JAP&T
TPA-Timişoara

Available online at http://journal-of-agroalimentary.ro

Journal of Agroalimentary Processes and Technologies 2016, 22(3), 183-187

Journal of Agroalimentary Processes and Technologies

Quality assessment study on wheat flour during storage

Adriana Dabija*

Faculty of Food Engineering, Stefan cel Mare University

Received: 27 July 2016; Accepted: 30 August 2016

Abstract

The paper deals with the importance of storage conditions on the quality of wheat flour. In order to perform a complete analysis of wheat flour it was determined the sensory, physico-chemical, technological and microbiological characteristics.

This paper presents a summary of the quality assessment of wheat flour from a warehouse of specialized units to assess age and establish commercial value. The main characteristics were determined for six batches of wheat flour using analytical methods stipulated by law. Age assessment was carried out based on the results of sensory analysis and determination of flour acidity, while commercial value was based on baking test results for the 6 lots of flour studied.

Technological qualities of flour are also affected by improper storage conditions for maintaining stocks without movement that result in exceeding the life of the product, which leads to the impossibility of using flour in the baking industry.

Keywords: shelf life, technological qualities, use value, human consumption

1. Introduction

Flour quality can be defined as the set of organoleptic, physical, chemical and rheological characteristics imposed by processing requirements for the purpose it is intended. The usefulness of flour is different depending on the industry in which it will be processed: bread and bakery products, pasta etc.

A complete flour quality analysis involves determining organoleptic indices, physico-chemical indices and the characteristics of technological flour - baking test, microbiological load of flour. Knowing the optimal values of these parameters depending on flour's purpose, can be made recommendations on flour quality for each product group [1-4].

During storage, the quality of wheat flour undergoes major changes, some of them are beneficial, and others may worsen quality. The moment during storage when technological properties of flour improves, that process is called maturity.

Freshly ground wheat flour, has inappropriate technological characteristics: it forms sticky, inelastic dough, with low capacity to retain its shape and retain gas fermentation, and resulting bread has low volume while the baking process widens.

For optimal storage conditions, after a period of between 45 and 60 days, the technological properties are improved. Improvements are evident when flour is obtained from freshly harvested grain [5-8].

Corresponding author: *e-mail:* adriana.dabija@fia.usv.ro,

During maturation, a number of interdependent physical, colloidal and biochemical processes occur which improve the technological properties of flour.

A feature that indicates the degree of freshness is flour acidity; provisions of the standards in force for this indicator have a value between maximum 2.2 acidity degrees for white flour and max. 5 acidity degrees for diet flour.

Higher flour acidity records are registered for:
- flour made from wheat kept in unsuitable conditions, with high microbial load;
- flour stored at high temperature and humidity favor:
    - activity of lactic acid bacteria to form organic acids;
    - mould growth, with changes in smell and taste;
- flour stored over shelf life, can accumulate large amounts of free fatty acids that are formed by hydrolysis of lipids [9,10].

Following the alteration produced flour qualities and technological changes, resulting in the reduction of the amount of gluten in terms of quality, which becomes gray, crumbly, not gathering in a compact mass, it has a lower elasticity. It is known that, for a baking flour, gluten content should be a minimum 22%, very important from the point of view of the baking properties and quality.

A main cause of reducing quality flour can be defective economic management of inventories, turning slow moving inventories or without motion, which results in a rational long periods of immobilization products with high degree of qualitative impairment flour and unable to be used for human consumption.

Flour storage under optimum conditions impose the following measures:

- wharehouses should be clean, dry, well ventilated and cleaned, floors made of cement, asphalt or bitumen;
- storing sacks of flour is binding on wooden slats;
- between stacks of bags and wall or between two stacks must be kept at a minimum distance of 0.5 m;
- stacks should be well constructed;
- stacks must be so organized as to be able at any moment flour to be delivered in the order they produce, respecting the principle FI-FO (First In - First Out) [11, 12].

Health experts recommend that to avoid reduced quality of flour, it must be stored at temperatures below 12°C, in room with a relative humidity of 60 ÷ 70% [13, 14].

It is also recommended to strictly comply with the Quality Management System procedures and use of registration forms to identify traceability (the ability to restore the history, application or location of an entity by identifying records). This paper presents an overview of the quality assessment of wheat flour flour from a wharehouse of specialized units to assess age and establish commercial value.

