EFFECT OF HOMOGENIZATION ON SOME PROPERTIES OF SOUR CREAM

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SUMMARY

The effect of homogenization pressure and temperature on the properties of Sour Cream containing 16% fat was studied. Cream was homogenized under pressures ranging from 50 to 110 Kg/cm² at 45°C and 65°C respectively.

Cream homogenized at lower temperatures has slightly higher fat globule size, with appreciable increase in viscosity than their counterparts homogenized at higher temperature. Electron, and phase contrast microscopy showed the presence of more fat agglomerates in cream homogenized at low temperatures, and that it increased with the increase in the pressure used in homogenization.

Homogenization under a pressure of 80 kg/cm² at 65°C gave Sour Cream with acceptable organoleptic, as well as cooking and physical properties.

INTRODUCTION

Sour cream is one of the important dairy products in Hungary, as it widely used in cooking and bakery. Previous reports (Schrem and Obert, 1972), showed that the properties of Sour Cream was greatly affected by the conditions of homogenization. They (Schrem & Obert, 1972) reported that homogenization at 200—210 kg/cm² at 74 °C gave cream with the best consistancy, however, it had low heat stability.

Therefore, the present study was undertaken to find the proper homogenization pressure and temperature for Sour Cream to get a product with satisfactory cooking properties as well as other physical properties. This was the object of the present paper.

EXPERIMENTAL PROCEDURE

Preparation of Sour Cream:

Cream was standardized to 16% fat, pasteurized at 72°C for 8—10 min. and then cooled. Cream was homogenized using a single stage homogenizer (Soavi B. & Figli Z

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Fig. (1) Effect of homogenization pressure on the size of fat globules in fresh cream.

The viscosity of cream was determined at 20°C using viscosimeter type RN23. The size of fat globules was measured turbidimetrically according to Vaitkus and Kaslaus Kaite (1969). Five-tenth milliliter of cream was diluted with ml of 0.3%
EDTA in distilled water and tested for fat agglomeration using Mikroval-Lavoval phase contrast microscope with 550 magnification at 2 sec. intervals.

The structure and dispersion of fat globules in Cream was examined by electron microscopy following the method of Henstra and Schmidt (1970) with the following modifications. Cream samples were fixed with 2% glutardaldehyde followed by 1% OsO₄ in a phosphate buffer of pH 6.5 and ionic strength 0.05, and then dehydrated by successive immersion in solutions with increasing alcohol concentrations and finally in absolute alcohol. The dehydrated specimens were soaked successively in solutions of equal portions of propylene oxide and absolute alcohol and propylene oxide and durcupan each for 15 min. Finally, the specimens were embedded in durcupan for 36 h. at 60°C.

Sections (500 μ) were cut using LKB ultramicrotome type 4802, and stained with alkaline lead citrate and uranyl acetate and then examined by TESLA BS613 electronmicroscope.

The cooking properties of cream was tested by mixing 10 ml of Sour Cream with 75 ml of boiling distilled water and then cooled to room temperature. Ten milliliters of the treated cream were layered in a petri-dish, and the density of the formed flocculent was recorded; the more curdled properties would indicate inferior cooking properties.

The Sour Cream was judged by test pannel of seven experts according to the Hungarian Standards.

RESULTS AND DISCUSSION

Fig. 1 shows the changes in the fat globule size as affected by the pressure and temperature of homogenization. It is obvious from the attained results that both factors greatly affected the fat globule size. Thus, unhomogenized cream had an average fat globule size of 3.52 μ that greatly reduced to 1.13 and 1.25 μ when homogenized using a pressure of 50 kg/cm² at 65°C and 45°C respectively. The average fat globule size of homogenized cream gradually decreased with the increase in the pressure used reaching 0.53 μ and 72 μ in cream homogenized under pressure of 110 kg/cm² at 65 and 45°C respectively. These results showed that the higher temperature used; namely 65°C, improved the efficiency of homogenization, probably due to the lower viscosity of cream at the higher temperature.

