

STUDY REGARDING PROCESSING TECHNOLOGY AND QUALITY OF “POPULAR” TYPE BISCUITS

STUDIU CU PRIVIRE LA TEHNOLOGIA DE OBTINERE ȘI A CALITĂȚII BISCUIȚILOR DE TIP „POPULAR”

AVARVAREI B.V.¹, GHEORGHÎĂ Șt.¹,
DAVIDESCU Mădălina Alexandra¹, USTUROI AL.^{1*}, NISTOR C.E.^{1*},

*Corresponding author e-mail: alexusturoi@yahoo.com
is_cata@yahoo.com

Abstract: Biscuits are food products that are made from flour, water, sugar, fat and baking powder. Depending on the assortment, the biscuit recipes are improved by adding milk, eggs, seeds (poppy or sesame), various flavours, toppings (honey, chocolate), etc. Biscuits are products with an important role in the food industry, worldwide, being highly requested by consumers. The aim of the work was to follow the technological flow for obtaining the Popular biscuits (900 g). This assortment was also subjected to physicochemical laboratory analyses to verify the quality and compliance with the quality standards in force.

Keywords: Popular type biscuits, technology, quality

Rezumat: Biscuiții sunt produse alimentare care se obțin din făină, apă, zahăr, grăsimi și afânători. În funcție de sortiment, rețetele pentru biscuiți sunt îmbunătățite, prin adaosuri de lapte, ouă, semințe (mac sau susan), diverse arome, toppinguri (miere de albine, ciocolată), etc. Biscuiții sunt produse cu rol important în industria alimentară, la nivel mondial, fiind foarte solicitate de către consumatori. Scopul lucrării a fost urmărirea fluxului tehnologic pentru obținerea biscuiților de tip Popular (900 g). Acest sortiment a fost supus și analizelor fizico-chimice de laborator pentru verificarea calității și respectarea standardele de calitate în vigoare.

Cuvinte cheie: Biscuiți tip popular, tehnologie, calitate

INTRODUCTION

Flour confectionery remains an integral part of any cuisine and plays a great role in nutrition of humanity at world level (Timoshenkova *et al.*, 2018).

Biscuits are convenient food products, and become very popular among worldwide population both from urban and rural areas (Dayakar Rao and Bhargavi, 2017; Goubgou *et al.*, 2021).

Amongst the whole variety of semi-finished baked products intended for cake production, biscuits which are characterized by a puffy and light structure gain an important place and role (Timoshenkova *et al.*, 2018; Moskvicheva *et al.*, 2019).

¹Iași University of Life Sciences, Iași, Romania

Biscuits are food products that are made from flour, water, sugar, fat and baking powder. Depending on the assortment, the biscuit recipes are improved by adding milk, eggs, seeds (poppy or sesame), various flavours, toppings (honey, chocolate), etc. Biscuits are products with an important role in the food industry, worldwide, being highly requested by consumers (Constantinescu (Pop) *et al.*, 2020; Dragomir *et al.*, 2020, Man *et al.*, 2021).

The diversity of biscuits is evident if we look at the shelves of a supermarket. These food products are distinguished by their low moisture content (below 5%), and some authors state that “*due to the low moisture, the biscuits can be kept for a long time on the shelf, as long as the atmosphere is poor in oxygen and moisture. At the same time, they have a high nutritional value, thanks to the raw materials they contain. Biscuits are nutritious, sweet and tasty, we find them in various forms and we can eat them straight from the packaging*” (Manley, 2011; Davidson, 2016; Davidson, 2019).

Biscuits were classified according to sugar and fat content or according to composition and destination (Mihaly and Pop, 2008).

The biscuit manufacturing technology consists in the homogenization of the mentioned ingredients, by following the manufacturing recipe, in order to obtain a dough with the desired consistency and texture. Following the modelling and baking process, the biscuits obtained must meet the quality standards, being packaged for distribution to the final consumer (Avarvarei and Nistor, 2019).

Biscuits are floury food products obtained from a dough composed of wheat flour, water, yeast, salt, sugar, raising agents, fats and emulsifiers. They are obtained in a proportion of at least 60% from cereal flour. The most used flour is wheat flour, but oat, rye, barley, corn or rice flour can also be used (Wrigley *et al.*, 2004). Flour is the product resulting from the grinding of cereal grains, with a powder appearance. The main grains ground and used in the production of biscuits are: wheat, rye and corn (Avarvarei *et al.*, 2019). To obtain biscuits, a flour protein level between 7-10% is recommended, a medium quality protein being desirable and not often the type of flour is selected taking into account its functionality in obtaining the finished product, depending on of cost and availability (Manley, 1998; Wrigley *et al.*, 2015).

