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STUDY ON FLOUR QUALITY ASSESSMENT DESIGNED TO OBTAIN BISCUITS

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Abstract: *The main aim of this study was to research the influence of wheat flour on biscuits' manufacturing. Flour, the main ingredient in most biscuits, does not bring much flavour, except perhaps where bran is included. It does contribute strongly to the baked texture, hardness and shape of biscuits. The nature of these effects differs for different biscuits related to the enrichment with fat and sugar and to the way in which the dough has been mixed. Wheat flour is the ingredient responsible for quality in confectionary including biscuits. Among the many indicators of quality of the wheat flour, the following are considered as having technological importance: the content and the quality of gluten, the fineness of the grinding, and the water absorption. Most biscuits can be made from flour that has low quantity of protein and gluten which is weak and extensible. Unfortunately, for biscuit makers, nearly all the research on flour quality by rheological testing has been done with simple flour/water/salt systems which are not easy to relate to biscuit recipes. But, it is useful to know what can be measured by using a Brabender Farinograph and Extensograph. Thus, flour with a protein level of less than 9% is best and levels of more than 9.5% often create processing problems. But, to a certain extent, the quality of the gluten can be adjusted by additives and processing techniques.*

Keywords: *raw materials, dough, rheological properties, proteins quality*

1. Introduction

Biscuits are mainly made from flour, sugar and fat. Biscuits are manufactured in many shapes and sizes, and they can be covered with chocolate, containing fat-based fillers or other pleasantly fragrant fillers. There is a very extensive assortment of biscuits due to many raw and auxiliary materials which are used, with different proportions of raw materials and technological processes applied [1].

Raw and auxiliary materials used in the manufacture of biscuits give their taste, flavour and appearance; physico-chemical transformations of raw and auxiliary materials that occur during the technological process also help to improve the final product characteristics [2, 3].

The flour, the main raw material used has an important role in achieving high quality end-products. The influence of the flour on biscuits' quality depends on the assortment of biscuits, determined by the total flour weight. If flour has a lower share in the total mass of product, then flour influence on the product quality is proportionally lower [4]

Permanent development of assortments, along with the progress in manufacturing technology of several products, requires the use of flour with differentiated physical-chemical and technological properties. The flour quality is nowadays one of the fundamental problems for bakery and pastry industry. This is due to advanced mechanization and, especially, automated processes that do not allow easy modification of established operating parameters. Therefore, to obtain good quality products in superior economic conditions, the flour should have reasonably constant characteristics and appropriate manufacturing requirements of each item or group of products.

The flour used for making biscuits is, generally white wheat flour (can be used oat

flour, corn flour, etc.), with a minimum content of 27% gluten. Depending on the type of desired biscuit, a higher or lower content of gluten is imposed. The biscuits require flour with medium gluten content. If flour with high gluten content is used, the final products will strongly deform during baking, the surface will be rough and covered in blisters. Tender biscuits are prepared from flour with weak gluten, because a high content of gluten leads to considerably hard biscuits. To reduce the high protein gluten content of flour, starch can be used from potatoes or corn, which reduces elasticity and increases the plasticity of the dough. Flour granularity should be in the range 50-150μ, a higher granularity determines an obtainment of products with reduced volume and porosity [5, 6, 7].

Biscuits belonging to various groups of varieties require appropriate quality flours for each respective group. The most common index that characterizes the quality of biscuit flour is gluten protein content. The flour for the manufacture of biscuits differs from that used by bakers due to its protein content and gluten quality content [8, 9]. Wheat flours used to make the biscuits must have a low content of 9-10% protein, low gluten content and plastic properties given (Table 1).

Table 1.

Selection criteria of biscuits flour [10]

Indicator of flour quality	Quality indicator for assortment groups		
	Gluten biscuits	Sugary biscuits	Crackers
Wet gluten,%	25 - 35	24 - 34	26 - 36
Strain Index, mm	15 - 25	5 - 25	5 - 15
Dry gluten, %	8.5 - 11.5	8 - 11	9 - 12
Proteins,%	11 - 13	10 - 12	11.5 - 13.5

Usual flours used for biscuits manufacturing have extensible gluten, and for crackers it is recommended a mixture of 75% strong flour and 25% weak flour. For laminated biscuits is recommended flour richer in gluten, while for biscuits with sugar content of about 40% and about 24% fat, are recommended even stronger flours.

