

HEAT STABILITY AND QUALITY CHARACTERISTICS OF THE FRUIT FILLINGS USED IN PRODUCTION OF LOCAL BAKERY PRODUCTS

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Abstract: Thermal tolerance limits of fruit fillings are the dominant factor in governing the distribution patterns of filled confectionery and bakery products manufacturing.

One of the major problems related to the preparation of filled confectionery and bakery products consists in the heat instability of used fruit fillings. The heat stability of these products would be a property which is inherent to their structures, or it might be acquired by using of some special stabilizers of structure, such as starch, gelatin, xanthan, pectin, carrageenan, and other hydro-colloids.

In the present work, we used a special bakery test for determination of heat stability of existing fruit fillings. In order to provide a better understanding of this specific process, a brief description of the thermo-stable fruit fillings production is presented.

Study was carried out to evaluate the heat stability and quality characteristics of the fruit fillings used in production of local filled bakery products. Collected samples of fruit fillings were analyzed for their heat stable properties at three different temperatures: at 115°C, 175°C and 220°C for a various lengths of time according to these temperatures: for 10, 15 and 20 minutes.

Experimental studies have shown that food industry specialists need to develop heat-stable fruit fillings for bakery and confectionery products manufacturers of the Republic of Moldova.

Key words: fruit filling, heat-stability, bakery test

Introduction

From the Forbidden Fruit in the Garden of Eden to actual fruit-filled bakery products, customers have been tempted by a large number of sensory, textural and nutritional benefits derived from fruit. These advantages appear to grow daily as scientific research discovers more curative qualities found in fruit. However, without the proper manipulation and processing, fruit-based raw materials and fruit fillings obtained from them can significantly damage all sensory and physico-chemical characteristics of the fruit-filled bakery products.

Bakery products with fruit fillings are among the fastest growing segments of the food industry, benefiting from high consumer demand for palatable, cheap and ready on-the-go snacks and meals. Nowadays extended demand for eco-friendly fruit-based food products has resulted in development of various confectionery and bakery products with an ever growing array of fruit fillings, including the increasingly popular fillings with fruit pieces. Furthermore, with the increasing popularity of healthy lifestyles programs focusing on nutritious meals such as low-calorie fat free cereal snacks or bars with various fruit fillings, leading manufacturers of canning convenience foods are turning their attention towards the production of fruit fillings with thermo-stable characteristics for filled bakery products. One of the most significant challenges concerning the use of

fruit fillings for baking is their thermal stability. High baking stability of a fruit filling ensures that the final filled product will be aesthetically agreeable and attractive, with fresh fruit taste and aroma, good texture, while reducing the appearance of cracks and filling leaks.

Nutritional filled bakery products are a popular consumer product meeting the increasing demand for on-the-go healthy meals. For manufacturers, improved fruit filling's composition for dietary intake such as sugar free high fruit and fiber content can increase the appeal and variety of filled bakery products on the market. Global manufacturers of fruit-based fillings have become the experts at hitting upon flavor and aroma combinations and variants that seem to strike a chord with not only customers who are expect to find conventional fruit fillings' taste, but also those who looking for something a little out-of-the ordinary in the way of taste sensations. However formulations for heat-stable fruit filling with high sensory characteristics face technological difficulties that impose some constraints. Generally, the requirement for high quality fruit fillings' ingredients can't be matched with heat-stability and low water activity and thus, manufacturers have to resort to imitation or application of high amounts of various food additives.

Bake-stable fruit fillings are composed of many ingredients, including fruit-based component, water, stabilizers such as pectins, starches or gums and also sweeteners, food colorants, acidulants, flavorants and preservatives, if necessary. All these ingredients play a significant role in achieving the proper structure for heat-stable fruit filling.

There are three major types of bakery fillings: bake-stable (or heat-stable), limited bake-stable (or with medium stability) and non bake-stable (or non heat-stable) fillings. Heat-stable fruit fillings which are introduced in a pastry prior to the baking process have to possess limited or full baking stability, depending on the requirements. Together with the dough fruit fillings are exposed to a defined heat for a certain time during the baking process in the oven. If a fruit filling is bake-stable it won't change its original shape under applied heat (it won't start boiling nor melting and won't also show any tendency to syneresis). While non-baking stable fruit fillings melt under the given conditions and start to flow or, due to the oven temperature, they begin to boil and bubbles start forming because of steam formation. These bubbles finally escape at the surface resulting in an undesired and not controllable change of the product surface. This is also called "cratering". Within the baking process free water would lead to boiling of the fruit filling which would result in bubble formation and in a change of the original shape. If the filling only melts at the surface under the given high temperature, this will result in an attractive area gloss without changing the original shape significantly. This way a limited baking stability is described [1].