2. Matherials and methods

From a milling firm, flour samples were taken to assess its quality and establishing the storage age, given that the flour was not properly labeled (could not establish the date of manufacture).

The finished product warehouse company identified six batches of flour - total:

$$1220\ SACKS \times 40\ kg\ FLOUR/SACk = 48800\ kg\ FLOUR$$

Flour samples were taken following the provisions of SR 90:2007. In order to measure flour quality, the following analyzes were made:
- sensorial analysis: infestatuon, odor, color, taste, impurities;;
- physico-chemical analysis:
    - moisture - SR EN ISO 712:2010;
    - acidity, protein content, gluten content, deformation index - SR 90:2007;
    - falling index, hydration capacity - SR EN ISO 3093:2010.
- analysis of baking characteristics:
    - baking test:
        - bread sensory analysis - based on a score - 30 points scheme;

- physico-chemical analysis bread - acidity, porosity, elasticity, specific volume, humidity - SR 91:2007.

Baking test is the most comprehensive analysis. It consists in assessing the quality of flour based on achieved bread quality. This analysis aims at testing the flour obtained from grist, establishing an optimum processing formula and its correct destination, correlating quality of gluten and enzyme activity. It is performed after a certain recipe and manufacturing technology well established regime.

3. Results and discussion

The results of the sensory analysis of the six samples of flour included in the study are summarized in Table 1.

The degree of freshness of the flour can be appreciated, primarily by sensory characteristics: the girded (hot) smell, rancid taste bitter or sour, gray-white and the presence of impurities, concentrations of flour indicates the storage in unsuitable conditions or out of term validity of the flour. From Table 1 it can be seen that all of the six samples of flour do not correspond in terms of sensory properties, sample 6 shows a high degree of infestation, while all the samples show almost dead insects.

The physico-chemical properties of flour samples analyzed are presented in Table 2. It is noted that the analyzed flours acidity is very high, with values between 7.6 and 12.6 degrees to the provisions SR 90:2007: max.2.8 for 650 flour and max. 5 for 1350 flour.

Wet gluten content in the analyzed samples is much smaller than those of the reference document: 16% (sample 3) and 22.8% (sample 6) to firm standard: min. 25% for 650 flour and min. 24% for 1350 flour. In terms of quality: gray, crumbly, not gather in a compact mass, without elasticity (deflection = 0). The content of gluten for baking flour should be a minimum. 22%, very important from the point of view of the baking properties and quality.

In assessing the baking characteristics of the flour, the obtained bread's quality was measured by sensory analysis and physico-chemical analysis.

Table 1. Sensory characteristics of studied flour

Sample no.	Characteristic				
	Color	**Odor**	**Taste**	**Infestation**	**Impurities**
1	Grey-white	girded	rancid	-	particles of bran, whole grains, cracks
2	Grey-white	girded	rancid	-	dead insects, chaff
3	Gray with bran particles	girded	rancid	-	dead insects, with plenty of bran
4	Grey-white	girded	rancid	-	Dead insects
5	Gray with bran particles	girded	rancid	-	Straws, rodent droppings, debris, whole grains, cracks
6	Gray with bran particles	girded , highly unpleasant	rancid	Live worms, larger than 1 cm, heavily infested	flour lumps (clod)

Table 2. Physico-chemical properties of flour included in the study

Characteristic	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Humidity, %	12.48	12.50	13.51	12.73	12.30	13.51
Acidity, acidity degrees	8.6	10.2	12.6	7.6	12.4	12.5
Protein content, %	13.79	14.47	14.65	13.36	13.46	13.79
Gluten content, %	22.4	18.0	16.0	21.0	20.8	22.8
Deformation index, mm	0	0	0	0	0	0
Falling index, sec.	200	223	238	282	230	309
Hydration capacity, %	59	60	62	65	65	60

Table 3. Sensory appreciation of bread samples obtained

Quality index	Sample					
	S1	S2	S3	S4	S5	S6
The shape and volume of the product	1	2	0.75	2	1	0
Color, appearance and strength of the crust	1	1	0.75	2.5	0.5	0
Core ripeness, condition and appearance	2	2.5	1	3	1,5	0
Core porosity and pore structure	1	1.5	1	3	1	0
Aroma (odor)	0.5	0.5	1	2	0.5	0
Taste	2	2	2	3	2	0
Total	7.5	9.5	6.5	15.5	6.5	**0**

Physico-chemical indices were determined below the threshold of acceptability: low volume of bread, very small core porosity and elasticity, high acidity.

