e-ISSN 2320 –7876 www.ijfans.org
Research Paper
Vol.11, Iss.9, Dec 2022

EFFECT OF CHAMAECOSTUS CSPIDATUS EXTRACT ON SUGAR SOLUTION- A ULTRASONIC TECHNIQUE

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Abstract

The velocity of ultrasound in the bio-liquids is highly useful in estimating the behaviour of the samples such as sugar level, molecular interactions. Diabetes is an inevitable in people of adults and youths due to genetic cause. Insulin plant which is used to increase the insulin level in the body and reduce the blood sugar level. The sugar solution and insulin plant extract has been mixed in various ratios and were studied. The Ultrasonic Interferometer has been used for the measurement of ultrasonic velocity(U), Ostwald Viscometer is used to determine viscosity(η); also, density(ρ), adiabatic compressibility (β) and acoustic impedance(Z) has been studied in this paper. FTIR test have been taken to determine the variations in the mixture. Using the test result, it has been concluded that there is a fall in the blood sugar level.

Key Words: Ultrasonic velocity(U); viscosity(η); density(ρ); adiabatic compressibility (β); acoustic impedance(Z).

1. Introduction

Chamaecostus cuspidatus, is known as insulin plant which act as an herbal cure for diabetes. It is mostly available in hills of Namakkal district, Tamil Nadu. This leaf is rich in protein, iron and antioxidant components such as ascorbic acid, β- carotene, steroids and flavonoids.The ultrasonic studies in bio-liquids are essential for utilizing them in bio-medical diagnose . It has

a complex pattern and the molecules are larger in size. It is crucial to consider ultrasonic study on some bio-liquids . In this paper the insulin plant is taken as a bio-liquid sample. Insulin plant acts as a sugar cut down agent. It helps to scale the insulin level up in the blood and scale the blood glucose level down. Insulin plant extract and sugar solution were mixed in different ratios and were observed. This may be helpful in the field of medicine.

2. Materials and Methods

Fresh leaves were taken, boiled in distilled water and was allowed to cool down. Then it was filtered through filter paper and its extract was taken. Then sugar solution was prepared by dissolving sugar in water. Ultrasonic velocity, viscosity, density was found out for Insulin plant extract, sugar solution, and mixture of both in ratios of 30:30, 20:40, 10:50 respectively.

3. Formulae:

1.1 Measurement of ultrasonic velocity (U)

Ultrasonic Interferometer is a device used to measure ultrasonic velocity. It is used to determine the velocity of ultrasonic sound in liquids with a high degree of accuracy. In an ultrasonic interferometer the ultrasonic waves are produced by piezoelectric method. It ranges from 1 to 12MHz [3]. Ultrasonic Interferometer technique is one of the best tools for examining the bio samples, specially plant leaf extract.

$U = C \lambda$

1.2 Measurement of density (ρ)

An electronic weighing balance with a precision of + or – 0.1mg is used for the measurements of mass of pure liquids or liquid mixtures [4].

1.3 Measurement of viscosity (η)

The measurement of viscosity was done through Ostwald Viscometer. The viscometer was filled with reference liquid (distilled water). The time taken for the flow of water from upper meniscus to lower meniscus was noted. Similar procedure was taken to measure the viscosity of the samples. The viscosity is measured by

$$\eta = \frac{\rho_s}{\rho_{dw}} X \frac{t_s}{t_{dw}}$$

e-ISSN 2320 –7876 www.ijfans.org
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1.4 Theoretical studies

From the experimental data ultrasonic velocity (U), density(ρ), viscosity (η), and various acoustic parameters have been calculated.

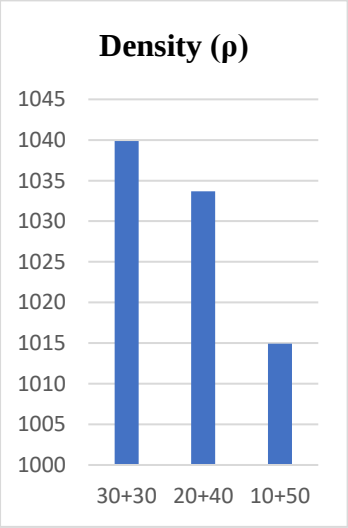
Acoustical parameters have been calculated by using the following formulae

Adiabatic Compressibility (β) = $\frac{1}{\rho U^2}$

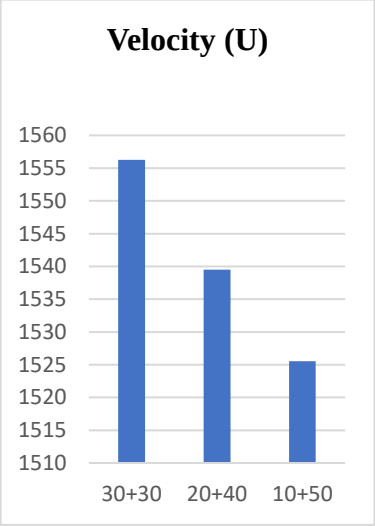
Acoustic Impedance (Z) = ρU

Table 1: Experimental values of ultrasonic velocity (U), density(ρ), viscosity (η), Adiabatic Compressibility (β) & Acoustic Impedance (Z).

