A Baking Function Depending Upon Storage Condition and a Type of Flour

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Summary

Flour is a raw material, more exactly grocery very sensitive on external influence. Namely, due to the hygroscopic nature of the flour it is good base for microbial growth. Normal moisture content in flour ranges from 13 to 15 %. An increase in moisture contents makes conditions suitable for microbial growth, accelerating the enzymatic activity and spoiling of flour. The storage conditions have a great influence on the moisture content, especially temperature and humidity.

The flour reaction to the storage condition is based to its chemical composition, which is related to the moisture, fat and proteins content.

Baking function is dependable upon the storage condition and storage period, as well as acting of the flour during making of dough, and baking of made dough.

The aim of this study was to establish behaviour of different flour types (T-500, T-850 and whole meal flour) stored at temperatures +4 and 20 °C and defined humidity.

Each flour sample was analyzed determining its chemical contents and farinograph characteristics immediately after milling and after 10 and 21 day, and baking test was done on those days.

The obtained results proved that storage conditions significantly affected the chemical composition of composite flours, as well as baking functions of flour and characteristics of baked bread.

Key words

flour, type of flour, storage conditions, organoleptic properties

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Introduction

Flour is one of the most important groceries. There are different types of cereal, and depend on the type of cereal we have different types of flour. According to that, types of flour are: wheat, maize, rye, and mix of those flours. Wheat, maize and rye flours are used more often. By its chemical composition the wheat flour has the best characteristics for baking. Namely, the wheat flour by its contents has the best characteristics for production of bakery products. This refers first of all to the quantity and quality of the present proteins especially to the gluten. Protein gluten has significant effects to dough characteristics. Due to the low contents of gluten in corn and rye flour, from this types of flour it is not possible to get proper bakery product. That's why usually mixture is made of wheat and maize or rye flour in adequate proportions.

One type of flour also may have different labeled flour varieties, which is especially characteristic for wheat flour. The different available flour varieties are labeled according to the ash mass that remains in flour after milling operation. There are several types of wheat flour: T-400 wheat grits and T-500 white wheat flour made after removing of bran, germ and other parts of grain. T-710 is half white flour, T-850 is dark flour and T-1100 is whole grain flour. In different countries there is a slight difference between these varieties in regards to the labels and ash mass. For example, T-710 is mixture of flour T-500 and T-850 usually made in mills or bakeries by mixing the exact quantity of these two flour varieties. Usually name for such flour is half white because it is origin mixture of white and dark flour.

Storage conditions, mainly temperature and humidity, have the influence on flour and final product quality. After grinding the flour is not ready for use and for market. It has to stand for some time inside the storage to stabilize. While standing the flour is "mellowing" and inside of the flour changes are happening. These changes are very important for establishment of the proper structure and relation between main ingredients primary protein (gluten) and also water and ash.

After this period of standing the flour is getting properties for its use in the bakery, production of biscuits etc.

Of course, the big influence on properties of flour, baking and completed products have storage conditions of flour after this period of standing.

The goal of this work was to distinguish the changes that are happening inside the fresh flour which was grind up, during the process of standing and storage at the different temperatures, in the duration of 20 days. Also, to find out what kind of influence it has on mixture and baking in the test baking.

Material and methods

Three types of wheat flour T-500, T-850 and whole grain flour were used in experiment. Flours were stored at the temperatures of +4 °C and +20 °C. Analysis and test baking were done right after grinding up process, on 10th and 21st day.

Main chemical composition and farinograph, extensograph and amylograph analysis of flour was done. Farinograph and extensograph analyses of whole grain flour were not possible because of properties and chemical composition of that flour.

After baking test we did organoleptical inspection of the baked bread.

