

MINOR RESEARCH PROJECT

NAME ADDRESS OF THE PRINCIPAL INVESTIGATOR:

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DATE OF IMPLEMENTATION : 01 July 2011

TENURE OF THE PROJECT : Two Years

TOTAL GRANT ALLOCATED: 140000 Rs.

(For 1st YEAR: 125000 Rs. and

For 2nd YEAR: 15000 Rs.)

SUMMARY OF PROJECT

Title: 'THE NON-LINEAR ACOUSTIC CHARACTERIZATION OF BIO-LIQUIDS'

From the earlier work carried out in this field our interest and workshop/symposium attended in the non-linear acoustic characterization of bio-liquids. It is found that the ultrasonic properties of liquids are very good promising, liquids showing scientific and industrial use. In the present work, we have studied binary mixtures of these liquids because liquid mixtures consisting of polar and non-polar components which are of considerable importance in industries such as Petrochemical, Pharmaceutical and dye. For medical diagnostic process, the propagation of ultrasound in bio-material solutions has become significant for research. The experiment and computed thermodynamic parameters would also be correlated with some theories.

This work would be important to determine the extent of bio-materials in polar and non-polar liquids to observe the potential application of non-linear acoustical phenomenon. The non-linear acoustical characterization of bio-materials would play a very important role in diagnostic procedure for more complete investigation of normal and diseased state. The ultrasonic studies in bio-liquids are essential for utilizing them in biomedical technology. Bio-liquids are made up of

long chain molecules consisting of aromatic compound. Bio-molecules are bigger in size and complicated in structure. To understand the behavior of bio-molecules representative aliphatic, aromatic and α, β – unsaturated carboxyl Compounds have been selected for study.

Under this project, as per the year wise planning, during the first year, the information and the data regarding the project has been collected from the different sources. The setup of experiment and information of instrumentation has been taken from the expert from Mittal Enterprises, New Delhi, Dr. B. M. Suryavanshi, HOD, Deptt. of Physics, Institute of Science, Nagpur and Dr. V. D. Bhandakkar, HOD, Deptt. of Electronics, Anand Niketan College, Warora and setup the instrument for the measurement of acoustic parameters.

In the second year of project, performed experimental work, taken the data i.e. Acoustic parameters such as, ultrasonic velocity and absorption of some bio-liquids, some organic Liquids at different temperature and presented the result for the completion of the project.

Our present research bringing in the instrumentation setup established in the laboratory, has been provided useful and interesting information in the ultrasonic velocity and absorption measurements of ultrasonic parameters in the bio-liquids and in some organic liquids in the laboratory. This project would provide a platform for the research scholars.

Under this project the ultrasonic velocity in different biomaterials at different frequency of transducer in polar and non-polar liquids has been measured. The measurement of ultrasonic velocity could be carried out by using interferometer techniques. The density and viscosity measurement in bio-system would be carried out using Psychometrics method and an appropriate Ostwald's viscometer respectively. A temperature variation of different parameters has been measured by maintaining liquid sample in thermostat arrangement (constant temperature bath) with flowing water technique. The proper experimental set-up capable of providing ultrasonic attenuation and velocity through the liquid medium of the ultrasonic wave has been established.

The thermo-acoustic analysis in biological medium would be interesting to discuss its non-linear behavior with respect to concentration and temperature. Therefore related thermodynamic parameter has been measured experimentally. The thermodynamic parameters such as Adiabatic compressibility (β_a), Intermolecular free length (L_f), specific acoustical impedance (Z), Effective mass (M_{eff}), Internal Pressure (J_i), Relaxation time (τ), Molar volume (V_m), Rao's constant (R), Wada's constant (W), Enthalpy (H), Internal Latent heat of vaporization (ΔH_i), excess adiabatic compressibility (β_a^E), excess free volume (V_f^E), excess free length (L_f^E), Classical Absorption (α/f^2), Moelwyn-Hughes Parameter (C_1), Lattice Gruneisen Parameter (Γ or K), Thermodynamic or Average

Gruneisen Parameter ($\bar{\Gamma}$), Sharma's Parameter (S^*), Gruneisen Like Parameter (Γ_0), Dimensionless Parameter (A), Parameter (K_1), Parameter (J_x), Bayer's Non-linear Parameter (B/A), Isothermal Gruneisen Parameter (Γ') and Characteristic Pressure (P^*) data has been calculated for the pure liquids and the liquid mixtures at the frequencies 1-4 MHz and at the temperatures 298K, 303K and 308K using experimental data of ultrasonic velocity, density and the viscosity. A list of papers published in various journals.

The required data, detailed information about setup of experiment and information of instrumentation of the project has been collected from the reference books purchased under this scheme. These reference books helped a lot. Special thanks to UGC, for this purpose. Last but not the least I would express my sincere thanks from my heart to the UGC, for providing financial assistance and sanction of this project. Expecting and soliciting such help in future.

(Dr. G. R. Bedare)
Principal Investigator