On the problem of the bakery-stable fruit filling production

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Abstract
Bakery products with various fruit fillings are very popular due to their fresh-fruity fragrance. Said fruit fillings, which are added to the pastries after the baking process, should have, besides the required sensory properties, also very good physicochemical characteristics regarding processing (dosing, pumping, injecting). Heat stable fruit fillings should only be used for filled pastries because they can endure the heat emerging together with the dough during the baking process without changing their shape and volume. In order to prepare some types of bakery stable fruit fillings with required organoleptic and technological characteristics it’s necessary to use versatile structure stabilizers (with gelling, thickening and water-releasing properties). Owing to the careful stabilizer selection with its correct application, heat-stable fruit fillings with optimal structure characteristics (smoothness and high firmness at the same time, lack of syneresis, big resistance towards mechanical stress, good pump-ability) can be produced meeting all requirements of the bakery industry.

Keywords: heat-stable, filling, bakery products.

Sommaire
Les produits de boulangerie fourrés aux fruits sont très populaires du fait de leurs arômes frais et fruités. Les garnitures intérieures aux fruits, ajoutées à la pâtisserie après cuisson, en plus de leurs propriétés «sensorielles» particulières, doivent présenter d’excellentes caractéristiques physico-chimiques au moment du traitement (dosage, pompage, injection). Les garnitures intérieures résistantes à la chaleur sont plus adaptées lorsqu’il est question de pâtisseries fourrées: en effet, ces garnitures peuvent supporter la chaleur qui provient de la cuisson de la pâte sans que leur forme ou leur volume en soit altéré. Afin de préparer certains types de garnitures résistantes à la chaleur et destinées à la pâtisserie, et pour que celles-ci aient les propriétés organolectiques et technologiques requises, il est indispensable d’utiliser des stabilisateurs de structures (comme un gélifiant capable d’épaissir et de relâcher l’eau de la garniture). Grâce à un bon choix de stabilisateur dont il sera fait correctement usage, des garnitures de fruits résistantes à la chaleur (présentant les structures optimales et les bonnes caractéristiques: douceur et fermeté en même temps, absence de synerèse, grande résistance mécanique, bonne pompabilité) peuvent être produites et rencontrer toutes les attentes de l’industrie pâtissière.

Mots-clefs: résistant à la chaleur, garniture intérieure, produits pâtissiers.

1. Introduction

As fruit fillings are generally used for bakery products with a long shelf life it is especially important that the pastries keep their optimal quality during storage period. Therefore the fruit filling is expected to be stable also after baking and it may not show any tendency to syneresis. One of the basic problems related with the preparation of filled bakery products (muffins, doughnuts, puff pastries, croissants, pies and buns) consists in the bakery instability of the used fruit fillings (physicochemical and sensory degradation, water releasing, otherwise called “syneresis”, etc.).

The aim of this paper is to select a versatile stabilizer for producing a heat-stable fruit composition for bakery fillings, with lack of syneresis, which maintains its physicochemical characteristics (texture, form, viscosity, etc.) and freshness after the baking and also during the storage of final product. Pastries often combine their dough and other current components also with fresh or stewed fruits or vegetables, (which are whole or diced), as well as other food products
with a high water content. The following bakery products can be mentioned: tarts coated or stuffed with fresh or stewed fruit (such as apples, cherries, strawberries, pears, plums, apricots, peaches, etc.), regional traditional variations of the fruit or vegetable-stuffed pie (such as Moldavian or Romanian “plăcintă” with the filling completely enclosed in the puff pastry shell, like American filled flapjack), turnovers coated with several types of raw-stuff. These water-rich foods can release water before baking during the freeze-thawing processes (when half-stuff and raw material are preserved for several months by freezing), while baking (through evaporation, by boiling water inside the oven), after baking, or during the cooling step.

Water release also happens when the filled pastry product is frozen after being baked (precooked frozen food) and then thawed out when used. This water exuding evokes a long series of disadvantages, both from the aesthetic and organoleptic point of view, which make the final product unacceptable for the consumer because of his low quality. For example, thawed fruits and berries lose their initial texture and brilliance, becomes mushy and tends to get a dampish and rotting appearance. Stuffings from these fruits and berries release an excess of moisture that wets the dough and often prevents its correct baking (the pastry does not rise uniformly, the inside is raw and wet, the outside tends to dry or bum).

Fruit fillings from these raw materials tend to degrade inside the pastry and release a large amount of water (pies, turnovers, as well as puff pastry, do not rise, are sticky and diffluent). Depending on the type of raw-stuff, on the degree of preservation and operating conditions said bakery fillings can release, in a shorter or in a longer time, even up to 80% of water, referred to the initial weight of the whole product. Furthermore, water forcibly released during the baking process (oven temperature is on average far higher than water boiling temperature) stains above all the pastry, thus making the outer appearance of the finished product even worse. As a consequence, these pastries, after being baked, take on an inhomogeneous and partially sticky appearance, with a high viscosity named “chewing-gum” effect, which does not allow them to be sliced neatly. Also they aren’t crumbly and thin as it would be desirable.

In the baking industry it is known to use various fillings in connection with certain baked goods. Such fillings comprise fruit based or flavored fillings, cream based or textured fillings, nuts, icings, or almost any conceivable edible product in one form or another. Fillings of this kind are applied in some instances to the no-baked dough after which they undergo subsequent baking. They are also applied to the hot baked products shortly after they have been removed from the oven. In other instances, certain fillings are applied only to the baked product after it has been cooled and in some instances to such products that require subsequent refrigeration.

