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ULTRASONIC WAVES - MEASUREMENT OF THE ULTRASONIC VELOCITY OF WATER

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ABSTRACT

The ultrasonic in general follows the principles delineated in acoustics the study of vibration and the correlation between pitch and frequency of the round source to scientific standard. Ultrasound devices operate at frequencies from the kilohertz range to the gigahertz range. We have some methods to generate the ultrasonic wave there are piezoelectric generator magneto striction generator. Mechanical Method and Ultrasonic waves propagated through a medium can be detected in number of ways. And we can measure the Ultrasonic velocity of liquid by using measuring cell. Ultrasonication is used in many applications, such as homogenizing, disintegration sono chemistry, dyeing or cleaning. Health practitioners involved in prenatal care have reason to be concerned about the use of ultrasound although proponents point out that ultrasound has been used in obstetrics for 50 years. The present paper aims to measure the nature of ultrasonic waves and to measure its velocity of water.

Keywords: Ultrasonic Waves, Velocity Of Liquid, Frequency, Pitch, Kilohertz, Gigahertz.

I. INTRODUCTION

A Wave is disturbance or oscillation of a physical quantity that *travels* through matter or space accompanied by a transfer of energy. A material medium provides such an example. Here, elastic forces bind the constituents to each other and, there for the motion of one affects that of the other. If you drop a little pebble in a pond of still water, the water surface gets disturbed. The disturbance does not remain confined to one place; but propagates outward along a circle. There patterns which move without the actual physical transfer or flow of matter as a whole are called waves. In a wave information and energy, in the form of signals, propagate from one point to another but no material object makes the journey. All our communications depend on the *transmission* of signals through waves. When we make a telephone call to a friend at a distant place, a sound wave carries the message from our vocal cords to the telephone. There, an electrical signal in generated which propagates along the copper wire. If the distance is too large the electrical signal generated may be transformed into can light signal or electromagnetic waves and transmitted through optical cables or the atmosphere, possibly by way of a communication satellite. The repeating and periodic disturbance that moves through a medium from one location to another is referred to as a wave. The waves we come cross a mainly of three types:

- Mechanical waves
- Transverse waves
- Longitudinal waves

- Surface waves
- Electromagnetic waves
- Radio waves
- Microwaves
- Infrared
- Ultraviolet
- X-rays
- Gamma rays
- Matter waves

As ultrasonic in general follows the principles delineated in acoustics, its development particularly in the early years. Is to some extent embedded in the broad developments in acoustics. The study of acoustics probably had its beginning with the greek philosopher pythagorus. Whose experiments on the properties of vibrating strings were so popular that they led to tuning system that bev1il name (the sonometer). A ristotle assumed that a sound wave resonates in air tesih motion of the air, a philosophy based hypothesis more than one of experimental physics. Vitruvius determined the correct mechanism for the movement of sound waves, and he contributed substantially to the acoustic deign of theatres, he was an architect. Bothius the roman philosopher, documented several ideas relating science to music, including a suggestion that the human perception of pitch is related to the physical property of frequency.

II. GENERATION OF ULTRASONIC WAVES

There are different methods for the production of ultrasonics and the most commonly used method is as under:

1. Piezoelectric Generator
2. Magnetostriction Generator
3. Mechanical Method

2.1 Detection of ultrasonic waves

Ultrasonic waves propagated through a medium can be detected in a number of ways. Some of the methods employed are as follow

1. Kundt's tube method
2. Sensitive flame methods
3. Thermal detectors
4. Quartz crystal method

2.2 Objectives of the Study

The study was focused towards achieving the following objectives

(i) To measure the nature of ultrasonic wave.

(ii) To measure the ultrasonic velocity of water.

2.3 Methodology

To measure the ultrasonic velocity of water, an experiment has been undertaken through the use of "The measuring cell, high frequency generator (1 and 3 MHz). Base to hold the cell co-enial cable

III. EXPERIMENTAL RESULT & DISCUSSION

4.1 Nature of Ultrasonic waves

- The ultrasonic waves cannot travel through vacuum.
- There waves travel with speed of sound in a given medium.
- Their velocity remains constant in homogeneous media.
- There waves can weld certain plastics, metals etc.
- There can produce vibration in low viscosity liquids.
- The ultrasonic waves are reflected and refracted just like light waves.
- The ultrasonic waves are high frequency sound waves.
- They are having smaller wavelength.
- They produce heating effect when passes through the medium.
- They get reflected, refracted and absorbed by the medium similar to the ordinary sound waves.
- They act as catalytic agent to accelerate chemical reaction.
- They produce stationary wave pattern in the liquid, while passing through it.

