QUALITY OF CREAM PRODUCTS WITH THE ADDITION OF EMULSIFIERS FROM DIFFERENT SOURCES

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ABSTRACT

The aim of this work was to determinate the physical characteristics of the cream spreads produced in the laboratory ball mill, with the addition of emulsifier lecithin from soybean, sunflower and oilseed rape, depending on refining time.

The physical properties of the cream products with penetration were defined by hardness at temperature of 20ºC, where it was determined that the cream samples with the longest retention time in the ball mill have the highest hardness. Rheological measurements confirmed thixotropic flow curves of all samples.

The samples with retention time of 30 minutes in the ball mill have the best uniformity and stability of system, but the samples of cream with the addition of lecithin from soybean and sunflower, with retention time of 45 minutes, have the best and very similar sensory characteristics.

Key words: crem spread product, emulsifier, ball mill, rheology, quality

1. INTRODUCTION

The composition of cream products consists of powdered sugar, edible vegetable fat, sunflower oil, cocoa powder, milk powder and hazelnut mass (1). The high fat content, which is the continuous phase of cream spread products, influences the consistency and behavior of this type of products (2). Therefore, the fat selection for cream spreads requires a good knowledge of characteristics of fat and complex processes that may occur during manufacture and later in storage (3).

Production of cream mass requires the mixing the raw materials, refining in a five roll mill and conching at a temperature of 40°C. Involving the ball mill in cream spreads production all operations of preparation and mixing to obtain a homogeneous suspension take place in the ball mill (4).

The main characteristics of cream spreads are: good uniformity and softness in a wide temperature range - from the room temperature to the cooler, a rich creamy taste, smooth homogeneous structure with no separation of oil on the surface, adequate durability, and good oxidative stability (5).

The technological defect that often occures in cream spreads production causes the separation of fatty phase and migration of oil to the surface. In order to prevent the fat phase separation, which is is very undesirable from the technological aspect, the use of properly selected emulsifier is necessarily (6). The very low concentrations of emulsifiers are enough to achieve an appropriate emulsify effect. The most often used emulsifiers, derivatived from vegetable oils and based on mono-, di-and triglycerides, prevent the separation of fat, and, on the other hand, do not change the sensory characteristics of the cream products (7). Lecithin is a commonly used emulsifier in the food industry. It is a light brown liquid that contain about 65% of phosphatides and about 35% of oil. Commercial production includes the extraction of lecithin from soybean seeds (8).

2. MATERIALS AND METHODS

2.1. Row materials for cream spread production

Cream mass (semi-product of factory „Vekić", Serbia)
Vegetable fat EK Vital (Factory „Vital AD", Serbia)
Sunflower Oil (Factory „Dijamant AD", Serbia)
Lecithin from soybean (Factory Victoriaoil, Sid, Serbia)
Lecithin from sunflower (Factory Victoriaoil, Sid, Serbia)
Lecithin from oilseed rape (Factory Victoriaoil, Sid, Serbia)

2.2. Description of the experiment

The cream spread was made in the laboratory ball mill (capacity of 5 kg), by domestic producer. Row materials were measured and added into the ball mill. The diameter of balls in the mill is 9.1 mm and the mixer speed is 50 rpm. The ball mill is equipped with the recirculation system with speed of 10 kg/h. The internal diameter of ball mill is 0.125 m, and the height is 0.31 m. The volume of space provided for balls and 5 kg of chocolate mass is 0.122 m^3.

Three types of cream spreads are produced:
Cream 1 - with the addition of 0.5% lecithin from soybean
Cream 2 - with the addition of 0.5% lechitin from sunflower
Cream 3 - with the addition of 0.5% lechitin from oilseed rape

Creams samples were taken from the ball mill after 30, 45 and 60 minutes.

2.3. Methods for determining the physical properties of cream spreads

The rheological properties of cream spreads were determined by rotational viscosimeter Rometar Rheo Stress 600, Haake, according to O.I.C.C. method, on temperature 40±0.1°C (9).
The hardness of the cream products were defined with penetration on the temperature of 20°C (10).
The sensory characteristics of the cream spreads were determined by the method of scoring, where the maximum score is 20 (11).

2.4. Results of physical analysis

The hardness and work of shearing of cream spread samples at the temperature of 20°C are shown in Figure 2, which shows that the samples of cream with the addition of soy lecithin have the greatest hardness and work of shearing, which indicates a good emulsify effect without fatty phase migration, while the cream samples with the addition of lecithin from oilseed rape have the lowest hardness and work of shearing. The longer retention time of all samples in the ball mill, as for a higher degree of reduction of particles leads to increasing the values of both examined parameters.