As fruit fillings are mainly used for filled bakery products with a long shelf life it is especially important that this foodstuff keep its optimal quality parameters after baking and also during storage period. Therefore, heat-stable fruit fillings are expected to be stable after baking without any tendency to syneresis.

When producing fruit-filled bakery foods, high-volume manufacturers can either purchase ready-to-use fruit fillings from a canning supplier or create their own fillings using fruits, water, stabilizers and other required ingredients. Moldovan high, low and medium-volume bakery and confectionary companies basically purchase ready-to-use heat-stable fruit fillings or stabilizing systems from foreign ingredient suppliers.

Materials and methods

The fruit fillings' samples were purchased for testing from national and international ingredient suppliers and also from the main fruit processing companies. All purchased samples were analyzed for thermal stability, total soluble solids content (°Brix), pH value, and organoleptic characteristics.

The fruit fillings were put through a series of baking tests to evaluate their thermal stability as follows. Initially there was measured the fruit fillings' bakery index through the first standard bakery test: a specific amount of prepared fruit filling was given into a base of special filter paper named "Blue ribbon" with a diameter of 120 mm by a metal ring with defined geometry (50 mm diameter and 10 mm height) and then was baked under exactly fixed conditions: at a temperature of 115, 175 and 200°C for 10 minutes [1]. During and after this baking process all changes in physico-chemical, textural and sensory attributes of the tested fruit fillings were evaluated. The bakery index was determined by measuring the sample diameter before and after baking established by placing a line across the sample and calculating by using the following formula:

$$BI=100 - (D_2 - D_1)/D_2 \cdot 100 \quad (1)$$

where

BI – bakery index, %;

D_1 – average diameter of sample before baking, mm;

D_2 – average diameter of sample after baking, mm.

Diameter of the filling sample before baking is 50 mm, because it's the diameter of the metal ring used in bakery test. For measuring the sample diameter depending on its shape from two to four lines were drawn, and the average was calculated.

After that fruit filling's thermo-stability was measured through the second standard bakery test inside a dough sample as follows. Portions of a fruit filling were also placed on a dough sample so that a dough margin was left around the perimeter of each filling portion. Then the first dough sample with filling portions were covered with top sheet of dough, which was already punctured with steam escape holes. All of the dough edges were spliced by crimping in order to provide the necessary seal. After that fruit fillings inside uncooked pastries were baked in an oven at and 220°C for 30 minutes. The baked pastries with fruit fillings had a size of 60 mm in length and width and 12 mm in thickness.

Results and discussions

The table I below reports the thermal stability expressed through bakery index, total soluble solids content (°Brix), pH value of the tested fruit fillings.

Table 1. Physico-chemical and thermostable characteristics of the tested fruit fillings

№	Fruit filling	pH	Soluble solids content, °Brix	Bakery index, BI		
				t=115°C, τ=10 min	t=175°C, τ=10 min	t=200°C, τ=20 min
1	Unsterilized cherry filling (producer Pr. A.O. "Bucovinaproduct") purchased for the bakery plant Odius"	2,90	71,5	96,15	77	69,45
2	Peach-based filling produced at the Călărași canning factory	3,35	51,0	90,91	71,43	60,98
3	Fruit filling locally produced at the "Conserv-E" canning for the bakery plant "Franzeluța"	3,45	66,0	100	94,34	73,53
4	Fruit filling purchased from the international ingredient supplier "Puratos" for the Anenii-Noi bakery plant	3,25	71,0	100	92,59	79,37
5	Heat-stable fruit filling "Sladici", seria T, produced at the "Doka-Torgservis" company, Samara, Russia	3,65	58	83,33	60,25	58,82

Conclusions

Nowadays reasonably priced filled bakery products are available to the population of the Republic of Moldova. However, actual fruit fillings found in the Moldovan marketplace aren't readily adaptable to modern requirements for bakery technology, because they can't resist oven temperature of 200-220°C, retaining their initial color, flavor, aroma and structure.

Therefore, nowadays national canning manufacturers should rapidly and intuitively respond to changing bakery and confectionary market demands and be mainly focused on development of high quality heat-stable fruit fillings for filled bakery products or ready-to-eat meals.

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