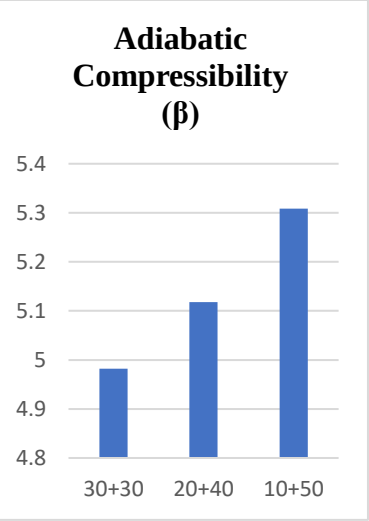
Sample	Density (ρ) Kg/m^3	Viscosity (η) $x\ 10^{-3}\ NS.m^{-2}$	Velocity (U) m/s	β $kg^{-1}ms^2$	Z x 10^6 $kg.m^{-2}s^{-1}$
30+30	1039.856	1.0513	1556.25	4.9822	1.289
20+40	1033.678	1.0357	1539.52	5.1176	1.269
10+50	1014.946	0.8789	1525.54	5.3085	1.235



Graph 1.1



Graph 1.2



Graph 1.3

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4. Fourier Transform Infrared Spectroscopy (FTIR) Test

Pure Insulin Plant: Graph 2

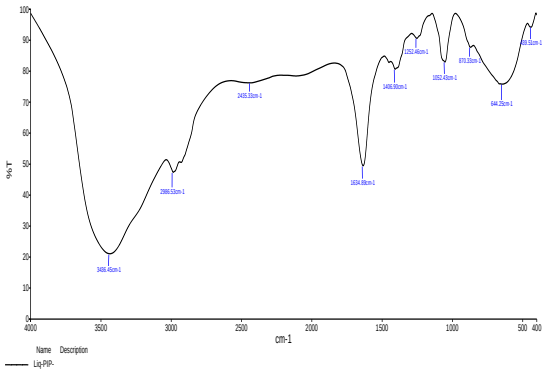

Table 2

GROUP CLASS	APPEARANCE	COMPOUND
O-H Stretching	Strong, broad	Alcohol
C-H Stretching	Medium	Alkane
C=Stretching	Medium	Alkane
S=O Stretching	Strong	Sulfonyl chloride
C-O Stretching	Strong	Primary alcohol
C-Br Stretching	Strong	Halo compound

Pure Sugar Solution: Graph 3

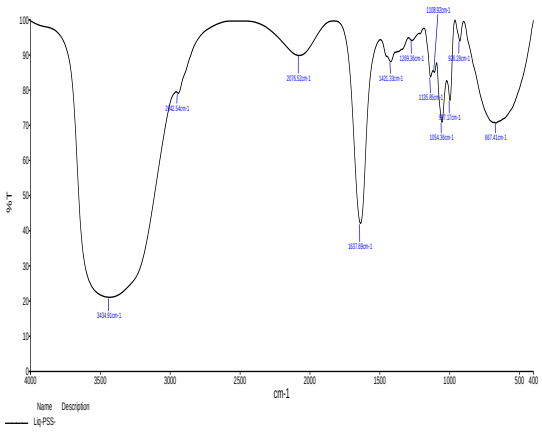

Table 3

GROUP COMPOUND	APPEARANCE	CLASS
O-H Stretching	Strong	Alcohol
N-H Stretching	Strong	Amine salt
N=C=S Stretching	Strong	Isothiocyanate
N-H Bending	Medium	Amine
O-H Bending	Medium	Carboxylic acid
C-O Stretching	Strong	Alkyl aryl ether
C=C Bending	Strong	Alkene

Insulin plant & Sugar Solution – 30:30

Table 4

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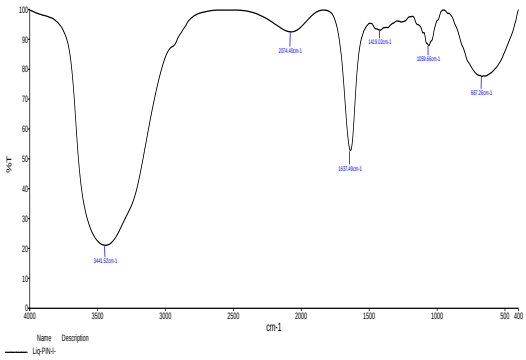
Graph 4