Water, in the biscuit dough, plays an essential role, being the only ingredient removed by the baking process. Water hydrates the flour particles and protein substances, which helps to form gluten (Modoran, 2007; Manley, 2011).

The yeast or biochemical leavening agent belongs to the genus *Saccharomyces*, species *Saccharomyces cerevisiae*, obtained from the molasses resulting from the processing of sugar beets, with the addition of nutritional salts (Modoran, 2007). The type of yeast used in the preparation of whole Popular biscuits is the compressed type, which spreads more quickly in water (Pascal, 2012).

Salt is an ingredient used under various types of dough, less so in the case of diet products. In biscuit dough, salt has two considerations: the first is the

aroma, salt having a role in accentuating or potentiating the flavours of the ingredients, and the second consideration being that salt controls fermentation and helps eliminate unwanted bacteria (Wrigley *et al.*, 2015).

Sugars influence the fermentative activity of yeasts (Modoran, 2007).

Fats are mainly used to increase the nutritional value of biscuits (Modoran, 2007; Negoită *et al.*, 2016).

The obtained dough is subjected to numerous processes (leavening, rolling, stamping and baking) (Avarvarei and Nistor, 2019).

The aim of the work was to follow the technological flow for obtaining the Popular biscuits (900 g). This assortment was also subjected to physicochemical laboratory analyses to verify the quality and compliance with the quality standards in force.

MATERIAL AND METHOD

The main goal consisted in tracking and observing the stages on the technological flow, so that the production is simultaneous, quantitative and qualitative.

To achieve the secondary aim, the quality of the biscuits was checked, through a series of sensory and physicochemical determinations, respectively: humidity; alkalinity; total volume and specific volume.

The research was carried out into a bakery unit from Iași County, Romania and all the presented photos in the current paper are original ones.

Determination of moisture content had as its basic principle the heating of the sample to a temperature of 130°C, with variations of $\pm 2^\circ\text{C}$ (Nistor *et al.*, 2019).

Alkalinity determination had as its basic principle the preparation of an aqueous extract from the sample to be analysed. The obtained extract was titrated with HCl 0.1 N solution, using the bromothymol blue as indicator. Alkalinity was expressed in degrees of alkalinity, one degree indicating the volume of HCl 0.1 N needed to neutralize the alkalinity per 100 g of product (Nistor *et al.*, 2019).

Total volume was determined using the empirical method (Nistor *et al.*, 2019). *The principle of the empirical method* in the case of biscuits is to determine the volume by multiplying the three dimensions (L, w and h).

Specific volume is based on the determination of the ratio between the weight of the biscuits (g) and their total volume (cm^3) (Nistor *et al.*, 2019).

RESULTS AND DISCUSSIONS

The technology for obtaining Popular biscuits (900 g)

The technological flow for obtaining of Popular biscuits, was followed in stages, starting from the quantitative and qualitative reception of the raw material (wheat flour), until the moment of storage and delivery of the final product.

The product **Popular Biscuits (900 g)** is made from a dough that includes the following raw and auxiliary materials: white flour type 650, sugar, glucose, non-hydrogenated palm oil, leavening agents (ammonium bicarbonate and sodium

bicarbonate), acidifier (citric acid), preservative (sodium metabisulphite), iodized salt and water.

Reception and storage of flour.

Flour reception (fig. 1) is done automatically, through pumps and pipes that store the flour directly in silos (fig. 2). Flour unloading of the flour is carried out after performing the laboratory analyses through random sampling.

The raw and auxiliary material is stored and dosed in clean, aerated and well-ventilated spaces (fig. 3, fig. 4, fig. 5 and fig. 6).



Fig. 1 Flour reception



Fig. 2 Silos – White flour



Fig. 3 Area for storage of raw and auxiliary material



Fig 4 Area for dosage of ingredients



Fig. 5 Area for oil storage



Fig. 6 Oil pump and tub

Preparation of raw and auxiliary materials. The first stage of the technological process consists in the preparation of raw and auxiliary materials with the aim of bringing the raw materials into a physical state suitable for the preparation of the dough. Sodium bicarbonate, ammonium bicarbonate and sodium metabisulfite are dissolved in 5 litres of water.

