ACOUSTIC-ASSISTED TAMIL MEDICINAL PLANT EXTRACTS AND THEIR THERMO ACOUSTICAL RESEARCH

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ABSTRACT:

Up to 80% of people in some developing nations, according to the World Health Organisation (WHO), practise traditional medicine. In India, conventional herbal medicine remains a vital part of medical care. India, home to cover a billion people from a variety of sociocultural origins, is the second-largest country in the world. The British first used the word "Siddha medicine" in 1923, however Thamzhil maruthuvam or Tamil medicine, was the previous name for traditional medicine in Tamil Nadu. The siddha system of traditional medicine is primarily used in Tamil Nadu and other Tamil populated areas. Research indicates that the ancient Tamil peoples had their own literature and had maritime connections with other regions of the world starting in the third century BC. Some literary works date back to the Sangam period (300BC-300AD**). The purpose of this study is to both record and quantitatively analyse the existing knowledge about traditional plants (Tulsi – Ocimum Sanctun, Karpooravalli – Plectranthus Amboinicus), using Ultrasonic interferometer. In summary, further research into medicinal plants is crucial not only for enhancing healthcare outcomes but also for promoting economic development, conserving biodiversity, advancing scientific knowledge, and preserving cultural heritage.**

KEY WORDS: Medicinal plants, Ultrasonic velocity, Density, Adiabatic Compressibility, Ultrasonic Interferometer.

INTRODUCTION:

Ultrasonic technique has been a powerful tool nowadays, improving valuable information regarding the molecular behaviour of liquids. Recent developments have made it possible to use ultrasonic energy in medicine, engineering, agriculture and industry [1]. This technique is frequently used because of its ability in characterizing the physicochemical behaviour of the liquid systems. This method is preferred due to its simplicity as well as sensitivity of its very low density at higher energy states.

AIM OF THE PROJECT:

Aim of the project is to study the elastic properties, structural aspects, molecular relaxation process and molecular interaction process by Ultrasonic provides the valuable information about Tulsi – Ocimum Sanctun, Karpooravalli – Plectranthus Amboinicus)

- To measure the ultrasonic velocity of medicinal plant extract using ultrasonic interferometer.
- To measure the viscosity of medicinal plant extract using Ostwald's viscometer.
- To measure the density of medicinal plant extract.
- To calculate the thermo-acoustical parameters.

MATERIALS AND METHODS:

MATERIAL CHOSEN:

Ocimum sanctum, commonly known as Tulsi or Holly basil which it is one type of plant that appears as strong aroma, and bitter in taste. Tulsi have precious ingredients that can be alternative herbal treatment to treat ailments and problems such as common cold, headache, liver diseases and many more.

Plectranthus amboinicus belonging to the family Lamiaceae commonly known as Karpooravalli or Omavalli in Tamil as a large succulent aromatic perennial herb. It is highly aromatic pubescent herb with distinctive smelling leaves. The leaves of this plan have been used in malarial fever, hepatopathy, renal and vesical calculi, cough, chronic asthma.

METHODOLOGY:

Collect fresh, healthy leaves from the plants of (Tulasi – Ocimum Sanctum, Karpooravalli – Plectranthus Ambionicus) Avoid leaves with visible disease or insect damage. Rinse the leaves under running tap water to remove surface dirt and debris. Next Soak the leaves in distilled water to remove residual impurities. Once purified, you can proceed with extraction using double distilled water. The extract is poured in the beaker, kept in the Digital Ultrasonic cleaner for 15 minutes. Using ultrasonic interferometer, the density, ultrasonic wavelength and viscosity is measured for the extract.

RESULT AND DISCUSSION:

OCIMUN SANCTUM (TULSI):

SAMPLE	Ultrasonic Velocity(U) (m/s)	Density (ρ)× 10^3 kgm^{-3}	Viscosity (η)× 10^{-4} Nsm^{-2}	Adiabatic Compressibility (β_a) × 10^{-10} $N^{-1}m^{-2}$	Acoustic impedance (Z)× 10^5 kg$m^{-3}s^{-1}$
Ocimum Sanctum (Tulsi)	1487	1273	0.2248	3.5526	18.929

Table 1: Values of Ultrasonic Velocity, Density, Viscosity, Adiabatic Compressibility and Acoustic impedance of Ocimum Sanctum (Tulsi).

From the above table it is observed that the Ocimum Sanctum is slightly higher velocity (1487 m/s) with moderate density having the applications of Reduce stress & anxiety, Regular blood sugar and support liver and kidney function.