Results and discussion

Volume grade of bread made from flour T-500 and T-850 stored at +4 °C changed from zero to 21 days of storage, while

Table 1. Effects of storage on chemical composition of flour T-500, T-850 and whole grain flour immediately after milling, after 10 and 21 days of storage at temperature of +4 °C

		Water content (%)	Ash content (%)	Protein content (%)	Wet gluten content (%)	Degree of acidity
T-500	0 day	14.83	0.54	10.30	30.20	2.1
	10th day	14.70	0.54	11.50	33.90	2.1
	21st day	14.85	0.52	10.70	32.30	2.6
T-850	0 day	14.91	0.89	11.80	29.20	2.5
	10th day	14.79	0.89	10.90	32.00	2.6
	21st day	14.90	0.73	12.00	31.00	2.8
Whole	0 day	11.80	0.98	11.70	29.70	2.6
wheat	10th day	12.40	0.98	11.40	30.40	2.7
flour	21st day	12.40	1.05	11.20	29.80	3.4

Table 2. Effects of storage on chemical composition of flour T-500, T-850 and whole grain flour immediately after milling, after 10 and 21 days of storage at temperature of +18 °C

		Water content (%)	Ash content (%)	Protein content (%)	Wet gluten content (%)	Degree of acidity
T-500	0 day	14.83	0.54	10.30	30.20	2.1
	10th day	15.00	0.54	11.00	31.50	2.3
	21st day	14.50	0.53	11.00	32.80	2.9
T-850	0 day	14.91	0.89	11.80	29.20	2.5
	10th day	15.00	0.89	11.80	30.90	2,6
	21st day	14.30	0.79	12.10	31.50	3.4
Whole	0 day	11.80	0.98	11.70	29.70	2.6
wheat	10th day	12.30	0.98	11.80	30.90	3.6
flour	21st day	12.30	1.00	11.50	30.60	4

Table 3. Results of farinograph analysis for flour T-500 and T-850 immediately after milling, after 10 and 21 days of storage at temperature of +4 °C

		Water apsorp (%)	Development time (min)	Dough stability (min)	Degree of softening(Fj)	Quality number	Quality group
T-500	0 day	58.30	2.00	0.50	40.00	80.80	A-2
	10th day	57.20	2.00	0.50	70.00	78.80	A-2
	21st day	58.00	1.50	1.00	50.00	81.30	A-2
T-850	0 day	60.00	2.00	7.00	30.00	83.70	A-2
	10th day	59.10	2.00	1.00	50.00	83.70	A-2
	21st day	60.30	1.50	6.00	50.00	83.20	A-2

Table 4. Results of farinograph analysis for flour T-500 and T-850 immediately after milling, after 10 and 21 days of storage at temperature of +18 °C

		Water apsorp (%)	Development time (min)	Dough stability (min)	Degree of softening(Fj)	Quality number	Quality group
T-500	0 day	58.30	2.00	0.50	40.00	80.80	A-2
	10th day	56.50	1.50	1.00	50.00	83.20	A-2
	21st day	58.30	1.50	1.50	60.00	81.30	A-2
T-850	0 day	60.00	2.00	7.00	30.00	83.70	A-2
	10th day	59.50	2.00	6.00	40.00	84.20	A-2
	21st day	60.40	1.50	2.50	60.00	82.50	A-2

Table 5. Results of extensograph analysis for flour T-500 and T-850 immediately after milling, after 10 and 21 days of storage at temperature of +4 °C

		Energy (cm^2)	Extensibility (mm)	Resistance (Ej)	Maximal resistance (Ej)	Ratio number extensibility/resistance
T-500	0 day	126.00	160.00	480.00	550.00	3.44
	10th day	120.00	160.00	420.00	470.00	2.94
	21st day	130.00	165.00	460.00	520.00	3.15
T-850	0 day	98.00	165.00	330.00	380.00	2.30
	10th day	109.00	160.00	380.00	410.00	2.56
	21st day	107.00	165.00	460.00	520.00	3.15

Table 6. Results of extensograph analysis for flour T-500 and T-850 immediately after milling, after 10 and 21 days of storage at temperature of +18°C

