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RESEARCH FOR OBTAINING THE MELTED CHEES FROM COW MILK

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Abstract: *Since processed cheese was first manufactured in the early 20th century, many different types of processed cheese have been manufactured around the world. Most processed cheese, with the exception of processed cheese analogues, are manufactured from natural cheese, with the type and amount of cheese used varying between different processed cheese products.*
The objective of this paper is to provide an overview on the technological process of obtaining the melted cheese as well as the quality parameters of the raw material and the finished product.
Keywords: *cow milk quality, cheese properties, melted cheese.*

1. INTRODUCTION

Cheese has been present in the human diet for many years, with recent literature suggesting early cheese-making practices date as far back as 5200 BC [7]. Although the high protein and calcium content of natural cheese is a proven nutritional energy source, issues arising over its low stability lead to the initial production of processed cheese (PC), a natural cheese derivative with higher stability and reduced need for refrigeration [2, 8].
Cheese is a type of fermented milk-based foods, with a myriad of cheese types in a wide variety of flavor and forms all over the world, with each region shaping its products according to culture and resources. Cheese can be regarded as a bio complex ecosystem colonized by a diverse group of microorganisms, known as cheese flora, provided by raw milk, starter and adjunct cultures. This flora are the major contributors to the perceived sensory attributes of the different cheese types owing to their complex interaction with milk proteins, carbohydrates and fats that mainly occur in an important technological process in cheese manufacturing, known as ‘’ripening’’ [1, 4].
Processed cheese can be manufactured to have a variety of characteristics when compared to natural cheese, for instance increased melt ability, longer shelf-life stability, high diversity, and reduced refrigeration requirements, which make it a suitable and reliable product for the hospitality, bakery and fast food sectors. Recent studies have found that in 2015, 70% of all American households purchased processed cheese for everyday consumption [3], which is attributed to the large variety of targeted processed cheese products now available on the market. With such a large existing consumer base, and projected market growth in developing countries around the world [9], it has been predicted that the dairy sector will experience continued demand of processed cheese, with a high potential for market growth in the future [8].
Cheeses are popularly used as ingredients in many prepared, ready-to-eat foods in which the cheese often undergoes melting. Use of Cheddar cheese on toasted sandwiches and Mozzarella cheese on pizza are some familiar examples. Consumer acceptance of these foods depends on the melting quality of the ingredient cheeses. Therefore, the melt ability of cheese is an important factor in determining the quality for particular product applications [6].
During heating cheese undergoes a phase change from solid to liquid. This transition plotted as ‘‘cheese flow vs. heating time” is known as the cheese melt profile [6].
Moisture and fat contents, pH, and free tyrosine levels were not related to the melting quality of cheese. No relationship was found between melting quality and fat, moisture, or pH level of process cheese [5].

2. MATERIALS AND METHODS

In order to obtain the melted cheese from cow's milk, the experimental research methodology of Fig. 1. was fallowed.

