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# STUDY AND ANALYSIS OF EFFECT OF ULTRASONIC WAVES IN SUGARCANE JUICE WITH REFERENCE TO THE pH VALUE

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**Abstract:**

*Modern theory and practices of generated ultrasonic waves also show multidimensional properties which are commonly used in the engineering applications. The ultrasonic effect is employed in controlling and changing pH in petrochemical electromechanical industries for getting yield product, quality control and changing the characterization.*

*It is known that sound is due to vibrations of one or another kind of particles interact with each other. Ultrasonic is a branch of acoustics deals with the artificial modified acoustic model. This method focuses on reducing the difficulty thereby which was arrived in the industry to maintain the pH value. Similarly, we discussed the experimental set up and about the instruments which we use during the experiment for sugarcane juice. The main functioning of all the instruments with the experimental procedure is mentioned. Similarly different observations for sugarcane juice were considered where pH and ultrasonic waves are two main parameters. Hence in the present innovative study the measurement and change in the pH value (ΔpH) of sugarcane juice via using ultrasonic waves of specific wavelength has been carried out by using single prototype.*

***Key words: Ultrasonic, acoustic, pH value.***

## 1. INTRODUCTION:

Ultrasonic waves of high frequency are pulsed up to four times per second from the face of the transducer. As we know ultrasonic waves when penetrate through the liquid then sound wave reflects from the surface of the liquid and then return to the transducer. The time flight between the sound generation and receipt is measured by sensor. It translates the measurement due to sensors in to the distance between the transducer and the liquid surface.[1]

In every industry pH measurement has a variety of applications. Also in industry pH measurement technique is used for waste water treatment. As for liquids pH values range is in between 0 to 14 pH. This range is frequently used for the measurement of conductivity. Based on the pH values we can find out whether the given solution is acidic, basic or neutral. The pH value is below 1.0 then the glass error subject to acid errors.

Considering all above facts in mind we consider the pH value concept which is very important parameter in our day today life. Similarly, we use ultrasonic waves for penetration which are not harmful to human body. In this research work the main focus is on the pH value means when we penetrate ultrasonic waves in the aqueous solution then pH value of that solution will change and that change is observed in this research work.

The entire experimental methodology based on the principle of wave propagation of ultrasonic sound waves with respect to frequency. It is found that for a particular frequency range when we penetrate ultrasonic waves through a particular solution its pH value will change. Proposed work deals with guided control of pH value, whereas controlling will be found very safe, easy than the current methods. The following paragraph explains the actual experimental procedure and experimental setup

In to a liquid medium when the high power of ultrasound is penetrated then alternate high and low pressure is created i.e. nothing but compression and rarefraction with rates depending upon the frequency. Small vacuum bubbles or voids are created in the liquid during the low pressure cycle when high intensity ultrasound waves are passed through it. During high pressure cycle bubbles volume increases so that they cannot absorb energy then they collapse violently which is nothing but cavitation.[2,3]

Here for experimental work we consider sugarcane juice. Sugarcane juice is very useful for diabetic patient. Sugarcane juice acts as an instant energy drink because of the sugar content in it. So, a diabetic person needs to be cautious of the amount he or she is consuming. Also, it should be balanced with a nutritious diabetes-friendly meal. Sugar from sugarcane is processed in our livers, instead of the small intestine. It can be safely used as a substitute for aerated drinks and packaged juices, which are far damaging for people diabetes.

## 2. MATERIALS AND METHODS

- The juice used in this work is sugarcane juice. For the evaluation of basic idea of effect of ultrasonic waves on pH can be studied by laboratory scale prototype ultrasonic pH controller for steady state. It is found that for a particular frequency range when ultrasonic waves penetrate through a particular solution its pH value change. This great dealing is further so useful in the industrial sector and also in food industry.
- To study the effect of ultrasonic waves on pH of aqueous solution with reference to fruit juices.

This solution we can use in the industry similar concept is also used for the juices. In the food or biochemical industry, to preserve the juices or jams either they are heated or use some preservatives to change the pH value. Similarly they need some juices which are acidic in nature.[4]

Considering all these things this method which we are proposing in this research work is very useful. Responses to the framework, when deployed under various conditions, are reported.

## 3. ORIENTATION OF THE RESEARCH WORK

In the experimental part, ultrasonic waves were penetrated through the aqueous solution which is for steady state. In this experimental apparatus Piezoelectric crystal was connected to the ultrasonic probe and when ultrasonic waves are penetrated then sonication process is observed. In the solution during sonication process cycles of pressure increases from thousands of microscopic vacuum bubbles and when that bubbles collapse the process is called as cavitation. This cavitation process causes powerful waves of vibration in the solution. Due to which it release an enormous energy force in the cavitation field that disrupts molecular interactions. Shock waves are created when the bubbles implode then it radiate externally from the site of collapse. [5]Also generates pressure and temperature at the implosion site. Intense heating of bubbles is occurred due to shock waves during the navigational collapse. This process is observed in the experimental part of this work when ultrasonic waves are passed into the liquid i.e. sugarcane juice.

pH of the sugarcane juice solution before and after ultrasound was determined by pH meter. The measurements were carried out by placing ph electrode in the Sugarcane Juice Solution.