		Energy (cm^2)	Extensibility (mm)	Resistance (Ej)	Maximal resistance (Ej)	Ratio number extensibility/resistance
T-500	0 day	126.00	160.00	480.00	550.00	3.44
	10th day	115.00	170.00	420.00	480.00	2.82
	21st day	156.00	155.00	620.00	680.00	4.38
T-850	0 day	98.00	165.00	330.00	380.00	2.30
	10th day	105.00	160.00	370.00	420.00	2.63
	21st day	105.00	145.00	400.00	440.00	3.03

volume grade of bread made from whole grain stored at +4 °C increased. Storage of whole grain flour at 4 °C improved its properties, making influence on volume of bread. On the other side, volume grade of bread made from flour T-850 stored at 18 °C changed, and for bread made from whole grain flour and flour T-500 decreased.

External appearance of bread made from whole grain flour stored at 4 °C improved – grade increased, while grade for bread made from flour T-500 and T-450 varied. At room temperature grade for bread made from flour T-500 and T-850 decreased, and for bread made from whole grain flour varied.

Grade for crumb appearance of bread was good for all kinds of bread, but for bread made from flour T-500 and whole grain flour increased and for bread made from flour T-850 varied. For bread made from whole grain flour stored at 18 °C grade increased, but for bread made from flour T-500 and T-850 varied.

Grade for odour crust and crumb of bread made from flour stored at 4 °C were good and increased and for bread made from flour stored at 18 °C were good, but varied.

Taste of crust and crumb of bread was very good, especially for bread made from flour T-850 and whole grain flour stored at 4 °C and for bread made from flour T-850 stored at 18 °C. For other kind of bread grade varied.

Table 7. Results of amylograph analysis (determination of maximal viscosity) for flour T-500, T-850 and whole grain immediately after milling, after 10 and 21 days of storage at temperature of +4 °C

		Maximal viscosity (Aj)
T-500	0 day	1020
	10th day	960
	21st day	-
T-850	0 day	1040
	10th day	910
	21st day	900
Whole flour	0 day	840
	10th day	740
	21st day	760

Table 8. Results of amylograph analysis (determination of maximal viscosity) for flour T-500, T-850 and whole grain immediately after milling, after 10 and 21 days ofstorage at temperature of +18 °C

		Maximal viscosity (Aj)
T-500	0 day	1020
	10th day	1080
	21st day	760
T-850	0 day	1040
	10th day	1080
	21st day	1020
Whole flour	0 day	840
	10th day	1010
	21st day	1180

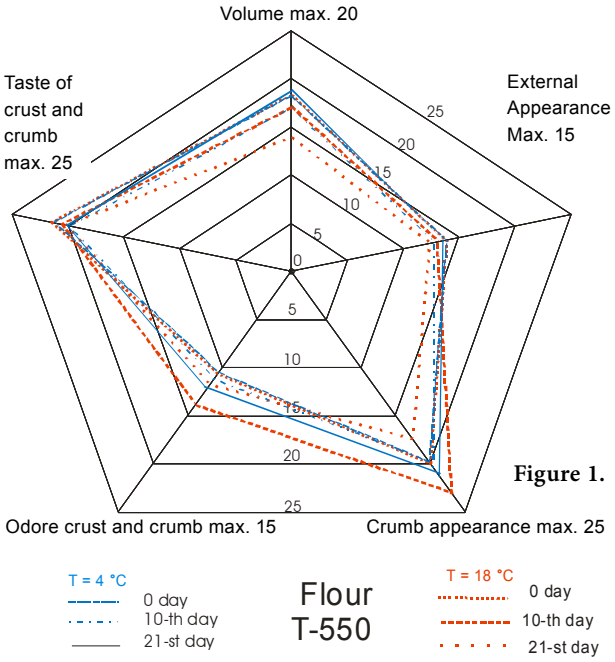


Figure 1.

