

Milk Testing By Ultrasonic Waves

R. P. Yadav

Regional Higher Education Officer, Bareilly, U.P., India.

M. Saleem Khan

Professor Dept. of Applied Physics, M.J.P. Rohilkhand University, Bareilly, U.P., India.

Gaurav Kumar Mishra

Research Scholar, Department of Applied Physics, M.J.P. R.U., Bareilly, U.P., India.

Abstract- The milk industry makes a sizeable contribution, not just to the domestic market but also to the global market. Nevertheless, the fact that dairy is a consumable liquid poses a serious barrier. Because of the ever-increasing demand for milk as well as the items manufactured from it too. It is not only difficult but also extremely hard to maintain the company's freshness and quality. It is conceivable that less reward may be provided to a farmer if the techniques of milk testing are not transparent and accurate enough. For a substantial period of time, farmers, as well as dairy groups, have been left confused as well as dissatisfied with manual methods of dairy testing. On other hand, not anymore! After collecting these findings and conducting this analysis. Quick has established a holistic solution that really can improve the milk ecosystem at the farm, the collecting center tier or the milk level. The implementation of milk testing equipment that is both accurate as well as reliable was a huge aid in preserving this balance. There are several different methods for testing milk, but the ultrasonic technique is currently the most advanced way to determine whether dairy has been adulterated. Using this technique, which involves passing ultrasonic waves through a number of different milk products, we were able to determine certain physical properties, like the speed of ultrasonic waves in those samples. With the help of the velocity, you are able to identify other related parameters, such as the impedance as well as the acoustic absorption of those specimens when they are at room temperature. It has been found that the percentage of milk which has been tempered with is linearly related to the attenuation of ultrasonic as they travel through the samples.

Keywords: - Milk, Adulteration, Ultrasonic wave, Acoustic Impedance, Milk's fluidity, Density, Melting.

Introduction - Milk is indeed as edible substance that really is ideal for human food. But unfortunately, problems related to the additives in milk are very common in our modern society. This affects a large number of people. They are vulnerable to acquiring several diseases, including diarrhea,

On occasion. The use of ultrasonography as a method to identify adulteration in milk is very helpful technology. On the other hand, in the standard approach, we put certain elements or chemicals into the dairy that we test and then observe the reaction. The ultrasonic method, on the other hand, does not require the detection of any reaction in milk samples itself. The testing process using technologies is both very economical and very fast. (A, Sadat, P, Mustajab, & I.A. Khan, 2005)

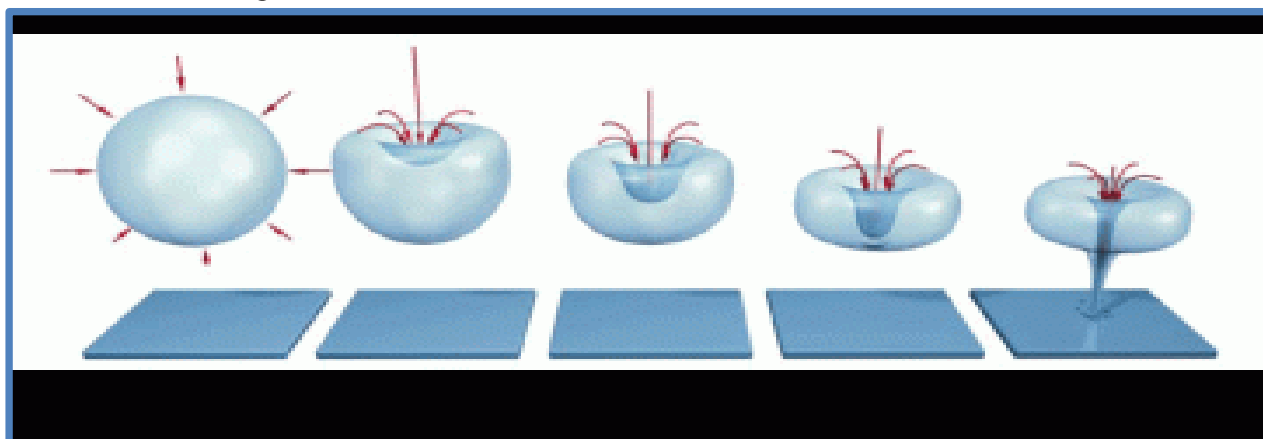
When clean milk is contaminated with water, the milk's fluidity, density, melting temperature, but rather conductance capability, and heating value will vary. In this paper, we discuss several parameters, such as sound attenuation as well as acoustic impedance, which aid in identifying adulteration. The majority of these time-honored methods also need large investments. Consequently, the development of better instrumental methods is needed in order to provide better and more accurate results, which are necessary for the speedy as well as set of usefulness of these kinds of additives. The purpose of this paper is to facilitate the simple identification of

additives. The ultrasonic technique is an easy-to-implement, reduced method that can substantially enhance the level of medical care in our society. (A.Q.Chen.S Freear & D.M.J. Cowell, 2007)