### 3.1 Statistical analysis:

The whole study was repeated and after each 5 minutes and 10 minutes PH was measured when ultrasonic waves are passed. The effect of the ultrasound treatment on the properties investigated and determined. pH values for different periods were noted when ultrasonic waves are passed through the solution and are shown in the observation table.[6,7]

## 4. INSTRUMENTATION

Instrumentation includes glass material reactor fitted with ultrasonic generator and pH measurement system which is as shown in figure. During research work amplitude is on one fixed range and also the penetration on and off time is set by controller button. [8]To start penetration of ultrasonic waves the main important point is to set the buttons accordingly. The prototype design for the experimental work is shown in below figure

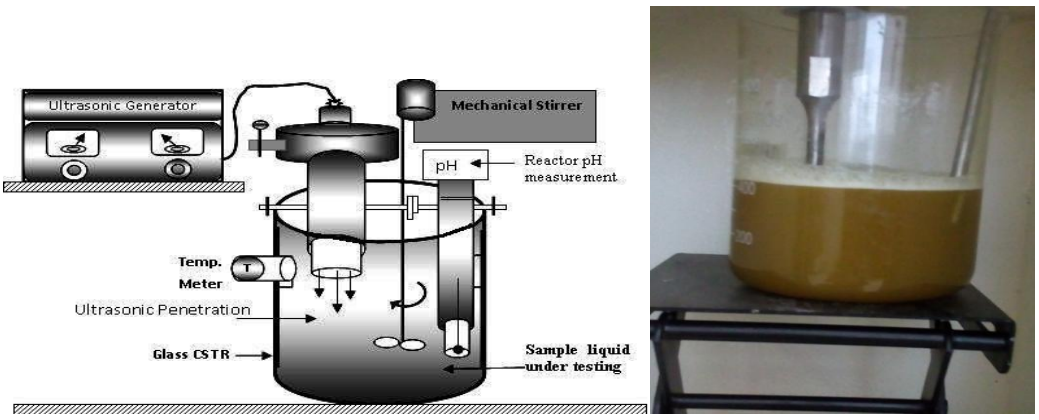



**Fig : Photo of experimental setup**

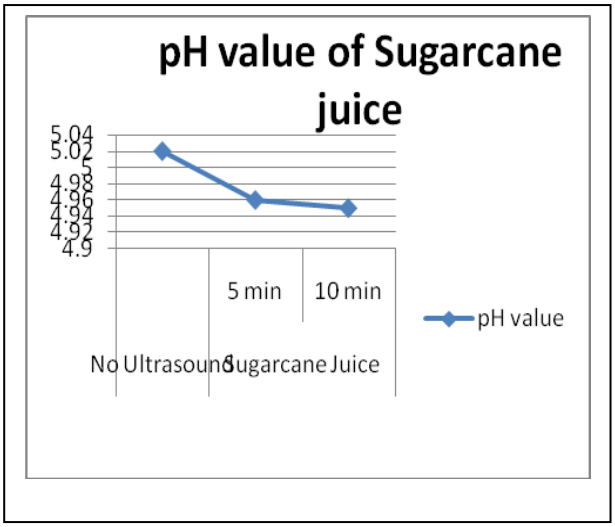
## 5. OBSERVATION AND OBSERVATION TABLE

The experiment is carried out for sugarcane juice and after 5 minute and 10 minutes pH is measured successively. The value of pH is measured before penetration of ultrasonic waves and then after penetration of ultrasonic waves. When ultrasonic waves are penetrated through the aqueous solution i.e. sugarcane juice then we observes cavitation process which is shown in figure. Also pH value changes when we penetrate ultrasonic waves in the liquid.

Observations are shown in the observation table given below:

**Table 1 Value of pH before and after penetration**

| Sr. No. | Time interval | pH before penetration of ultrasonic waves | pH measured after penetration of ultrasonic waves |
|---|---|---|---|
| 1 | 0 | 5.02 | - |
| 2 | 5 min | | 4.96 |
| 3 | 10 min | | 4.95 |




## 6. RESULTS AND DISCUSSION

The ultrasonic waves penetrated through the Sugarcane Juice solution with the fixed frequency for each 5 minutes and 10 minutes reading are recorded from the time of penetration of ultrasonic waves as described in the observation table. Penetration of ultrasonic waves alters pH value of sugarcane juice solution from 5.02 to 4.95 within 10 minutes. In the present study, the parameter i.e. pH changes are observed before penetration of ultrasonic wave and after penetration. This research work basically compares traditional control with the ultrasonic control of pH, the comparison motives for further research work for greater industrial application. Penetration energy of ultrasonic gives the measure change in the pH value.

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