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ВЛИЯНИЕ РАСТИТЕЛЬНЫХ ИНГРЕДИЕНТОВ НА СТРУКТУРУ СПРЕДОВ

А.Петрына[1], А.Терещенко[2], Г.Била[2]
[1]*Филия Национального университета пищевых технологий в г. Львове, Львов, Украина, alabogd@mail.ru*
[2]*Национальный университет пищевых технологий, Киев, Украина, billa2003@mail.ru*

THE INFLUENCE OF VEGETABLE INGREDIENTS ON SPREADS COMPOSITION

Alla Petryna[1], Anna Tereshenko[2], Galyna Bila[2]
[1]*Lviv State College of Food and Processing Industry NUFT, Lviv, Ukraine, alabogd@mail.ru*
[2]*National University of Food Technologies, Kiev, Ukraine, billa2003@mail.ru*

Abstract

The article proves the advisability of using vegetable ingredients in the spreads formation. The content of solid triglycerides in the vegetable-fat blends with different amounts of milk thistle fruit-oil, and the addition of Citri-Fi dietary fibers has been investigated. The influence of the above-mentioned fibers on the texture of vegetable-fat blends, as well as the ability to preserve the ductility under mechanical stress and while storage has been determined according to the hardness index. The obtained results are used to develop the spreads with fillers technology.

Keywords: *spread, orange dietary fibers, hardness, content of solid triglycerides, milk thistle fruit-oil.*

Introduction

Nowadays there is a tendency of the increased production of low-fat oil and products with a combined fat composition – spreads. This is due both to the economic situation and the growing need for creating healthy food products with reduced calorie and cholesterol content. Vegetable oils are major sources of essential polyunsaturated fatty acids (PUFAs) of ω-6 (linoleic, γ-linolenic, arachidonic) and ω-3 (α-linolenic, eicosapentaenoic, docosahexaenoic) kinds. The physiological significance of PUFAs of ω-6 and ω-3 kinds is shown in Fig. 1 [1, 2].

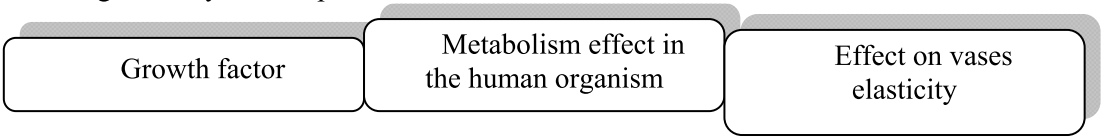

Fig. 1. The physiological significance of PUFAs of ω-6 and ω-3 kinds

The partial exchange of butterfat for non-dairy product during spreads production changes the finished product consistency. Differences in the fat nature are caused by co-crystallization process, which is reflected in the structural and mechanical properties. For the spreads produced on the basis of cream and vegetable fat, such variations are less noticeable. In the case of recombination (the production on the basis of the molten fat and milk plasma) the decrease in plasticity, structure restorability and leakage of liquid fat from the final product monolith can be observed, as well as occurrence of excessive hardness or softness on the contrary. All this facts lead to deterioration in the consistency of the finished product. The additional problems arise for low-fat spreads: the stability during oil formation, dispersing and moisture content in the product monolith [3, 4].

An important criterion for the spread quality is the ability to preserve fine-grained structure and homogeneous plastic consistency within wide temperature range for a long time. The fat matrix containing a wide range of triglycerides ensures such properties. For this purpose the optimum dairy and vegetable fat ratio is necessary. Another way to ensure the necessary quality of dairy products is the use of emulsifiers. They reduce the surface tension at the interface, accelerate oil formation and improve the spread structure [5, 6].

The main conversion processes of milk-fat dispersion in spreads are glycerides crystallization which proceeds first in the fat globules and then in the fat melt, followed by formation of the final product via phase inversion and its structuring. These combined processes occur in a short period of time and provides the spread structure with certain rheological characteristics. It is known that the mechanical properties of solids are the result of their crystal structure and cohesion due to the action of van der Waals forces. The coagulation structure is formed through the thin layer of the dispersion medium, which determines their low strength, ductility and specific property – thixotropy, i.e the ability to recover spontaneously. The lower layer of the liquid medium, the greater the molecular interaction forces and the stronger the structure. Therefore, the development of spread composition needs to consider the solid/liquid phases ratio, dispersibility of crystalline fat and the nature of dispersed particles bonds promoting the formation of stable plastic properties [2, 6].

Important physico-chemical parameters of different fats used in the production of emulsion products are: the melting temperature, hardness and solid phase content. The content of solid triglycerides (STG) in the temperature range from 10 to 40 °C determine fat product ductility and characterize the fat ability to maintain the shape under the influence of mechanical stress after loading removal. For optimal structures of spread fat phases it is possible to use new types of fat with different content of solid glycerides [7].

Application of vegetable ingredients with emulsifying and stabilizing properties in the spreads formation would allow to control the dispersion viscosity. Thus, the investigation of vegetable ingredients effect on the spreads structure is an urgent task.

Object and Methods of Investigation

The object of investigation is the texture of the spread with milk thistle fruit-oil and orange dietary fibers (DF). “Citri-Fi 100” was used as a consistency stabilizer which has high fat-binding capacity (the conclusion of the state sanitary-epidemiological expertise of Ukraine No. 05.03.02-03/50735 from 14.08.2009 concerning the possible use in dairy products).

To study spreads texture dependence on the content of solid triglycerides we prepared samples according to the classic technology providing components mixing. For this purpose the milk powder was reconstituted at the temperature of (40±2) °C. Apart from this, milk-fat blends with 10 and 20% of milk thistle fruit-oil (MTFO) were prepared. Butter was heated, mixed with MTFO at (65±2) °C and then Citri-Fi DF was added. The formed blend was combined with reconstituted milk, pasteurized at (95±2) °C and cooled to 10 °C with step of 5 °C.

The content of solid triglyceride in vegetable-fat blends was determined at different temperatures using nuclear magnetic resonance (NMR) by Bruker Minispec NMR Analyzer mq 20 on the basis of PJSC "Lviv fat plant" (Ukraine) [6].

To study the effect of vegetable ingredients on the spreads texture relative to the hardness we prepared samples according the above-mentioned technology. To form spread crystalline structure it was cooled to 0 ...- 5 ° C and sustained for 3 days.

The hardness of the formed spreads was determined using texture analyzer «LFRA BROOKFELD», designed to investigate the rheological characteristics and properties of solids, viscous liquids, powders and granular materials. Mode: Normal (compression force measurement). Speed: 2 m/s. Distance: 10 mm. Trigger 4 g. Probe: Brookfeld TA 15-45° Perspex conical. The method is based on measuring the load causing sample deformation under standard conditions. Researches were carried out by compressing or stretching. The resulting samples allow to evaluate the rheological parameters of vegetable-fat blends, for this purpose they were placed in a container of 200 ml. After finishing the product crystallization all samples were brought to a temperature of 20 °C and triply analyzed.

Results and Discussion

The content of solid phase in the vegetable-fat blends within the range of 5–35 °C defines their plasticity. The fat blend with necessary plasticity does not change the solid/liquid glycerides ratio in a wide temperature range. The investigation results about solid triglyceride content in the fat phase of