Dosage of raw and auxiliary materials. Flour, sugar, oil and water are dosed with the dosing device (fig. 7) by selecting the recipe on the dosing station screen. The rest of the ingredients are dosed manually using the electronic scales in the dosing line (see fig. 4).



Fig. 7 Dosing line for raw materials

Dough preparation of the takes place in two phases, in the bowl of a mixer (fig. 8), in which sugar, glucose, iodized salt, citric acid and palm oil are introduced. Kneading is slow, for 1 minute. Add sodium bicarbonate, ammonium

bicarbonate (both dissolved in 5 l of water), flour and water. The second kneading follows, quickly, for 6-7 minutes.



Fig. 8 Mixer tub

The mixer is a horizontal one, model HSM 800, with a bowl having a kneading capacity of over 500 kg. High-speed mixers are kneading machines for the production of hard and soft doughs used in the manufacture of biscuits. They are made of high quality stainless steel. The process of preparing dough for biscuits is carried out with the help of kneading arms. The tank-mantle allows the control of the temperature inside, having the ability to tilt by hydraulic actuation, for emptying. The kneading programs are entered from the control panel.

Dough rest. The kneaded dough is turned over in mobile tubs, where it is left to rest for about 25-30 minutes (fig. 9), after which it is transferred to the processing line. The role of rest is to alleviate internal tensions created during kneading.



Fig. 9 Dough rest in mixer's mobile tubs

Dough processing. The tubs with dough are overturned with the help of the hydraulic installation that lifts and overturns the dough in the hopper of kneading machine (fig. 10 and fig. 11); from here the dough with the help of conveyor belts is led into the hopper of rolling equipment (fig. 12).



Fig.10 Dough lift up and overturning in kneading machine



Fig. 11 Dough pieces exiting the kneading machine



Fig. 12 Dough transport to hopper of rolling equipment

Dough processing is done according to the product recipe (existing in the equipment software) which contains all the parameters specific to the operations. The technological operations that are performed in the case of the processing phase are the following:

Lamination is done with the help of the laminating installation (fig. 13), where the formation of a sheet takes place by pressing the dough between two groups of metal rollers (fig. 14). The resulting dough sheet after rolling is cut to a certain length, followed by layering of the dough sheets for rolling.

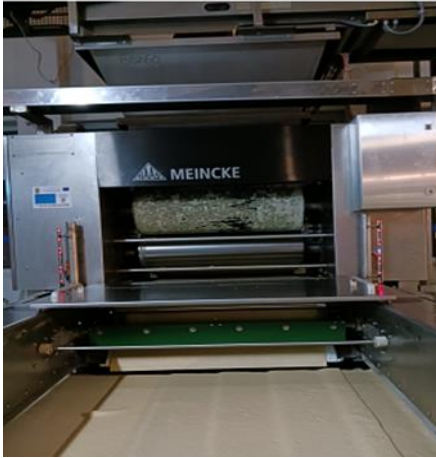


Fig. 13 Lamination of dough sheets



Fig. 14 Layering of dough sheets

Rolling takes place by passing the layered dough sheets through three groups of rollers with the role of forming the dough sheet to the desired thickness (fig. 15).



Fig. 15 Primary and final rolling

Cutting takes place after adjusting the thickness of the dough sheet; first the sheet of dough is passed under the shaping roller (fig. 16), then the rectangular pieces of dough are cut (fig. 17).



Fig. 16 Dough finishing



Fig. 17 Dough cutting

Dough weighting. The nominal weight of the dough pieces is determined according to the type of dough and the baking losses. Checking the nominal weight is done manually, using the electronic scale, weighting 10 pieces of dough. Nominal weight of this dough for normal biscuits is between 126-128 g (fig. 18).



Fig. 18 Dough weighting

Biscuits baking represents the technological phase after which the moulded dough undergoes change processes that result in obtaining the specific characteristics of the finished product. The biscuits are transported on the metal belt of the oven for baking (fig. 19). Baking is done in a tunnel type oven (fig.

20), with three zones of action, for 6.8-7.8 minutes. The selection of the baking regime is done by setting the product-specific recipe.