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 the 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 would not change its original shape under this heat (it does not start boiling nor melting and does also not show 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 is called a limited baking stability (Herbstreith & Fox KG).

2. Materials and methods

According to the scientific literature review, the thermal stability of a fruit filling can be evaluated by means of standard tests in a laboratory (otherwise called “bakery tests”). By these laboratory tests a specific amount of prepared fruit filling is given into a base by a metal ring with defined geometry and is baked under exactly fixed conditions. During and after this baking process all the changes in physicochemical, textural and sensory attributes should be observed and
evaluated. If during this bakery test a fruit filling does neither melt nor boil and if it retains its original shape and volume after baking, this fruit filling is called heat-stable. If after baking this fruit filling shows a slight melting at the surface without any changes of the original shape resulting in a nice gloss, it is named limited bake-stable. If the fruit filling has melted completely after baking it isn’t heat-stable (Herbstreith & Fox KG).

3. Results and discussion

The melting behaviour of fruit fillings depends on the process duration and the oven temperature of the baking. Fruit compositions start melting and low if they are exposed for a short time to a temperature much higher than their melting point or if they undergo high temperatures in the range of the melting point in a long time. In order to produce high-stable fruit fillings with an attractive appearance, the melting temperature of the fruit half-stuff composition has to be higher than the temperature in the oven. Under such conditions said fruit fillings won’t change their original shape and other textural characteristics during the baking process. Fruit fillings with a brightly shiny, satined surface can only be produced, if there are used those fruit compositions, which have their melting point a little bit lower than the oven temperature.

General indicators for the selection of suitable structure stabilizers for heat-stable fruit fillings are: pH value and soluble solids content of the final fruit composition, which significantly influence the gelling and water-retaining properties (Frey, 2005). Generally the suitable pH range correlates with the final soluble solids content of the fruit filling. Bakery fruit fillings with the lowest soluble solids content (from about 30% to about 50%) have a very short shelf life, and they are typically used in production of muffins, or are meant for frozen half-stuffs, such as frozen fruit compositions for fillings. The next highest soluble solids content are the bakery fillings with soluble solids content of from about 50% to about 65%. These products have a longer shelf life and are used in the manufacturing of packaged donuts, muffins, tarts, pies and other pastries. Finally there are fruit fillings with soluble solids content of from about 65% to about 80% which are manufactured for some bakery products with a very long shelf live, such as cookies, toaster pastries, and snack cakes.

Versatile stabilizers, basically hydrocolloids, perform gelation in fruit fillings (Peleg, 2006) and, as mentioned above, determine other properties that are relevant both for the manufactures (such as bakery stability and viscosity) and also consumers, (such as taste, odor, texture, and visual appearance).

Historically, several various stabilizers of structure have been put to use in fruit filling and jam production. Gelatin was among the earliest hydrocolloids used, especially in candies and jelly fillings. But gelatin isn’t only ineffective as a stabilizer for bakery fillings, but in recent years it has also become somewhat less preferred by food producers overall because it fails to meet the dietary guidelines of vegetarians, and also has been associated with Bovine Spongiform Encephalopathy.

Alginates have also their disadvantages: while they do perform well in confectionary jams and jelly fruit fillings, they can impart an unpleasant flavor note and taste of alginates as extracts from brown seaweed. Pectin, which has long been the most widely used stabilizer of structure for jams, jellies and marmalades offer more promise for utilization in the field of bakery stable fruit filling production. However, experimental studies and commercial experience have shown that present types of this hydrocolloid must be carefully selected in manufacturing of heat-stable bakery fillings (Willats, Knox & Mikkelsen, 2006).

Fruit fillings for the industrial manufacturing of bakery products are almost exclusively produced with low methylester pectins. On the other hand, high methylester pectins are generally used in fruit compositions for the traditional fabrication of bakery products.

The advantage of using of high methylester pectins is the high melting temperature of their gels. Fruit fillings which are manufactured with high methylester pectins thus manifest an excellent baking stability. The gel network formed by high methylester pectins, even so, can simply be destroyed under mechanical stress (Frey, 2005). With destroying this gel structure the linked water is released again. Syneresis arises and such fruit filling loses its heat stability because the released water further will start to boil during the baking process.

Therefore, fruit fillings fabricated with high methylester pectins may be exposed only to potentially low mechanical stress during the processing (dosing, pumping, injecting, etc.) which is mostly only possible in the traditional
manufacturing of bakery products. In the industrial production, however, too much mechanical stress influences the gel network which is the reason why low methylester pectins are used for this application.

For some special bakery applications it will be a further advantage to use a combination of several hydrocolloids, for example: one low methylester pectin with one high methylester pectin, a mixture of one pectin derived from lemon peel and one from orange peel, several low methylester pectins and several modified starches, several citrus pectin with carrageenan, blends of xanthan with starch (Mandala, Michon, & Launay, 2004), etc.

4. Conclusions

In order to produce a heat-stable fruit filling and to prevent it from releasing water (syneresis), during all the steps involved in the preparation and preservation (before, during and after baking), it is necessary to utilize a suitable stabilizer of structure or a mixture of several versatile stabilizers having water-absorbing, thickening and gelling properties.

References