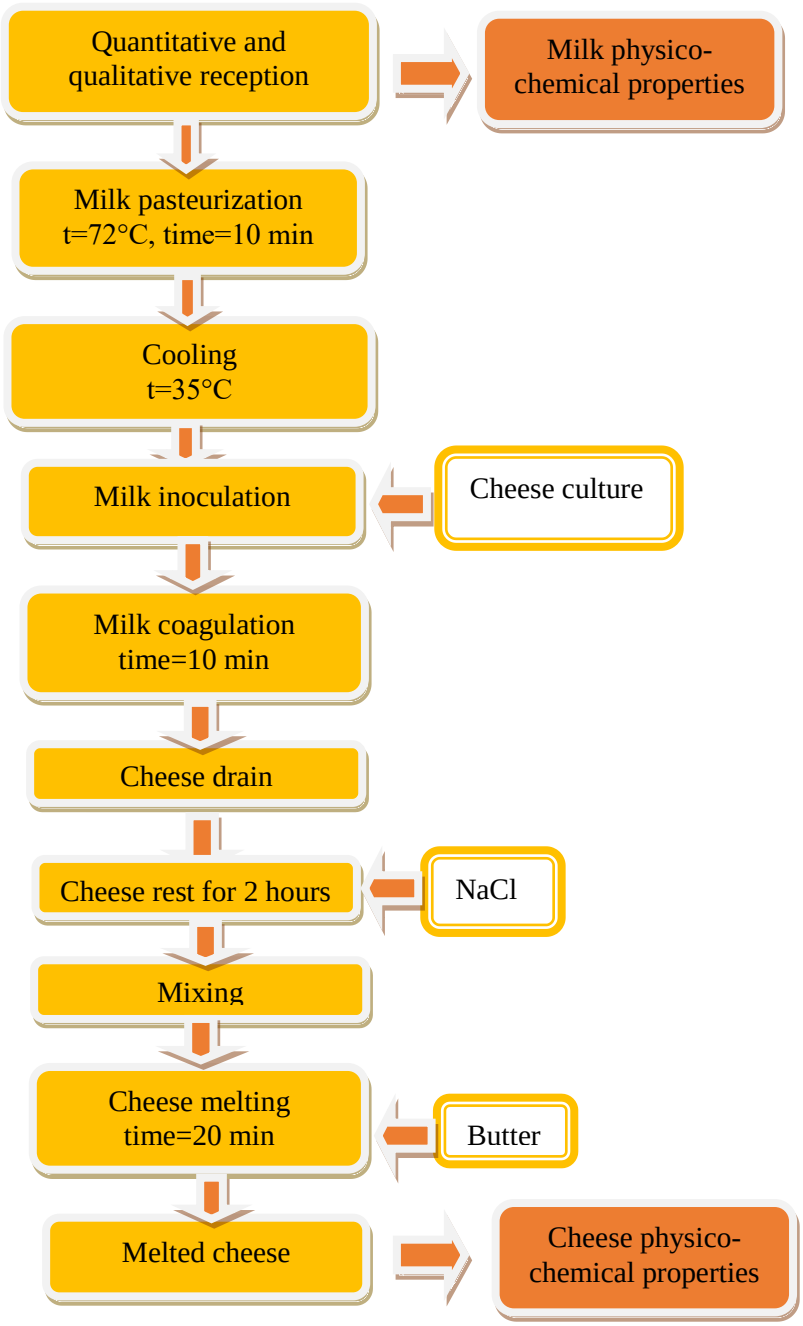

Figure 1: Experimental research methodology

Fresh cow's milk was used to obtain fresh cheese. In order to verify its quality, its physico-chemical properties were determined using the Lactostar apparatus from Funke Gerber.The Lactostar milk analyzer is a latest generation of instruments for the determination of *fats, proteins, lactose, non-fat solids, density and cryoscopy point*. Method of operation: The milk sample (20 ml) is sucked into the measuring cell using a pump. The fat and non-fat solids are determined using the effects of thermal measurement. The proteins, lactose, density and cryoscopy point are determined with the help of an additional measuring cell which is equipped with a combined impedance/turbidity sensory system.

The *pH* was determinate with an electronically pH meter Comsol.

The freezing point (*cryoscopic point*) varies between -0.540ºC and -0.670ºC and is determined by the concentration of dissolved substances (lactose and mineral salts). It is used to determine the falsification of milk by dilution with water and even its degree of dilution. A lower value of the cryoscopic point denotes an addition of water; The decrease of the cryoscopic point of milk by 0.01ºC is considered to correspond to an addition of 1.82% water. By the addition of sodium bicarbonate or sodium hydroxide for preservative purposes, the cryoscopic point decreases. As by the natural acidification of milk the cryoscopic point increases, determinations must be made in milk with a maximum acidity of 20ºT.

Milk acidity was also measured. The principle of the method is based on the assessment of the freshness degree and the quality of milk at collection. According to the SM-104 standard, the milk at collection must have 18 ° Thorner acidity. Way of working: in a glass of Erlenmeyer add 10 ml of milk, 20 ml of distilled water and 3 drops of phenolphthalein. The mixture is titrated with 0.1 N sodium hydroxide until a light pink coloration persists for at least one minute.