Fig. 19 Conveyor belt to oven

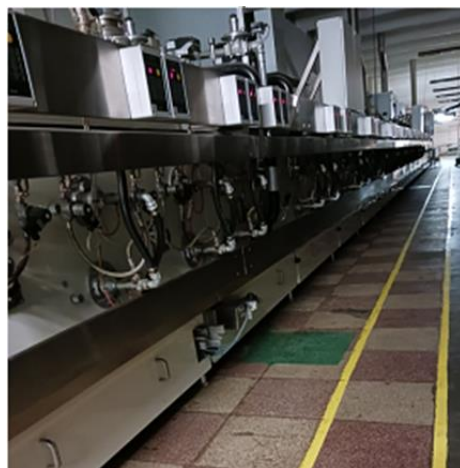


Fig. 20 Biscuits baking oven

Biscuits cooling. After the baking process, biscuits are taken by conveyor belts which have the role of equalizing the moisture of the biscuits and cooling the biscuits to the temperature of the manufacturing room (fig. 21).



Fig. 21 Biscuits transport to the cooling area

At the same time, when the biscuits come out of the oven, there is a sensory analysis, as well as a physicochemical analysis by determining the moisture.

Determination of biscuits' weight upon leaving the oven is done manually, using the electronic scale (fig. 22), by weighing 10 baked biscuits. The standard accepted weight is 98-102 g.



Fig. 22 Determination of biscuits' weight

Packaging. After cooling, the normal biscuits are transported to the scales (fig. 23), where they are automatically weighed (fig. 24) after which they are transported to the top-feeding packaging machine (fig. 25).

Packaging is done with a vertical automatic machine (fig. 26), in 900 g bags, using 60 μ thick foil (fig. 27).

The bags are manually placed in the boxes, and these are closed. The expiry date and batch number are marked on the lid of the boxes; after which they are placed on pallets.

Storage it is done in clean rooms, without moisture and without foreign smell (fig. 28).

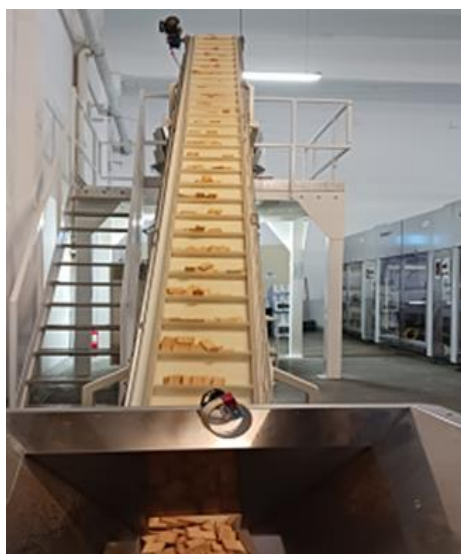


Fig. 23 Transport to weighing



Fig. 24 Automatically weighing



Fig. 25 Biscuits transport and vertical feeding up of packaging machine



Fig. 26 Packaging machine



Fig. 27 Packaging foil



Fig. 28 Storage area for biscuits

Biscuits sensorial and physicochemical analysis

Popular biscuits have a flat shape, are tender, non-crumbling, with prickles on the smooth, matte and blister-free surface. The dimensions are set as follows: length about 7 cm, width about 5 cm, and height about 0.6 cm. The taste of Popular biscuits is characteristic of the product, pleasant and balanced, suitable for salting. The appearance should show that the biscuits are well baked, and in the section and on the outside, the colour is light brown. No gaps or lumps of flour are accepted. The pleasant smell, characteristic of well-baked products, is the desired one, products with a foreign smell (of rancidity or mould) are not accepted.

Sensorial examination

In order to establish the quality of the finished products, the sensorial examination was carried out for the Popular biscuits, analysing the following parameters: appearance, consistency, colour, shape, size and aroma (tab. 1).

Table 1

Sensorial examination of Popular biscuits

Parameters	Analysis technique
	Popular biscuits (900 g)
Aspect	were analysed in whole and in section
Consistency	integrity was analysed
Colour	it was determined visually based on the colour palette
Shape and dimensions	was determined using the electronic calliper
Aroma	it was determined by tasting and smelling the products

Aspect of Popular biscuits was appreciated as follows:

- on the outside, whole pieces with a matte, perforated, unburnt, stamped surface were noted, with fine particles of crumb being present;
- uniform layers, with fine and even pores, without holes, characteristic of well-baked products, with fine bran particles were highlighted in the section.

Popular biscuits consistency was tender and unbreakable.

Popular biscuits colour was golden-brown, characteristic for this assortment (fig. 29 a, fig 29 b).