Seniority batches of flour were appreciated considering the acid value of flours, as follows:

Lot 3> Lot 6> 5 Lot> Lot 2> Lot 1> Lot4

4. Conclusion

All six (6) lots of flour analyzed did not meet the technical conditions stipulated in the reference document, and therefore this flour is not acceptable for human consumption. It can only be redeemed as meal feed.

Taking into account the depreciation of the quantity and quality of gluten oldest batch of flour is considered Lot 3, followed by Lot 6 (group with the most negative assessment), the most "fresh" is considered Lot 4.

Analysis of data obtained on samples of flour quality assessment, at least five (5) of the six (6) lots analyzed were older than a year, an amount of about 40 tons flour (from 48.8 tonnes in the store).

A major cause is the defective economic managementc of inventories, turning intentional stocks slow moving or motionless, it led to an intangible irrational for long periods of products with a high degree of depreciation quality of flour and unable to be used for human consumption.

References

1. Hrušková M., Machová, D., Changes of wheat flour properties during short term storage, , *Czech Journal of Food Science*, **2013**, *20*(4), 125–130
2. Linfeng-Wang, Flotes R.A., The effects of storage on flour quality and baking performance. *Food Rev. Int*., **1999**, *15*, 215–234
3. Mis A., Influence of the storage of wheat flour on the physical properties of gluten, *Int. Agrophysics*, **2003**, *17*, 71–75

4. Pirozi M.R., Germani R., Effect of storage on the technological properties of the flour of wheat cultivars grown in Brazil, *Brazilian Archives of Biology and Technology*, **1998**, *41*, 155–169
5. Wang L.F., Flores R.A., The effect of storage on flour quality and baking performance, *Food Reviews International*, **1999**, *15*, 215–234
6. Azizi M.H., Rao G.V., Effect of storage of surfactant gels on the bread making quality of wheat flour**,** *Food Chemistry*, **2005**, *89*, 133-138
7. Doblado Maldonado A.F., *et al*., Key issues and challenges in whole wheat flour milling and storage, *Journal of Cereal Science*, **2012**, *56*, 119-126
8. Harrak H., Jaouan F., Processing dates of low market value into flour: evaluation of quality and storage stability, *Acta Hortic*., **2010**, *882*, 593-602
9. Bothast R.J., *et al.*, Effects of moisture and temperature on microbiological and sensory properties of wheat flour and corn meal during storage, *Cereal Chem*., **1991**, *42*(3) 187-190
10. Samuels R., Modgil R., Physicochemical changes in insect infested wheat stored in different storage structures, *Journal of Food Sci. & Tech*., **1999**, *36*(5), 479-482
11. Nielsen M.M., Hansen, A., Stability of vitamin E in wheat flour and whole wheat flour during storage, *Cereal Chemistry*, **2008**, *85*(6), 716-720
12. Maraschin C., ET AL., Effect of storage temperature and flour water content on lipids, lipoxygenase activity, and oxygen uptake during dough mixing, *Cereal Chemistry*, **2008**, *85*(3), 372-378
13. Cenkowski S., *et al.*, Mechanical compaction of flour: The effect of storage temperature on dough rheological properties, *Canadian Agricultural Engineering*, **2000**, *42*(1), 28-36
14. Fierens E., *et al*., Changes in wheat (Triticum aestivum L.) flour pasting characteristics as a result of storage and their underlying mechanisms, *Journal of Cereal Science*, **2015**, *65*, 81-87
15. Lee Y., *et al*., Effects of Flour Storage Conditions on the Lipid Oxidation of Fried Products during Storage in the Dark, *Food Science and Biotechnology*, **2006**, *15*(3), 399-403
16. SR 90:2007. Wheat flour. Analysis method, Standardization Association of Romania (ASRO), Bucharest, Romania
17. SR EN ISO 3093:2010. Wheat, rye and respective flours, durum wheat and durum wheat semolina - Determination of the Falling Number according to Hagberg-Perten, Standardization Association of Romania (ASRO), Bucharest, Romania
18. SR 91:2007. Bread. Bread and fresh bakery products. Analysis methods, Standardization Association of Romania (ASRO), Bucharest, Romania