Many researchers recommend weak flour for biscuits manufacture. In the case of sugary biscuits which are characterized by a high friability, flour should form a small amount of gluten (less than 20%) and poor quality. Studying the rheological characteristics of biscuit dough, it was considered appropriate amounts of biscuit flour those contained in Table 2.

Table 2

Quality characteristics of the main types of biscuits [10,11]

Quality Indicator	Recommended levels for		
	Gluten biscuits	Sugary biscuits	Crackers
Farinogram			
The stability of the dough, min	5 – 8	5 – 11	6 – 11
Dough softening, UB	60 – 120	50 – 120	30 – 60
Power, UC	40 – 50	40 - 60	50-60
Extensogram			
The ratio R / E (135 min)	0.2 – 0.1	0,2 – 0.25	1.0 – 2.5
Area, cm^2	5 – 50	5 – 90	30 - 90

The paper presents summary results obtained from the analysis of wheat flour from different origins, used as raw material in the manufacture of biscuits, with the destination of its use in formulation of the different types of biscuits.

2. Materials and methods

To study the quality of flour used for preparing biscuits, six samples of flour from a leading producer of biscuits, crackers, sticks and pretzels were analyzed.
Analyses were performed in the laboratory of the Centre for Training and Bakery, belonging to SC ROMPAK SRL Pascani. Thus, the six samples of flour received from the various mills of biscuit manufacturers were analyzed using a Pharinograph, a Brabender extensograf and apparatus for the determination of the Falling Number.

Table 3

Methods and equipment used for flour analysis

Quality Indicator	Determination method	Equipment used
Wet gluten, %	STAS 90-88	-
Strain Index mm	STAS 90-88	-
Falling Index	SR ISO 3093/2007	Falling number
Fariongrame	SR ISO 5530-1/1999	Farinograf Brabender
Extensogram	SR ISO 5530-2/ 1999	Extensograf Brabender

In technological terms the assessment technique of flour behaviour during dough stage presents interest. During this phase, all intrinsic properties of the flour, the dough behaviour constituting a summary of all interactions that occur between the various components of the flour are expressed.

3. Results and discussion

For wheat flour, protein substances content, wet gluten quantity and properties are very important indicators in terms of technological properties. There is an optimum of the protein content, flour gluten respectively, as well as the rheological properties of the gluten. Technological properties required for the manufacture of flour biscuits varies by group of assortments.
For gluten biscuits and crackers requiring dough with good elastic properties, the flour should have the following technological properties: a high capacity to form and retain gas which requires adequate quantity and quality of gluten, good hydration capacity and ownership to form light dough.
For sugary biscuits, dough is indicated to be brittle, therefore no special conditions are imposed on its elasticity and technological properties required from flour are hydration and assimilation capacity to form plastic dough with low elasticity that is easily processed, does not shrink and therefore the product keeps its printed form.
The flour quality requirements for obtaining biscuits are almost opposite intended as compared with those of flour for bread. Biscuit flour is weak flour with low protein content and should have a small grain starch. A high Falling Number is not an advantage in this technology, but a low Falling Number can positively influence the obtainment of biscuits with optimal characteristics. As regards biscuit dough, it must be characterized by elasticity and not by resistance.
The results of analysis of 6 samples of flour made of the above mentioned methods are shown in Table 4.
All the six samples of flour have an average content of the gluten-forming proteins, being characterized by different qualities. Samples S4 and S6 have a poor quality gluten because during wash was quickly formed a linked mass which had a low consistency and elasticity, high extensibility and low tensile strength. Left to stand after washing, the rheological properties worsened. Samples S2, S3 and S5 have average gluten quality and after wash formed a bounded mass which was sufficiently elastic, with average extensibility and deformation and, ranking in terms of its rheological properties of gluten in an intermediate position between strong and weak gluten.