$$A = 10 \cdot V \quad [°T] \tag{1}$$

where V the volume of the 0.1 n sodium hydroxide solution used for titration in cm^3.
Milk *pasteurization* was carried out at 72°C for 10 minutes.
The pasteurized milk was cooled down to 35°C was seeded with 2 g of Christian Hansen cheese culture.
The cheese obtained was mixed with salt and after resting it was melted using an electric hob. The melting time was 20 minutes. After cooling, the *acidity of the melted cheese* was determined. Principle of the method: the acidity of a certain volume of the sample prepared for analysis is neutralized by titration of 0.1 N sodium hydroxide, in the presence of phenolphthalein as an indicator. Way of work: weigh 10 g of cheese and place it in a porcelain capsule. Soak with 2-5 cm3 of distilled water and 1 cm3 of phenolphthalein solution until a uniform paste is obtained. Titrate with a solution of sodium hydroxide, stirring continuously, until pink, which is maintained for 1 minute.
The acidity of the cheese, expressed in Thorner degrees, is calculated by the formula:

$$A = \frac{V}{m} \cdot 100 \quad [°T] \tag{2}$$

where: V - the volume of the 0.1 n sodium hydroxide solution used for titration in cm^3; m - mass of product taken into operation, in grams.

3. RESULTS AND DISCUSSIONS

After the analysis of the milk quality, the following results were obtained (table 1).

Table 1: Fresh milk properties

Properties	**Value**
Fat %	4,316
Proteins %	3,946
Lactose %	5,66
Non-fat solids %	10,446
Density g/cm^3	1,0316
Cryoscopy point %	-0,623
Minerals %	0,54
Acidity °T	18
pH	6,52

Analyzing the results from the table 1 it can be observed that the milk falls within the quality parameters according to the standards and it can be used for making the chees.
If the acidity is slightly increased above 20ºT, the casein precipitates in the form of lumps, and if the acidity exceeds 26ºT, the casein precipitates completely.
During storage, the acidity of the milk increases, especially due to the lactic acid that is formed by the fermentation of lactose by the lactic bacteria. The faster the acidity increases, the higher the storage temperature. Milk with acidity over 35ºT coagulates on boiling, and then, the higher the acidity, the casein precipitation occurs by heating to a lower temperature; at 60-70ºT the phenomenon occurs spontaneously at room temperature. The acidity of the milk gives indications on its freshness and on its technological quality.

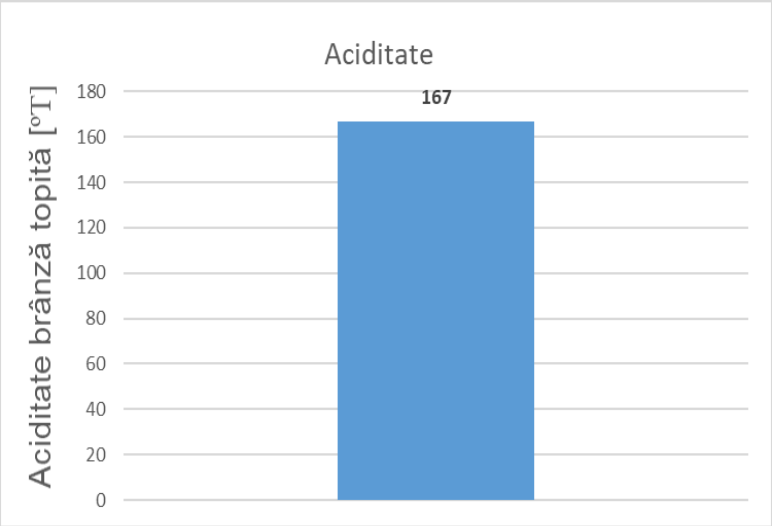

Figure 2: Melted cheese acidity

Regarding the melted cheese, an acidity value of 168ºT was obtained, which according to the standard is within the quality parameters.

4. CONCLUSION

Processed cheese can be manufactured to have a variety of characteristics when compared to natural cheese, for instance increased melt ability, longer shelf-life stability, high diversity, and reduced refrigeration requirements, which make it a suitable and reliable product for the hospitality, bakery and fast food sectors.
During heating cheese undergoes a phase change from solid to liquid. This transition plotted as ‘‘cheese flow vs. heating time” is known as the cheese melt profile.
Following the experimental research carried out in this paper, it was found that both the milk as raw material and the melted cheese correspond to the quality parameters according to the national standard.

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