Features Ultrasonic Milk Analyzer- The Ultrasonic Milk Tester that we make and sell is covered by a patent, and it analyses dairy using ultrasound waves. In addition to measuring milk density, it also may be synced in real time to the cloud. The elimination of the need for human intervention is facilitated by the fact that the gadget may be calibrated to use a mobile app that enables Bluetooth. By presenting accurate milk characteristics, the Ultrasonic Milk Analyzer from Quick is beneficial to all the members of the supply chain, including farmers, Milk Procurement Centers, as well as Dairy cooperatives. The Atma Niirbhar Bharat project is being backed by the iSmart Milk Analyzer, which has been developed at Prompt and it is the only product on the market that is entirely found in India. The product's services in dairy sector may be ascribed to its accurate finding about quality milk, durable construction, simple operation, and high level of reproducibility. (J.R. Pellam & J.K. Galt, 1946)

Notable Uses and Features of the Ultrasonic Milk Analyzer- No matter the weather or the humidity, the item can resist the elements. It is easy to utilize thanks to uncomplicated on-touch analysis. Cloud storage acts as the place for Milk Datalog, Error Log, as well as Calibration milk Datalog. The Dairy is able to utilise this real-time information in order to make business decisions that are both insightful as well as analytical. All information that is uploaded to or downloaded from the cloud is always encrypted before even being stored there. Costs of maintenance and operation that are low The data may be retrieved using the device that acts as the USB host connection. (M.F. Mabrook & M.C petty, 2003)

Milk Is Pasteurized Using Ultrasonic Waves



The high-temperature, short-time (HTST) technique of pasteurisation has become increasingly popular in the dairy industry in recent years. In this approach, the milk products is heated to 72 degrees Celsius for 15 seconds in order to attack the bulk of the bacteria that cause spoiling. However, during the high-temperature treatment, the nutrients lose from the a process known as heat deterioration. Our team studied the potential of using ultrasonication in combination with thermal treatment during the pasteuriza with the goals of reducing nutrient loss and preserving the efficiency of the pasteurisation. (Lund, 1988)

The use of ultrasonography is a cutting-edge technique which has a wide range of applications, including the food production process, the medical field, and obstetrics. A shock wave is responsible for triggering the underlying mechanism, which is an alternation of compression as well as viscous dissipation of the medium. In the operation of maintains a strong of milk, a cavitation phenomenon may occur as the ultrasonic wave moves thru the milk's aqueous solution. Its because milk is indeed an aqueous liquid. The radical that are generated as

a result of the disintegration of molecules of water are highly reactive with their environment and cause chemical reactions when they have been coupled with acoustic effect as well as the high pressure that is also produced.

It removes phosphate enzymes as well as germs without damaging any of the nutrients from the foods by mixing it with a thermal treatment at a low sufficient temperature.

Furthermore, strong eddies were produced as a result of a forceful vibrating of cavitation in the fluid that happens in ultrasonication. Micro-streaming is produced as a result of bubbles being attracted to an ultrasonic field. The intense agitation that is caused by the micro streaming helps achieve homogenization as well as boosts both thermal performances as well as mass transfer. The mechanism outlined above may effectively eliminate the possibility of a virus living thanks to the combination of efficiency and energy pressure that it generates. (D. M. Reddy, K. Venkatesh , & C. V. S. Reddy, 2017)

Principle of Technique- In this article, we explore both principles as well as the methodology behind locating or detecting instances of impurities in milk. A device called as a transmitter converts an electrical signal into such an ultrasonic signal of a certain frequency. This ultrasonic wave signal is passed through the milk sample in order to determine the intensity of the signal's decay as a result of its interaction with the milk sample, which might be fluid or milk. Now, a second ultrasonic signal transforms the outgoing signal into an electrical signal that is far lower than the input (electrical). For each frequency, both the overall losses as well as the time delay that occurs between the source and the destination transducer are measured. We are responsible for the calculation of the data on which the interpretation is based. The continuous loss of power that occurs inside an ultrasonic wave is referred to it as attenuation. These losses compensate for every conceivable kind of energy loss in the signal. (V.R. Singh & S. Dwivedi, 1995)

Experimental Method- In the physics laboratory, we use ultrasonic inter ferometer M-84 serial number 1402 Beemat company. We select some samples of milk popularly and commercially available brands as Amul milk (full cream) having 8% fat, 9% SNF. The Temperature during the experiment remains at room temperature we use double distilled water for milk adulteration. Double distilled water is mixed with 0%, 10%, 20%, 30%, and 40% to create adulteration in milk samples. The frequency of waves is set at 0.5 MHz, and the sample under testing is filled in the vessel size (70 x 40 x 65 mm). Acoustic waves are passed through the sample to check the alteration of output signal peak to peak voltage. The transducer is connected to function. (Freear & D.M., 2007)

The experimental setup is shown in fig.