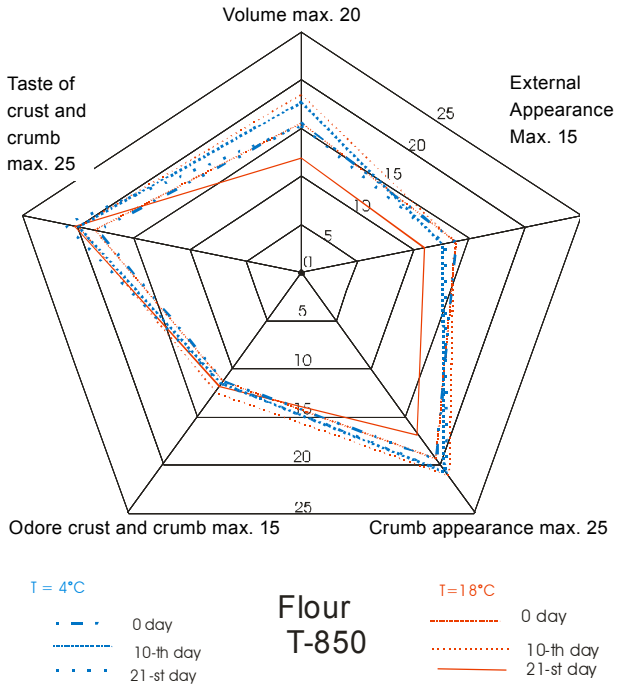
Figure 1. Results of organoleptic analysis for bread made from flour T-500 stored at 4 °C and 18 °C

Figure 2. Results of organoleptic analysis for bread made from flour T-850 stored at 4 °C and 18 °C

Figure 3. Results of organoleptic analysis for bread made from whole flour storing at 4 °C and 18 °C

Table 9. Total grade for all kind of bread

	Bread made form flour T-500		Bread made form flour T-850		Bread made form whole wheat flour	
	4 °C	18 °C	4 °C	18 °C	4 °C	18 °C
21st day	87.99	78.84	84.51	75.47	86.22	72.2
10th day	84.75	90.65	84.97	87.43	77.31	74.85
0 day	86.39		81.36		64.42	



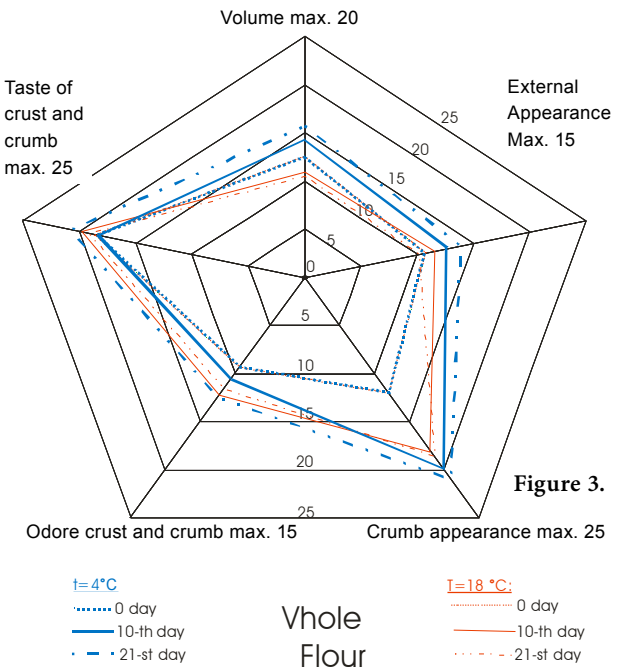


Figure 3.

Conclusion

Based upon results we concluded that conditions of storage have big influence on flour properties, chemical structure and organoleptical properties. To get a good final product the flour has to stand. The temperature is very important factor. Correct temperature and humidity regulation have a big influence on the flour quality and on its constancy.

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