It has a moderately low viscosity (0.2248×10^{-4}), suggesting a lighter consistency with fewer gel-forming compounds. Due to its moderate viscosity, it's used in cough syrups and herbal teas. Tulasi (Ocimum sanctum) (3.5526×10^{-10} Pa^{-1}) extracts show relatively high compressibility, meaning they are still flexible but have slightly denser molecular arrangements. And it has the (18.929×10^5 kg $m^{-2}s^{-1}$) Lowest Impedance.

SAMPLE	Free length (L_f)× 10^{-10} kgms^{-2}	Wada's Constant (W)	Relaxation Time (τ) × 10^{-12}s	Isentropic Compressibility (K_s)× 10^{-7}pa^{-1}	Ultrasonic Attenuation ($\frac{\alpha}{f^2}$) × $10^{-15}NP/ms^{-2}$
Ocimum Sanctum (Tulsi)	0.3807	16795.75	0.01064	5.2827	1.4120

Table 2: Value of Free length, Wada's constant, Relaxation time. Isentropic compressibility and Ultrasonic attenuation of Tulsi.

From the above tabulated value, it is observed that the Tulsi (0.3807296× 10^{-10}m) has the Highest Free Length meaning that their molecular structure is more loosely packed and it has the highest Wada's constant, indicating strong intermolecular interactions and a more compact molecular structure. Tulasi (0.010645×10^{-12}s) has the Comparatively lower relaxation time, suggesting moderate interaction strength. From the tabulated value its observed that Tulasi has the highest isentropic compressibility (K_s=5.2827×10^{-7}) and it Likely has a moderate molecular interaction level.

PLECTRANTHUS AMBOINICUS (KARPOORAVALLI):

SAMPLE	Ultrasonic Velocity(U) (m/s)	Density (ρ)× 10^3 kgm^{-3}	Viscosity (η)× 10^{-4} Nsm^{-2}	Adiabatic Compressibility (β_a) × 10^{-10} $N^{-1}m^{-2}$	Acoustic impedance (Z)× 10^5 kg$m^{-3}s^{-1}$
Plectranthus Amboinicus (Karpooravalli)	1640	1367	0.1345	2.7198	22.4188

Table 3: Values of Ultrasonic Velocity, Density, Viscosity, Adiabatic Compressibility and Acoustic impedance of Karpooravalli.

From the above table it's observed that the Karpooravalli (1640 m/s) has the highest ultrasonic velocity with more rigid or denser and they are showing Highest density. They contain high fibre content or structural compounds like lignin and cellulose, which improve sound wave propagation. Karpooravali exhibit very low viscosity and lowest adiabatic compressibility, making them highly free-flowing. Low viscosity makes it easy to mix into tonics and herbal decoctions Used in traditional medicine for treating colds, coughs, and asthma. And It's observed that the Karpooravalli (22.418 × 10^5 kg $m^{-2}s^{-1}$) extract has the highest resistance to sound transmission, indicating greater density or higher molecular rigidity. Higher impedance suggests that the extract has a compact structure with strong intermolecular forces.

SAMPLE	Free length $(L_f)\times 10^{-10}$ kgms^{-2}	Wada's Constant (W)	Relaxation Time $(\tau)\times$ 10^{-12}s	Isentropic Compressibility $(K_s)\times$ $10^{-7}pa^{-1}$	Ultrasonic Attenuation $(\frac{\alpha}{f^2})\times$ $10^{-15}NP/ms^{-2}$
Plectranthus Amboinicus (Karpooravalli)	0.3331	15781.13	0.00487	4.4605	0.5864

Table 4: Value of Free length, Wada's constant, Relaxation time. Isentropic compressibility and Ultrasonic attenuation of Karpooravalli.

From the table it is observed that Karpooravalli (0.3331182×10^{-10}m) has the Lower Free Length. This extract has a significantly lower intermolecular free length, suggesting that its molecular packing is tighter compared to the others. And it has relatively lower Wada's constant, suggesting a more open molecular structure with weaker intermolecular bonding. The extract has Lowest relaxation times, indicating weaker molecular interactions. Karpooravalli has the lowest isentropic compressibility (K_s=4.4605×10^{-7}) and it is the least compressible, meaning it offers higher resistance to compression. And it is also lowest in attenuation (0.5864×10^{-15}). This suggests that Karpooravalli is the least resistance to ultrasound wave propagation. Indicates low viscosity and fewer molecular interactions.

CONCLUSION:

Optimizing herbal extracts for drug delivery, ultrasound-assisted therapy, and biomedical imaging by leveraging their viscosity, compressibility, and acoustic properties. Future research can focus on nano formulations, personalized medicine, and regenerative therapies.

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