Fig. 29 a Standard colours

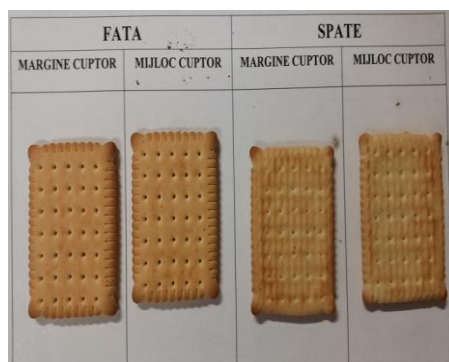


Fig. 29 b Obtained colours

Mean dimensions for Popular biscuits were: L = 6.7 cm; w = 4.7 cm; thickness = 0.75 cm

The results obtained for aroma, taste and smell, fell within the company's standard, the taste being characteristic of biscuits, sweet, pleasant, without foreign taste, and the smell a pleasant one, typical of biscuits, without foreign smell.

Physicochemical determinations

Determinations made on the finished product referred to: maximum core moisture, alkalinity, total volume, specific volume (tab. 2).

Table 2

Analysis of physicochemical parameters for Popular biscuits

Parameter	Company's standard	Obtained results		
		$\bar{X} \pm s_{\bar{x}}$	Min.	Max.
Core moisture (%)	9	8.59	7.95	8.9
Maximum alkalinity (°)	2	0.74	0.2	1.5
Total volume (cm ³)	-	23.61	21.95	24.0
Specific volume (g/cm ³)	-	0.49	0.47	0.5

Moisture determination for the analysed biscuits were obtained through laboratory methods and were compared with the values automatically calculated by the equipment soft. For Popular biscuits a mean value of $8.59 \pm 0.2\%$ was obtained, with a minimum value of 7.95% and the maximum value of 8.9%. The humidity values fell within the limits imposed by the company standard, its maximum being 9%.

Alkalinity determination indicated a mean value obtained of 0.74 ± 0.23 . The minimum and maximum values obtained are 0.2° and 1.5°, respectively. The company's standard is 2°, which indicates that the values obtained for alkalinity are below the standard.

Determination of total volume indicated a mean value obtained of 23.61 ± 0.51 cm³. The total volume values ranged from a minimum of 21.95 cm³ to a maximum of 24 cm³.

Determination of specific volume show a mean value of 0.49 ± 0.01 g/cm³. The minimum value being 0.47 cm³ and the maximum one being 0.50 cm³.

The results of the current research show us the fact that Popular biscuits assortment falls within the company's standards, being a finished product sought by consumers, due to its attractive taste and aroma.

CONCLUSIONS

The technological flow for obtaining the assortment of Popular biscuits was followed in stages, starting from the quantitative and qualitative reception of the raw material (wheat flour), until the moment of storage and delivery of the final product.

With regard to the technology for obtaining the Popular type biscuits (900 g), the work steps followed were the following: preparation of raw and auxiliary materials, dough preparation, dough resting, dough processing, laminating, rolling, cutting, dough weighting, baking, biscuits cooling, determining the weight, storage.

a) Sensorial examination

Biscuits' aspect:

- on the outside, whole pieces with a matte, perforated, unburnt, stamped surface were noted, with fine particles of crumb being present;

- uniform layers, with fine and even pores, without holes, characteristic of well-baked products, with fine bran particles were highlighted in the section.

Consistency was tender and unbreakable.

Colour was golden-brown, characteristic for this assortment.

Shape was rectangular.

The results obtained for aroma, taste and smell, fell within the company's standard, the taste being characteristic of biscuits, sweet, pleasant, without foreign taste, and the smell a pleasant one, typical of biscuits, without foreign smell.

b) Physicochemical determinations

Moisture determination: the mean value was 8.59%, the moisture values fell within the limits imposed by the company standard, its maximum being 9%.

Alkalinity determination: the mean value obtained was $0.74^{\circ} \pm 0.23$. The company's standard is 2° , which indicates that the values obtained for alkalinity are below the standard.

Total volume determination: for Popular biscuits the mean obtained value was 23.61 cm^3 .

Specific volume determination: for Popular biscuits assortment was obtained a mean value of 0.49 g/cm^3 .

According to the results obtained from the analyses carried out for the Popular biscuits product (900 g), it can be stated that the product complies with the standards in force and meets the requirements of consumers, being a qualitative and safe product for consumption.

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