



Opinion

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Non-Thermal Process: Ultrasonic Applications in Dairy Industry



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Opinion

Conventional method heat treatment is the most widely method used to achieve preservation of food, but heat can also have a negative impact on nutritive value and organoleptic properties of foods. The conventional method of milk processing used thermal treatment, such as pasteurization and ultrahigh temperature (UHT). When existing methods of pasteurization and ultrahigh temperatures are used, the drawback of these methods is lowering of organoleptic and nutritional quality [1]. For this reason, Ultrasound can be used as an alternative method to inactivate enzymes and destroy microorganisms with little or no heat.

Ultrasonic is a high power sound wave at frequencies between 16kHz and 100MHz [2]. The major advantage of ultrasound to conventional dairy processes has the potential to provide significant benefits for the dairy industry such as energy savings and improved product properties and non-thermal preserving the food. Ultrasonic process provokes the destruction of bacteria by cavitation bubbles caused by pressure different. During ultrasonication process, the sound wave encounters a liquid medium creating longitudinal waves, that generates regions of low pressure. These regions of different pressure cause cavitation and gas bubble formation. These bubbles increase gradually their volume until they implode, creating regions of high temperature and pressure. The pressure resulting from these implosions cause the main bactericidal effect of ultrasonics.

Ultrasonic is a considered to be an emerging technology in the dairy industry. Ultrasonic is considered as an alternative method for reducing fat globules size and can be effectively applied in place of conventional homogenizer. Consequently, ultrasonic is a good alternative method for food processing and preservation. Power (High-frequency) ultrasounds are used for specific dairy processing applications such as homogenization, crystallization, drying, and non- thermal sterilization or pasteurization.

In the food industry the use of ultrasound is divided into two categories: low-intensity (kHz) and high-intensity (MHz)

ultrasound. The low-intensity ultrasound (<20kHz, $1 \frac{w}{cm^2}$ lower then range) is a non-destructive technique providing information about physicochemical properties of food high-intensity ultrasound (>20kHz, $1 \frac{w}{cm^2}$ higher then range) is used to modify and alter food.

Ultrasonic at a low temperature is not severe enough for sufficient destruction of microbes. Some of the investigations shown that ultrasonic in combination with temperature has accelerate rate for the sterilization of food [3]. To improve the microbial destruction, ultrasonic is combined with treatments such as pressure, heat and both pressure and heat.

Thermosonication (TS)

The combination of heat and high power ultrasonic (thermoutrasonication) was first explored by Ordonez et al. [3]. The thermosonication combines moderate heat (37 to 75 °C) with ultrasonic treatment.

Manosonication (MS)

It combines the ultrasonic with moderate pressure (100 -300kPa) at sub lethal temperature. In 1992, Sala et al. [4] designed and built a resistometer to apply high-power ultrasonic under pressure at nonlethal and lethal temperatures. Results obtained with this instrument demonstrated that the rate of vegetative-cell inactivation by manosonication increased drastically when the static pressure was raised. The inactivation of microorganisms by ultrasonic waves was reported in the early 1930s [5].

Manothermosonication (MTS)

Manothermosonication consists of the simultaneous application of heat and ultrasound under moderate pressure (100-700kPa). It is one of these new technologies [6]. Manothermosonication is an efficient tool to inactivate enzymes and bacteria in milk. Moreover, ultrasonic is an as a safe processing technique compared to other emerging technologies [7].

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