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UHT Processing - Best Technology For Shelf - Life Extension of Milk

Editorial

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Milk is the basic food for every class of human being for nutrition and health. It is also an ideal medium for the growth and multiplication of diverse microorganisms resulting in its early deterioration. In order to extend its market reach, milk should have higher shelf-life. Under this condition, diverse non-thermal processing techniques such as high pressure processing, pulsed electric field, microfiltration, ultraviolet light or thermal processing techniques such as thermization, pasteurization or ultra high temperature (UHT) treatment or their combinations may be adopted for extending the shelf-life of raw milk.

Milk is virtually sterile when secreted into the alveoli of the udder [23] and its journey of contamination commence with commensal microflora on the teat skin or on the epithelial lining of the teat canal [24]. Raw milk possesses natural antibacterial system but its germicidal or bacteriostatic properties are short lived [14, 7]. Further, poor unhygienic environment at the producing farm coupled with poor unhygienic practices during milking and handling of milk result in poor microbiological quality of raw milk [20]. Raw milk should be chilled immediately after production to avoid its deterioration due to microbial growth. Research revealed that milk could be stored for 96h when stored at 2ºC, but at elevated temperature of storage at 4ºC the shelf-life is 48 h [15]. In India problems are faced due to higher ambient temperature coupled with location of dairy plants far away from producing farms. Raw milk can be preserved by Lactoperoxide (LP) system at farm level but it is not practical as preservative effect is for a shorter period and use of LP-treated milk is not suitable for the manufacture of all types of dairy products.

Thermal processing of milk by pasteurization is widely adopted worldwide. FAO/WHO (2004) defined pasteurization as "A microbiocidal heat treatment aimed at reducing the number of any pathogenic microorganisms in milk and liquid milk products, if present, to a level at which they do not constitute a significant health hazard. Pasteurization conditions are designed to effectively destroy the organisms *Mycobacterium tuberculosis* and *Coxiella burnetii*". Pasteurization can be done adopting Low Temperature Long Time (LTLT) pasteurization (63ºC/30min) or High Temperature Short Time (HTST) pasteurization (71ºC/15s). Sarkar et al. (2018) recommended adoption of additional techniques such as bactofugation or microfiltration in conjugation with pasteurization to produce spore free pasteurized milk with extended shelf-life. Shelf-life of pasteurized milk is more than raw milk but it is still limited. Shelf life of pasteurized milk is highly influenced by its storage temperature [17] and had a shelf-life of approximately 10-20 day when stored at 6.1°C [12]. Burdova et al., (2002) denoted a decrement in shelf life of full cream pasteurized milk (31 to 11 days) and skimmed pasteurized milk (32.57 to 10.71 days) with an elevation in storage temperature from 4 to 10°C due to more enhanced proteolytic and lipolytic activities of psychrotrophic microorganisms after 2-3 days at 10ºC in contrast to 4-6 days 4ºC. Results indicated that pasteurized milk has to be stored at lower temperature for better shelf-life.

Extended Shelf-Life (ESL), also called Ultra-Pasteurized milk is produced by thermal processing using conditions between those used for traditional HTST pasteurization and those used for UHT sterilization [6]. ESL products are defined as those that have been treated in a manner to reduce the microbial count beyond normal pasteurization, packaged under extreme hygienic conditions, and which have a defined prolonged shelf life under refrigeration conditions [19]. ESL products can be produced by two principal technologies: (A) Thermal processing using more severe conditions than pasteurization but less severe than UHT processing and (B) Non-thermal processes such as microfiltration [22] and bactofugation [11] usually combined with a final thermal pasteurization treatment to meet regulatory requirements. No specific temperature-time combination for ESL milk has been specified in most countries. In USA for ESL milk, a heat-treatment of ≥138 °C/≥2 s is recommended [6]. Commercially ESL processing is done at 123-127°C/1-5 s [10, 13]. Reported shelf-life of HTST pasteurized milk in aseptic package was 49 day/3ºC [21] or 35 days/4ºC [3] whereas ESL milk processed at 120-125 °C/1 s had a shelf-life of >37 days/7ºC [18]. Shelf-life of ESL milk is greater than aseptically packed pasteurized milk.

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UHT milk sterilization is a novel technique of milk preservation and is the most effective treatment for long shelf-life at room temperature [1]. During UHT processing, milk can be heated either by direct or indirect method. In the indirect system, the product and heating medium do not come in contact, but reverse happens in direct system. In indirect method severity of heating is less (3 to 4°C) and products have less chance of gelation and sedimentation but greater incidences of fat separation and development of more cooked flavor [5]. During UHT processing milk is heated continuously at 130 and 150°C for 3-5 s [9], and then it is immediately cooled to < 32°C and filled aseptically in sterile sealed packaging [16]. Barraquio (2014) reported higher shelf-life of UHT milk, when processed by indirect method (> 12 months vs. 12 months at 4ºC or upto 12 months vs. 6 months at 20ºC) in contrast to direct method. UHT processing may be more advantageous for countries like India due to lower energy costs, extended shelf life at higher ambient temperature and elimination of requirement of refrigeration or cold chain during storage and distribution.

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