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Thermal and Non- Thermal Treatment of Milk- A Review

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Abstract: - Milk and milk products have been consumed since thousands of years and considered as an important diet of human being. Milk is highly perishable commodity. The dairy industry is continuously investing new preservation techniques owing to increasing consumer demand for milk and milk products which are natural in taste, nutrient rich and safe for consumption. Processing with thermal i.e. pasteurization, sterilization and non thermal methods i.e. pulsed electric field, ultra sonication, high pressure processing (HPP) used to increasing the shelf life of milk and milk products. People are going towards minimally processed and healthy food engaging the industry to look after for better alternatives. Hence the non thermal techniques are in focused in order to increase the shelf life of milk.

Key Words: Perishable, thermal, non thermal, pulsed electric field, HPP

Introduction: Milk is a widely consumed beverage that is essential to the diet of several millions of people worldwide because it provides important macro- and micronutrients. Four components are dominant in quantitative terms: water, fat, protein and lactose; while the minor components are minerals, enzymes, vitamins, and dissolved gases. Milk is considered as complete food on the earth, sole source nutrition for new born. Growing consumption of dairy and other livestock products is bringing important nutritional benefits to large segments of the population of developing countries. Milk has high nutritional values and animal origin; it comes under the category of perishable food. To improve the shelf life of milk and milk products there are so many processing techniques. i.e. thermal and non- thermal. By these techniques we can extend the shelf life of milk from days to weeks.

Processing of milk: Processing of milk done by two methods.

(A) Thermal treatment

(B) Non thermal treatment

(A) Thermal treatment of milk

1. Pasteurization: - It is the process of heating every particle of milk to atleast 63°C for 30 minutes and 72°C for 15 seconds. After the pasteurization is complete, the milk is cooled to 5°C or below. The main objective of pasteurization is to render milk safe for human consumption by destruction of pathogenic micro organisms. And the second is to improve the keeping quality of milk by destruction of all spoilage micro organisms. There are two types of pasteurization LTLT (Low temperature Long time) and HTST (High temperature short time).in LTLT process (Batch process) heating milk 63°C for 30 minutes and in HTST Process (Continous process) heating milk 72°C for 15 seconds.

2. Sterilization:-it is also heat treatment of milk in which milk has been heatedyo a tempertaure of 100°C or above for such length of time that it remain fit for human consumption. Sterilization of milk is aimed at killing all microorganisms present, including bacterial spores, so that the packaged product can be stored for a long period at ambient temperature, without spoilage by microorganisms. There are two methods of sterilization. Conventional method: Packaging is done before heat treatment. The processing is usually carried out at 105-110°C for 30-45 min. It is also known as In-bottle sterilization. Another is UHT or aseptic method: Packaging is done after heat treatment. The ultra high temperature short time (UHTST) and very high temperature short time (VHTST) processes come under this category. The processing is at 135-150°C for 1-20 seconds. Then the commodity is packed aseptically.

(B) Non thermal treatments

Pulsed Electric Field:- Pulsed electric fields (PEF) technology involves the treatment of a biological material or food placed between two electrodes installed 0.1-1.0 cm apart in a treatment chamber separated by an insulator, with short pulses (1-10 μs) that are generated by a high voltage (5-20 kV) pulse generator. The basic principle of the PEF technology is the application of short pulses of high electric fields with duration of microseconds to milli seconds and intensity in the order of 10- 80 kV/cm. The processing time is calculated by multiplying the number of pulses times with effective pulse duration. The applied high voltage results in an electric field that causes microbial inactivation. When an electrical field is applied, electrical current flows into the liquid food and is transferred to each point in the liquid because of the charged molecules present (Zhang et al.,

1995)PEF treatment has achieved a reduction in the micro flora of milk with a shelf life similar to that of high temperature, short time (HTST) pasteurized milk. PEF treatment also has the potential for use in the pasteurization of dairy beverages such as juice-milk products

1. High Pressure Processing (HPP):- High-pressure processing (HPP) is a non-thermal method of preservation and sterilization food and dairy products, in which a product is subjected to very high pressure, leading to the inactivation of certain microorganisms and enzymes in the food. High-pressure processing is a novel alternative to the thermal processing in the food and dairy industry. HP treatment [2] was carried out at 680 MPa for 10 min at room temperature and observed 5–6 log cycle reduction in the number of microorganisms. The effect of HP on milk has been extensively studied (Kelly et al., 2008). Many researchers have studied inactivation of microorganisms Listeria monocytogenes, Staphylococcus aureus, or Listeria innocua either naturally present or inoculated in milk (Gervila et al., 1997).

2. Ultra sonication:-Refers to the application of sound waves at the frequency (> 16kHz) greater than the upper limit of human hearing through liquid, solid or gases which causes formation of small bubbles (known as cavitation). When these bubbles reach a critical size range, they collapse under near-adiabatic conditions generating extreme conditions within the bubbles and in the surrounding liquid that include intense shear forces, turbulence and micro streaming effects. These ultrasound-induced physical effects are finding increasing use in food and dairy processing, in applications such as the enhancement of whey ultra filtration, extraction of functional foods, reduction of product viscosity, and homogenization of milk fat globules, crystallization of ice and lactose and the cutting of cheese blocks.

3. Irradiation: Food irradiation is the process of exposing energy in the form of rays for improving food safety, eliminating and reducing organisms that destroy the food products. Electromagnetic radiation (X-rays and gamma rays) and electron-beam radiation are forms of ionizing radiations applied on food among the various ionizing radiations. When dairy products are treated with ionizing radiation, the first effect is the possibility of radiation penetration to all areas of the product, especially lactic starters in large containers and thus ensures the disposal of microbes and to ensure full sterilization of the product. The use of irradiation technology for milk and milk products is limited. There are two reasons that hindered the widespread uses of ionizing radiation in the preservation of dairy products: first reason is due to the composition of dairy products in terms of high moisture and fat content; the second reason is the consumer acceptance of irradiated dairy products. The second effect of radiation in dairy products is attributable to the impact of some characteristics of the quality of milk and milk products such as prescription of color and flavor.

4. Ohmic heating:- It was practice in the early 19th centuary. It is also known as joule heater. The movements of ions in liquid cause collisions, which in turn result in creating resistance and generation of heat, ohmic heating of milk products improve the texture as well as shelg life of products.

3. CONCLUSIONS

Milk and milk products have been consumed from thousands of years. By using the different processing treatment we can extend the shelf life of milk. Consumer preference minimally processed milk because if we give high heat treatment to the milk, it affect their nutritional as well as sensory quality. So by using non thermal technology we can extend the shelf life of milk,

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