On the other hand, sample 1 has strong gluten, after washing are obtained small particles, separated, which gradually become a homogeneous-bounded mass. It has high elasticity, low extensibility and high tensile strength. Left to rest and very little has changed in its rheological characteristics. Regarding the development of the dough, it can be seen that the dough for samples S1, S3 and S5 grew slower compared to the other 3 samples.

Stability is a measure of the tolerance of the flour to mixing, and strong flours have high stability, therefore the stability of the sample S1 is the largest, whereas the samples S4 and S6 have little stability; stability during mixing of the dough is strongly influenced by the protein quality (deformation index).

The degree of softening (UF) is the difference measured between the centre of curvature consistency at the end of the dough development curve centre and 12 minutes after this point. A high degree of softening is associated with poor quality flour, even if flour hydration capacity is high. Increased wetting is an important indicator of proteolytic degradation of wheat. After analysis there is a great variability of this parameter quite understandable because the degree of softening is strongly influenced by the type of grinding and physical-chemical indicators of wheat. Of the six samples of flour samples S2, S4 and S6 have the highest softening index.

In terms of dough energy, it can be seen that the energies for samples S1, S3 and S5 have a value above 50 U.B thus we can classify them as good quality flours, optimal for baking. S4 sample is characterized by a low amount of energy even since the first measurements, a figure which drops to 0. The other 2 samples (S2 and S6) have an average energy which decreases during the technological flow.

In practice, biscuit dough strength and elasticity depends on the amount of water used in the dough and mixing time, its strength and elasticity being directly proportional to the increase of mixing time. The ratio resistance / extensibility are above par for samples S1, S3 and S5 and below par for samples S2, S4, S6.

Table 4.

The analysis results of the flour sample

Sample analysed	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**
Physical-chemical indicators						
Wet gluten, %	26	27.2	25.6	28	26.4	26
Strain Index mm	3	6	5.5	10	7.5	10
Falling Index	439	385	408	436	459	343
Rheological indicators						
Hydration capacity,%	58.6	58.7	57.4	61.8	60	61.6
Dough development, min	2.2	2.0	2.3	2.0	2.5	1.7
Stability, min	11.9	8.1	10.7	1.9	8.4	1.4
Wetting index, FU	26	54	25	195	59	168
45 – 90 – 135 min						
Ratio R / E	1.6 – 2.0 – 1.9	0.9 – 0.8 – 0.8	1.1 – 1.3 – 1.4	0.5 – 0.3 – 0	1.1- 1.3 – 1.1	0.9 – 0.8 – 0.4
Extensibility, mm	150 – 140 – 129	169 – 158 – 149	173 – 181 – 155	186 – 140 – 0	157 – 152 – 141	177 – 178 – 201
Energy cm2	64 – 63 – 49	46 – 35 – 27	65 – 75 – 63	29 – 11 – 0	52 – 51 – 35	49 – 41 – 23

4. Conclusion

The dough used to make biscuits must be able to take shape with little effort and without subsequent deformation of the cut pieces, for this purpose the flour intended for the manufacture of biscuits must have a sufficiently low content of low quality protein and high extensibility.

Therefore, according to the results of the analysis, the samples S4 and S6 are the best for obtaining biscuits. These 2 samples are characterized by an average content of gluten-forming proteins, a ratio R / E below par and a small amount of energy that decreases during the technological flow.

Although other samples of flour do not possess optimal characteristics for this technology, they can still be used in manufacturing of biscuits. Very often it happens in practice that the raw materials (wheat) do not possess optimal properties for biscuit manufacture. Therefore, in order to obtain quality products it is necessary to control the plasticity of the dough by changing the quality of the gluten. This may be achieved by exogenous proteases.

To improve the quality of flour for biscuits' manufacture, may be used combinations of proteases with amylase and cysteine, depending on the quality parameters of flour or can be used flour mixtures in various proportions. For example, for the flour samples analyzed it is recommended to use the mixture of flour, between the sample 1 (10%) and sample 4 (90% of the recipe) in biscuits' manufacturing.

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