Figure 1: - Experimental setup

Experimental Result- The experiment held to find out the adulteration in the milk. The calculation of acoustic attenuation describes the relation between output intensity and output voltage. The measurement is obtained from the instruments in the form of peak-to-peak voltage of the received signal at the output of the proposed system at room temperature. The milk samples are adulterated with double-distilled water in different quantities. The figure shows the graph between peak-to-peak output voltage with an increase of adulteration in milk.

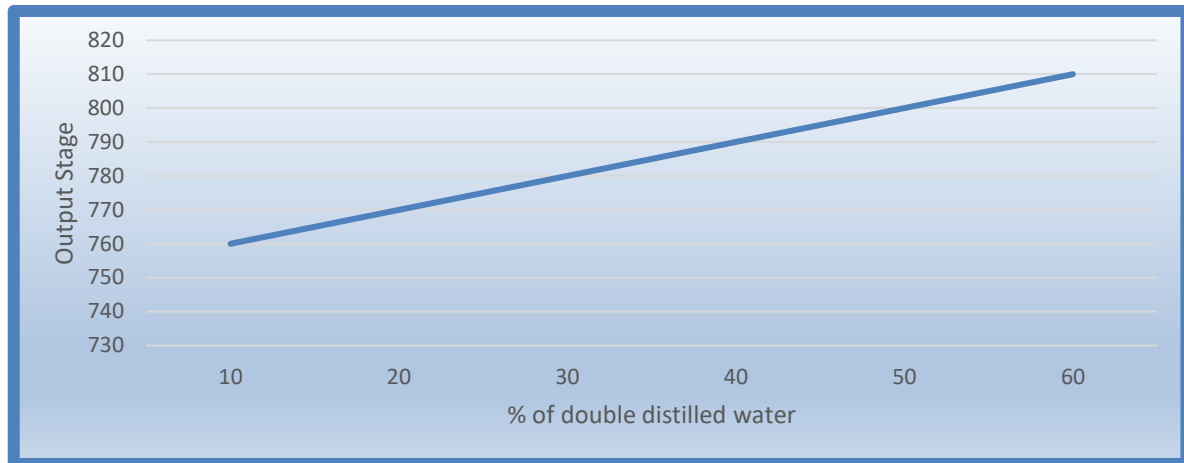


Figure 2: - Output voltage with percentage of double distilled water

Conclusion

We have observed statistically significant difference between various adulterated samples of milk by ultrasonic waves at 502.5 KHz at room temperature. The proposed method shows the useful technique to determine the adulteration in milk which is very easy and quick in response. This method is also useful to control the quality of milk products both fresh and packaged milk or dairy products.

References

1. A, Sadat, P, Mustajab, & I.A Khan . (2005). Determining the adulteration of natural milk with synthetic milk using ac conductance measurement. normal of food Engineering, vol-77, pp477.
2. A.Q. Chen.S Freear , & D.M. J Cowell. (2007). Measurement of solid in liquid content using ultrasound adulteration. In 5th world congress, industrial process homograph, Bergen (pp. pp 820-826). Norway.
3. D. M. Reddy, K. Venkatesh , & C. V. S. Reddy. (2017). Adulteration of milk and its detection: A review.
4. Freear, A. C., & D. J. (2007). Measurement of solid in liquid content using ultrasound adulteration. 5th world congress, industrial process homograph, (pp. pp 820-826). Bergen, Norway.
5. J.R Pellam, & J.K Galt. (1946). "Ultrasonic propagation in liquid," . The journal of chemical physics , vol- 14 (10) pp,608-614, .
6. Lund, D. (1988). Effects of Heat Processing on Nutrients. In Evaluation of Food Processing (pp. pp. 319-354). Dordrecht: Springer Netherlands. doi:10.1007/978-94-011-7030-7_12.
7. M.F. Mabrook , & M.C petty. (2003). A novel technique for the detection of added water to full fat milk using single frequency admittance measurement. sensors and Actuators.
8. V.R. Singh, & S. Dwivedi. (1995). Ultrasonic detection of adulteration in fluid foods. proceeding RCIEE-EMBS & 14th BMESI, (p. pp.1.73.1.74).