4.2 Measurement of ultrasonic velocity of water Theory

An ultra sonic interferometer is a simple and direct device to determine the ultrasonic velocity in liquids with a high degree of accuracy. The principle used in measurement of velocity (v) is based on accurate waves of known frequency are produced by a quartz crystal fired at the bottom of cell. These waves are reflected by a moveable metallic plate kept parallel to the quartz crystal, is the separation b/w these two plates is enodly or whole multiple of the sound wavelength, standing waves are formed in the medium. This acoustic resonance give rise to an electrical reaction on the generator during the quartz crystal and anode wirrent of the generator becomes a maximum.

4.3 Calculation

$$\frac{\lambda}{2} = \frac{23.98}{33} = 0.72 \text{ mm from table}$$

$$\text{And } \frac{\lambda}{2} = \frac{10.52 - 7.6}{2} = \frac{1.384}{2} = 0.69$$

Valocity, $V = r\lambda xf$ (1)

$= 2x\frac{\lambda}{2}xF$ (2)

$= 2x0.72x1x10^{6}x10^{-3}$

= 1440 m/sec

Density of water = 996.458 kg/m^3

Compressibility, βad = $\frac{1}{pv^2}$ (3)

$= \frac{1}{996.458x1440}$

$= \frac{1}{1434899.52}$

= $6.96x10^{-7}$ N/m^2

4.4 Observation Table

	Minimum	Maximum	Minimum	Maximum	
1	11.5	16.5	0.9	0.76	0
2	11.5	16.5	1.42	1.74	0.98
3	12	16	2.42	2.32	58
4	11.5	16	2.88	3.18	0.86
5	11	16	3.9	3,72	*0.54*
6	11.5	16	4.4	4.72	1
7	11.5	15.5	5.4	5.38	0.66

8	11.5	15.5	5.9	6.22	0.84
9	11	16	6.9	6.62	0.4
10	11.5	16	7.4	7.6	0.98
11	12	15.5	8.4	8.16	0.56
12	11.5	16	8.88	9,02	0.86
13	11.5	16	9.86	10.06	1.04
14	11.5	16	10.4	10.52	0.46
15	11.5	16	11.34	11	0.48

16	11.5	15.5	11.88	12.12	1.12
17	11.5	15.5	12.88	12.98	0.86
18	11.5	15.5	13.36	13.68	0.7
19	11.5	15.5	14.4	14.48	0.8
20	12	15.5	14.88	15.18	0.7
21	12	15.5	15.9	15.64	0.46
22	12	15.5	16.4	16.68	1.04
23	12.5	15	17.34	17.22	0.54
24	12.5	15	17.82	18.16	0.94
25	12	15	18.88	18.74	0.58

26	12	15	19.38	19.76	1.02
27	12	15.5	20.4	20.14	0.32
28	12	15.5	20.86	21.22	1.08
29	12	15.5	21.92	21.7	0.48
30	12.5	15.5	22.4	22.68	0.98
31	12.5	15.5	23.38	23.24	0.6
32	12.5	15.5	23.84	24.22	0.98
33	12.5	15.5	24.92	24.7	0.48

There are different method for the production of ultrasonic and most commonly used method are piezoelectric Generator. Magnetostriction Generator and Mechanical Method. And the final velocity of ultrasonic in liquid water is = 1140 m/sec. and its compressibility is $6.96x10^{-7}$ N/m^2.

Velocity of ultrasonic in liquid = 1440 m/sec.

Compressibility = $6.96x10^{-7}$ N/m^2

V. CONCLUSION

Ultrasonication is used in many applications, such as homogenizing, disintegration, sono chemistry, degassing or cleaning. Below, you find a systematic overview over the various ultrasonic applications and process.

Ultrasonic processors are used as homogenizers, to reduce small particles in a liquid to improve uniformity and stability. The dispersion and deagglomeration of solids into liquids is an important application of ultrasonic devices.

A wide range of intermediate and consumer products, such of cosmetics and skin lotions, pharmaceutical ointments, varnishes, paints and lubricants and fuels are based wholly or in part of emulsions are dispersions of two or more immiscible liquids.

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