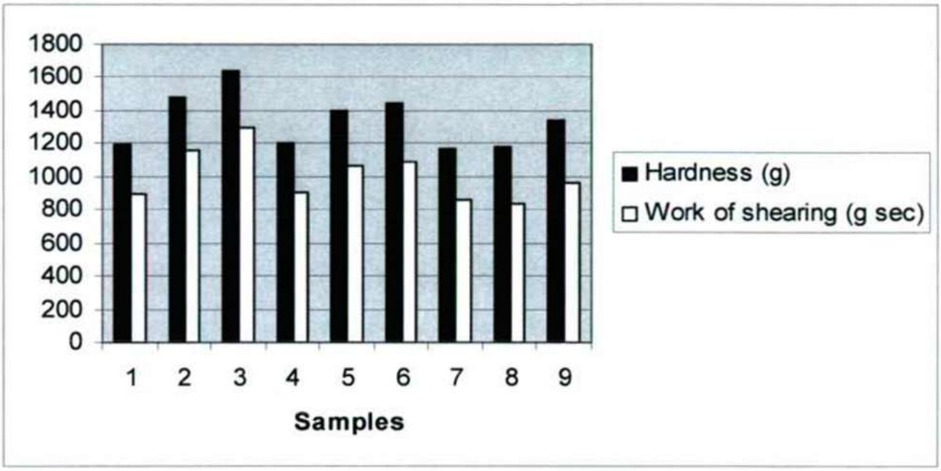
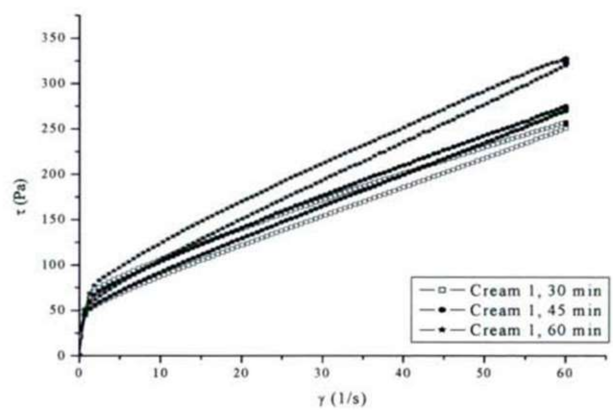
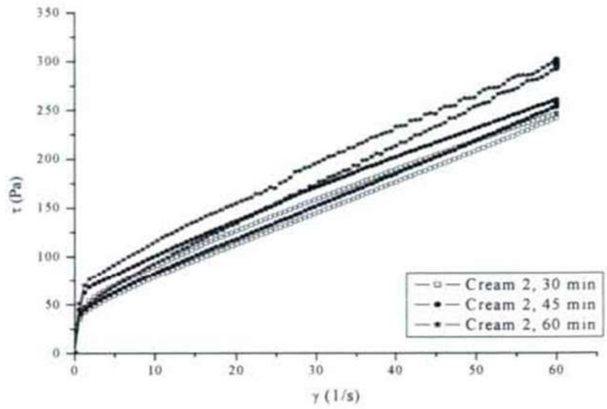


Figure 1 – Hardness and work of shearing of cream samples

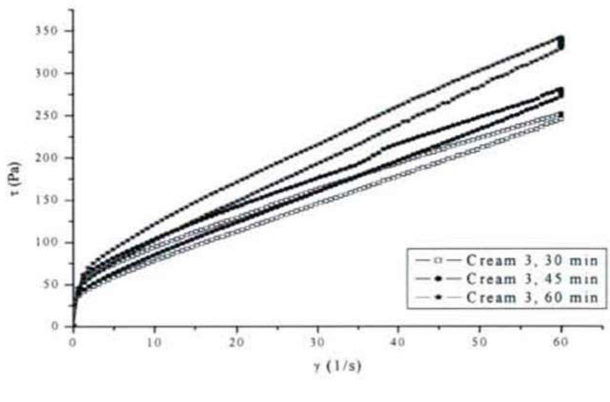
The flow curves at the temperature of 40°C depending on refining time and type of emulsifier were determined for all cream samples (Figure 3 a, b, c).



a.



b.



c.

Figure2 - Flow curves of samples depending on refining time and type of emulsifier
a) soybean, b) sunflower, c) oil rape

The source of lecithin does not have a significant impact on the viscosity of cream, but the lechitin from oilseed rape slightly reduces the value of viscosity. All samples of creams, no matter the source of lecithin, show similar thixotropic flow, while the samples with longer retention in the ball mill require higher shear stress at a given shear velocity. These samples have a higher degree of of particles reduction, as for higher viscosity comparing with the the samples with shorter retention time in the ball mill. The tixotropy curve area of cream samples are also bigger with increasing the refining time in the ball mill, as a result of greater complexity and less softness (Table 1). The samples of cream spreads with the refining time of 30 minutes have the least tixotropy curve area, the least complexity and the best softness. On the other hand, Table 1 shows that longer time of refining reduces the value of yield stress or the minimum necessary force thet must be applied to the system to began to flow.

Table 1 - Rheological parameters determined by static measurements

Samples	Yield stress (Pa)	Tixotropy curve area (Pa/s)
Cream 1, 30 min	0.723	972
Cream 1, 45 min	0.590	707
Cream 1, 60 min	0.355	1129
Cream 2, 30 min	0.822	743
Cream 2, 45 min	0.707	1054
Cream 2, 60 min	0.313	1384
Cream 3, 30 min	0.859	928
Cream 3, 45 min	0.474	1020
Cream 3, 60 min	0.834	1258

The samples of cream spreads with the addition of lecithin from soybean and sunflower show a very similar sensory characteristics, while the lecithin derivated from rapeseed causes less emulsify effect, so the oil migration occures in in this samples, which is certainly a negative characteristic of this type of product.The samples of cream products with the shortest retention time in the ball mill, regardless of the source of lecithin, have the most glosy surface, as a result of insufficient emulsify of particles and migration of oil to the surface. In these samples the large particles are clearly observed, that produce the sandy feeling in the mouth during chewing and have a strong smell and taste of oil. Prolonged refining time leads to increase of viscosity of cream spreads, and these samples are very sticky during chewing, but their smell and taste remain rounded.
Samples of cream products with refining time of 45 minutes showed the best technological and sensory properties because they have good softness and excellent melt in the mouth during chewing, and their smell and taste are suitable.

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