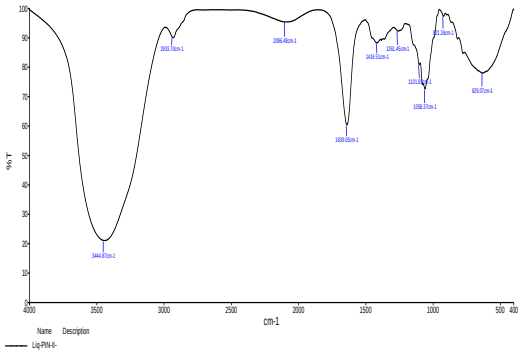


Insulin plant & Sugar Solution – 20:40

GROUP COMPOUND	APPEARANCE	CLASS
O-H Stretching	Strong, Broad	Alcohol
N=C=S Stretching	Strong	Isothiocyanate
C=C Stretching	Medium	Alkene
O-H Bending	Medium	Alcohol
C=C Bending	Strong	Alkene

Table 5

Graph 5



GROUP COMPOUND	APPEARANCE	CLASS
O-H Stretching	Strong, Broad	Alcohol
C-H Stretching	Medium	Alkane
N=C=S Stretching	Strong	Isothiocyanate
C=C Stretching	Strong	Alkene
C-O Stretching	Strong	Alkyl Aryl Ether
C-Br Stretching	Strong	Halo compound

GROUP	APPEARANCE	COMPOUND CLASS
O-H Stretching	Strong, broad	Alcohol
C-H Stretching	Medium	Alkane
N=C=S Stretching	Strong	Isothiocyanate
C=C Stretching	Medium	Conjugated alkane
O-H Bending	Medium	Carboxylic acid

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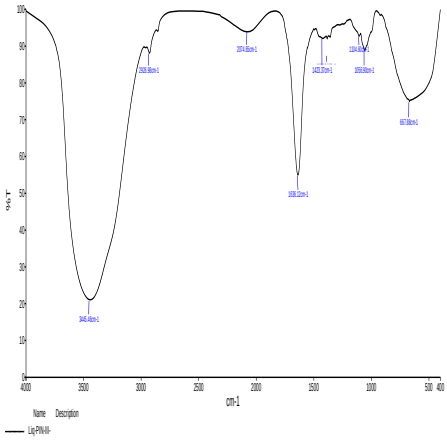
Insulin plant & Sugar Solution – 10:50

S=O Stretching	Strong	Sulfonyl chloride
C-Br Stretching	Strong	Halo compound

Table 6

Graph 6



5. Results and Discussion

The experimental values of density, ultrasonic velocity, viscosity and acoustical parameters for different liquid mixtures are shown in the table 1. It can be observed that ultrasonic velocity and adiabatic compressibility are inversely proportional to each other. From the results it can be seen that adiabatic compressibility increases as velocity decreases. When ultrasonic velocity decreases it can be noted that there is a change in the sugar solution. Density is the measure of liquid-liquid interaction. Decrease in density indicates lesser-solvent interactions. Thus, the results have been qualitatively used to explain the molecular interactions between the components of the liquid mixture.

From the FTIR results it can be interpreted that pure sugar solution contains alcohol, amine salt, amine, isothiocyanate, primary alcohol and alkene. When it is mixed with 30ml of sugar solution and 30ml of Insulin plant extract the amine salt and alkyl aryl ether are absent. Further 20ml of sugar solution is mixed with 40ml of Insulin plant extract it shows that a new component alkane and halo compound is formed but amine salt is absent. And when 10ml of sugar solution added with 50ml of Insulin plant extract a new compound sulfonyl chloride is formed and amine salt is absent.

By comparing the results of FTIR, it is observed that there are some variations in the functional groups and can be concluded that there is a certain definite fall in the glucose level.

6. Conclusion

This Ultrasonic study can be utilized as a powerful medium for characterizing the physicochemical properties of the bio-samples. The Ultrasonic velocity, Viscosity, Density and Acoustical parameters provide evidences for the confirmation of changes in the sugar content present in the sample with the help of FTIR graphs. From this study it can be concluded that the Insulin plant is an anti-diabetic agent by nature.

Acknowledgement

The authors thank the Department of Physics, St. Joseph's College, Tiruchirappalli for giving this opportunity.

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