Electron micrographs of specimen from unhomogenized cream, homogenized cream under a pressure of 80 kg/cm² at 45 and 65°C are shown in Fig. 2 a, b and c respectively.

With unhomogenized cream, the fat globules were not clearly detected due to the saturated character of milk fat to OsO₄ and the low thickness of the globule membrane. The electron micrographs also showed casein micelles as large spherical aggregates.

When cream was homogenized under a pressure of 80 kg/cm² at 45°C (Fig. 2b), the surface of the fat globules were surrounded by a thin osmophilic layer probably deformed casien. Besides the casien aggregates tended to be smaller than in unhomogenized cream. The
Fig. (2) Electron micrographs fat globules in 16% fat Cream; (a) without homogenization (b) homogenized at 45°C under 80 Kg/Cm², (c) homogenized at 65°C under 80 Kg/Cm².

figure also showed that casein acted as bridges between fat globule agglomerates.

Henstra and Schmidt (1970) reported that casein micelles tended to desintegrate on homogenization being in accordance with the present results.

Homogenization of Cream at 65°C, brought more protein on the surface of fat globules (Fig. 2c). On account of the thick osmophilic layer on the surface of fat globules. Besides the fat globules appeared as single globules or as agglomerates of few fat globules in comparison to cream homogenized at 45°C.

Results attained from phase contrast microscopy showed that fat globules in unhomogenized cream appeared as large spherical globules, Fig. 3a, while that of homogenized cream under a pressure of 80kg/cm² at 45°C as agglomerates of small fat globules surrounded by a thick layer of casein, Fig. 3b. On the other hand, few agglomerate were observed in cream homogenized at 65°C, Fig. 3c. These results add to the conclusion attained from electron microscopy, that at low temperature of homogenization, fat globules tended to agglomerate at different pressure used and fat globule agglomerate would increase with the
increase in the pressure of homogenization. These results are in accordance with that reported by Iverson (1971) using ice cream mixes.

The viscosity of unhomogenized cream was found to be much less than that of homogenized cream. Besides the viscosity of homogenized cream gradually increased with the increase in the pressure used. The effect of homogenization on the viscosity of cream was more pronounced at the lower temperature namely 45°C, Fig. 4. Based on the attained results from electron and phase contrast microscopy, one could say that differences in the viscosity with temperature of homogenization depends largely on fat globule agglomeration and to a limited extent on fat globular size.

Testing the cooking properties of Sour Cream revealed that unhomogenized cream gave large floculants indicating inferior properties.

With homogenized cream, the best cooking properties attained with cream homogenized using a pressure of 80 kg/cm² at 65°C.

Organoleptic scoring of the different Sour Cream showed that Cream homogenized using 80kg/cm² at 65°C ranked the highest scoring points and considered as the best cream obtained.

From the previous results one could say that homogenization of Sour Cream using a pressure of 80 kg/cm² at 65°C resulted in a product of good Organoleptic, cooking as well as other physical properties.
Fig. (4) Effect of homogenization conditions on the viscosity of Cream.
REFERENCES


Tأثير التجنيس على بعض صفات القشدة المخمرة

درس في هذا البحث تأثير الضغط ودرجة حرارة التجنيس على صفات القشدة المخمرة والحتوية على 16% دهون جنس القشدة باستخدام ضغوط تتراوح بين 210 - 110 كجم/سم² على درجة حرارة 45 درجة مئوية 0.65 درجة مئوية ذات حبيبات دهن أكبر نسبياً وذات وزجة أعلى كثيرة من نظرتها الجنسة على درجة أعلى. وقد ذال الفحص بالبيكروسكوب الإلكتروني على أن القشدة الجنسة على درجة حرارة منخفضة تحتوي على تجمعات من حبيبات الدهون بدرجة أكبر من الجنسة على درجة حرارة أعلى وأن تجمعات الدهن تزيد بزيادة الضغط المستخدم في التجنيس.

هذا وقد أعطى التجنيس بضغط 80 كجم/سم² على درجة حرارة 65 درجة مئوية قشدة مختارة ذات خواص حساسة وطبيعية جيدة بالإضافة إلى جودة خواصها في الطهي.