

Identification of Best Pasteurization Temperature – Time Combination for Retarding Microorganism Counts in Raw Cream as Ingredient of Butter: Approach to Improve Microbial Quality of Butter

K.A.H.S. Keenavinna, D.C. Mudannayake, A.M.N.L. Abesinghe,
Uva Wellassa University, Badulla, Sri Lanka

and

K. Jayarathne
Milco (pvt) Ltd, No.45, Nawala road, Narahenpita.

Introduction

This paper provides an overview of Best Pasteurization Temperature–Time Combination (BPTTC) for retarding microorganisms in raw cream as an ingredient of butter. BPTTC is an indicator of good quality raw cream as an ingredient of butter. Best pasteurization temperature–time combination is gaining the idea about good quality raw cream.

The quality of raw cream is the most important factor in production of butter. If cream has an increase of microbial count it can't produce butter. In order to determine the quality microbial count is very important. In this study, different pasteurization temperature – time combinations were used to retard microorganisms count. This test uses microbial analysis of raw cream by using Total Colony Count (TCC) method and Yeast and Moulds count methods.

When cream incorporates high intense heat fat separation occurs. It is not good for the production of quality butter. So when pasteurization temperature – time combinations needs to be critically monitored and identified its temperature – time combination then unhealthy pasteurization temperature – time range can be avoided.

An increasing number of people are consuming raw unpasteurized milk. Enhanced nutritional qualities, taste, and health benefits have all been advocated as reasons for increased interest in raw milk consumption. However, science based data to substantiate these claims are limited. People continue to consume raw milk even though numerous epidemiological studies have shown clearly that raw milk can be contaminated by a variety of pathogens, some of which are associated with human illnesses and diseases (Oliver *et al.*, 2009).

Food spoilage is an enormous economic problem worldwide. Milk is a highly nutritious food that serves as an excellent growth medium for a wide range of microorganisms. The microbiological quality of milk and dairy products is influenced by the initial flora of raw milk, the processing conditions, and post-heat treatment contamination. Undesirable microbes that can cause spoilage of dairy products include Gram – negative psychrotrophs, coliforms, lactic acid bacteria, yeasts, and molds. In addition, various bacteria of public health concern such as *Salmonella* spp., *Listeria monocytogenes*, *Campylobacter jejuni*, *Yersinia enterocolitica*, pathogenic strains of *Escherichia coli* and enterotoxigenic strains of *Staphylococcus aureus* may also be found in milk and dairy products (University of West Hungary, 2007).

The hygienic production of milk is of the greatest importance for cream, because although most vegetative cells are easily killed by heat treatment, spores are not, and some types, such as *B. cereus*, can be a cause of spoilage (as well as failure in the

methylene blue (MB) test). If the spore count of the milk is high (over 100 ml^{-1}), it may be worthwhile reducing this by high speed centrifugal methods. As aerobic spore – formers tend to form chains, these are more easily removed than single cell (Robinson, 1990).

Most vegetative bacteria cells, yeast and moulds in milk and cream should be killed by pasteurization. However, thermophilic bacteria will survive pasteurization and lactic organisms such as *Streptococcus thermophilus*, *Lactobacillus bulgaricus* and *Lactococcus lactis* are important. Some *Micrococcus* spp. And some enterococci can also survive pasteurization. Spore-forming thermophilic bacteria survive pasteurization and various aerobic and facultatively aerobic *Bacillus* spp. can be found in pasteurized milk and cream *B. cereus* and *B. subtilis* are proteolytic, whereas *B. polymixa* is gas forming. *B. licheniformis* and *B. coagulans* are also found. *Clostridium* spp. is the main anaerobic spore-forming organism found in pasteurized milk and cream, of which *C. butyricum* and *C. sporogenes* are common. Many of the clostridial organisms are proteolytic and/or saccharolytic and those that grow in milk also form gas. Frazier and Westhoff (1988) recorded that heat resistant lactic acid bacteria may spoil pasteurized products through the production of lactic acid, provided the storage conditions are favourable, i.e. the temperature is high enough. When storage temperatures are unfavourable for lactic bacteria, coliforms (the result of post-pasteurization contamination) may produce hydrogen, carbon dioxide, ethanol, formic acid, acetic acid and some lactic acid. In the absence of competition from lactic acid bacteria *Bacillus* spp. and *Clostridium* spp. will cause spoilage, the former mostly producing lactic acid and the latter often producing butyric acid, hydrogen and carbon dioxide (Early, 1998).

Methodology

In this project, milk and milk products move through several hands from production to consumer. Hence the assessment of overall efficiency of handling and processing of the products is a criterion in the evaluation of the quality delivered to the consumer. This is achieved by testing the samples of milk, milk products, water, swabs and rinse of dairy utensils in the microbiology laboratory. Each pasteurization temperature – time combination were used to five samples (cream) and the micro biological analysis was done. Also one temperature has two time changes. Good quality raw milk was tested by using Resazurin test. Total Colony Counts (TCC) and Yeast and moulds microbiological analysis were done to find out the best pasteurized cream sample.

Results and discussion

In this study, when pasteurization temperature was increased and TCC level and Yeast and mould counts level were reduced. Also when time period were increased and also results were obtained in lowest counts of microorganisms level.

Bulk collection of milk is common practice to be stored in creameries at $5 \text{ }^\circ\text{C}$ for up to 48 hours and even sometimes longer. The change from churn to bulk milk collection has resulted in a change in the microflora of raw milk, with an increase in the level of psychrotrophs. There is normally no problem with milk quality for milk so held, although psychrotrophs can grow very slowly at below $5 \text{ }^\circ\text{C}$. These are generally biochemically active against fat and protein, but do not usually ferment lactose to lactic acid. Thus cold – stored milk does not sour but can develop taints, and although the organisms are nearly all killed by pasteurization, they produce enzymes which can survive pasteurization and continue to produce changes in the pasteurized product

(Robinson, 1990). The raw cream is usually held at about the separation temperature (e.g. 40 °C) during the standardization. Furthermore, the cream may be contaminated by inadequately disinfected process plant or the skim – milk may not be of good quality (Robinson, 1990). Also high temperature pasteurization fat separation occurs and that problem mainly caused to the final product quality. So, high intended heat wants to avoid because of the fat separation. Also high intended heat has economic losses. Because of heat generating fuel is diesel and high heat wants to get much fuel burning. It is major threat for production of customer based product. If price is high product also fails in the market and the customer penetration is reduced. When free fatty acids of the cream are increased more than 0.37 % then it can't produce butter. So it converts in to ghee. Low temperature has more free fatty acids level so it pasteurization temperature – time combination can't produce butter. If that pasteurized cream is converted to butter, its shelf life is reduced and also off flavor is developed. High temperature pasteurization combinations produce low free fatty acids cream and it is good for production of butter. All milk and products made from it, such as cream, become contaminated by micro – organisms from the udder, or from the cow, or during the milking process. The 'original' flora in this sense consists mainly of lactic and other streptococci, micrococci, corynebacteria, and aerobic and anaerobic spore – forming bacteria.

Conclusions

$P < 0.05$, and all the temperature – time combinations were significant with 75 °C – 30 minutes pasteurization temperature - time combination. When temperature increases with more than 75 °C temperature (e.g. 80 °C) fat separation occurs and it can affect the final product quality. So, the best pasteurization combination is 75 °C – 30 minutes. This best pasteurization combination there have no any fat separation and also economic viable temperature – time combinations.

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