant database):

- 14-Deoxy-11-dehydroandrographolide
- 14-Deoxy-11-oxoandrographolide
- 5-Hydroxy-7,8,2',3'- Tetramethoxyflavone
- 5-Hydroxy-7,8,2'-Trimethoxyflavone
- Andrographine
- Neoandrographolide
- Panicoline
- Paniculide-A
- Paniculide-B
- Paniculide-C

II LITERATURE SURVEY

Medicinal Properties & Uses of *Andrographis Paniculata*

- It is Anti bacterial and anti fungal in nature.
- It also has anti viral, antipyretic, adaptogenic & anti inflammatory effects .
- It improves immunity & Liver protection.
- It can be used as liver tonic.
- It is a blood purifying bitter tonic.



III MATERIALS & METHODS

Various solutions of Nilavembu powder in water are prepared. To prepare Nilavembu solution, 20 gms of the powder is mixed with 50 ml water. This mixture is heated for 10 min at 100°C. It is then cooled and used for measurement. For each sample, Ultrasonic velocity & density values were determined using Ultrasonic Interferometer – Continuous wave method and Specific Gravity bottle method respectively. Using these values various acoustical parameters (Baldevraj et al) were determined. UV & FTIR studies were also carried out. Molecular interaction parameter is also determined to study the nature of interaction between the molecules.

IV ACOUSTICAL PARAMETER FORMULAE

USED

$$\text{Adiabatic Compressibility } \beta = \frac{1}{\rho u^2}$$

$$\text{Acoustic Impedance } Z = \rho u$$

$$\text{Molar Volume } V_m = \frac{M}{\rho}$$

$$\text{Intermolecular Free length } L_f = \frac{2 \times 10^{-6}}{u \sqrt{\rho}}$$

Molecular Interaction Parameter

$$\alpha = \frac{U_{exp}^2}{U_{im}^2} - 1$$

V. CALCULATIONS

Table 1 Ultrasonic Velocity & Density Values of Nilavembu

x ₁ moles	x ₂ moles	U m/s	ρ Kg/m ³
0	1	1500	1000
0.005	0.995	1400	1030
0.01	0.99	1591	1035
0.02	0.96	1597	1040
0.03	0.97	1594	1050
1	0	1535	1025

Table 2 Acoustical Parameters of Nilavembu

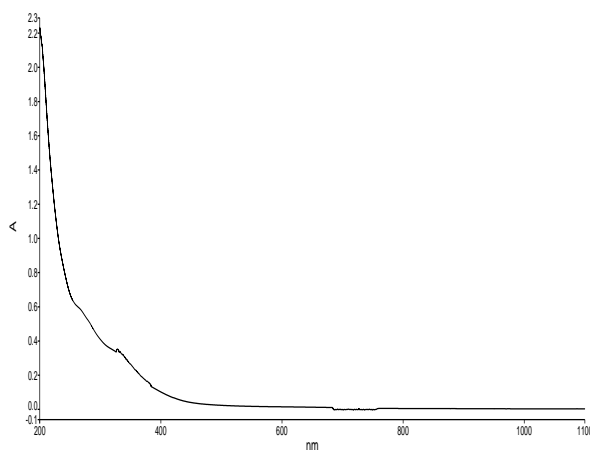
x ₁ moles	x ₂ moles	β x 10 ⁻¹⁰ Kg ⁻¹ ms ²	Z x 10 ⁶ Kg m ⁻² s ⁻¹	V _m m ³	L _f A ⁰
0	1	4.44	1.5	0.018	0.42
0.005	0.995	4.95	1.44	0.019	0.45
0.01	0.99	3.81	1.64	0.020	0.39
0.02	0.96	3.77	1.66	0.024	0.39
0.03	0.97	3.75	1.67	0.027	0.38
1	0	4.14	1.57	0.36	0.41

Table 3 Molecular Interaction Parameter of Nilavembu

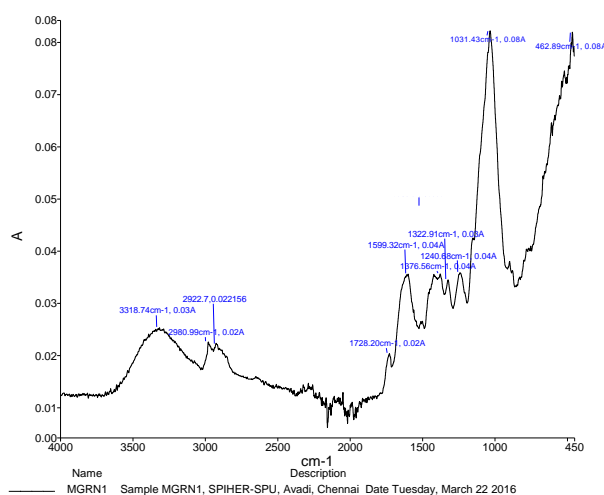
x_1 moles	x_2 moles	U_{exp}	U_{im}	A
0.005	0.995	1400	1500.1	0.13
0.01	0.99	1591	1500.4	0.12
0.02	0.96	1597	1500.7	0.13
0.03	0.97	1594	1501.1	0.13

VI UV & FTIR STUDIES ON ANDROGRAPHIS PANICULATA

Andrographolide is the main constituent of Nilavembu. Its physical properties are Molar mass 350.46 g/mol, Melting point 230°C and density 1.231 g/cm³. It is sparingly soluble in water. UV Spectrum is recorded using water as solvent, using Perkin Elmer Lambda 35 spectrometer. The value of λ_{max} is recorded as 400 nm and band gap energy is found to be 3.09 eV. The UV Spectrum is shown as below.

**Fig 5 UV Spectrum of Nilavembu**

The FTIR spectra of Andrographolide (Silverstein et al) have been recorded using Perkin Elmer Spectrum Two FTIR/ATR Spectrometer. Spectroscopic preparation of the sample was carried out under atmosphere of pre purified nitrogen. The characteristic absorption bands are absorbed at 1599.32 cm⁻¹(C=O), 3318.74 cm⁻¹(O-H), 2922.7 cm⁻¹(C-H) etc. These values well agrees with the molecular structure of Andrographolide. The spectrum is shown below.

**Fig 6 FTIR Spectrum of Nilavembu**

VII RESULTS AND DISCUSSIONS

The ultrasonic velocity, density values of various concentration of Nilavembu were found out. The acoustical parameters and molecular interaction parameter were also determined. From table 1 the maximum ultrasonic

velocity is recorded as 1597 m/s. From the values of ultrasonic velocities, shows that there is a good molecular interaction exist between the molecules of Andrographolide and water. This solution when taken into human body can well interact with the human blood and give the required remedy for the purpose it was taken. The band gap value obtained from UV Spectrometer shows that Andrographolide has NLO Properties. The stretching frequencies obtained from FTIR Spectrometer shows that it well agrees with the structure of Andrographolide.

VIII CONCLUSION

This research paper basically dealt with the acoustical properties of Andrographis paniculata. This present work can be extended to study various theoretical models of ultrasonic velocity and excess parameter calculations to establish the nature and strength of molecular interactions.

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