RESEARCH ON INFLUENCE ECOLOGICAL STORAGE OF WHEAT AT LOW TEMPERATURES ON STARCH GELATINIZATION PROPERTIES OF FLOUR

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The paper analyses the influence of low temperatures and the storage duration of the wheat upon the starch gelatinization. The raw material used in experiments was Dropia wheat. The wheat samples were stored at temperatures of 5, 10 and 20º C, for 3, 6, 9 and 12 months. After being stored at that temperatures, samples have been subjected to the same humidity of 14.5% kept for the same period of time at rest and ground with the Bühler laboratory mill. The starch gelatinization under the influence of alpha amylases is highlighted by means of a specific index called falling number. The differences between the values of the falling number corresponding to the temperature of 10º C, recommended by the preserving method through chilling, to different periods of storage, is situated in the limits known from the specific literature.

Key words: *cereals, storage, low temperatures, gelatinization*

Nowadays, in the context of lasting development and promotion of the ecological preserving methods of the deposited cereals, the method of preserving cereals through chilling imposes itself as a viable alternative to the classic methods. Research in this field has started for a few decades in Germany and the USA [3, 4], but this method is still topical. The low-temperature influence upon the technological properties of wheat concerns more and more specialists in the entire world [5].It is well-known that starch is one of the main components of the wheat flour and that the functional properties of starch influence the bakery qualities of bread; we have studied the evolution of starch gelatinization depending on the duration and storage temperature of a kind of bakery wheat: Dropia. The starch gelatinization under the influence of alpha amylases is highlighted by means of a specific index called falling number.

MATERIAL AND METHOD

The raw material used in experiments was Dropia wheat. The wheat samples were stored at temperatures of 5, 10 and 20º C, for 3, 6, 9 and 12 months. After being stored at that temperatures, samples have been subjected to the same humidity of 14.5% kept for the same period of time at rest and ground with the Bühler laboratory mill. After the homogenization of the fractions resulted from the three grits and three

mills, we have determined the flour humidity by the method STAS 90/88. The starch gelatinization under the influence of alpha amylases is highlighted by means of a specific index called falling number and has been determined with method AACC no. 56-81B, using the Falling Number analyzer, model 1310(A) together with its accessories [1,6].

RESULTS AND DISCUSSIONS

After analyzing the influence of the storage duration upon the falling number, we have obtained the results shown in figures 1, 2 and 3. The variation of the falling number depending on the storage duration when using the temperature level of 5º C is presented in *figure 1*.

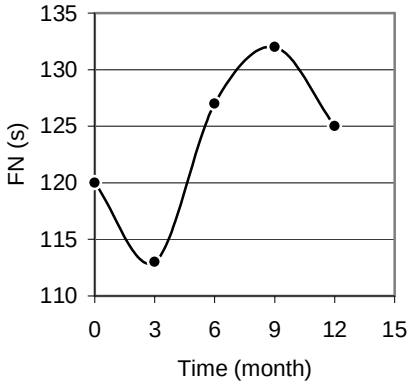

Figure 1 **Variation of the falling number depending on the storage duration when storing at 5º C**

Analyzing the variation of the falling number depending on the storage duration for flour obtained from Dropia wheat, we can easily notice that the maximum values are for those samples kept for 9 months, at 5º C, medium values corresponding to samples preserved for 6 and 12 months and minimum values corresponding to samples stored for 3 months at the same temperature. We can notice that values recorded after 6, 9 and 12 months from storing surpass those values recorded at the beginning of the experiments.

When using the temperature level of 10º C, we have obtained the results synthesized in *figure 2*.

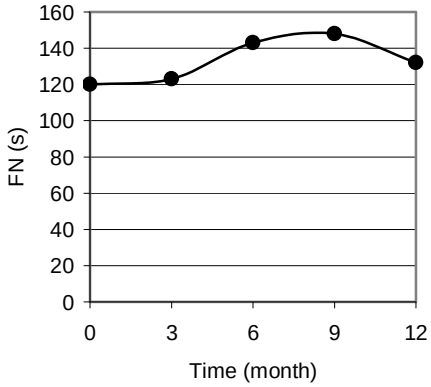

Figure 2 **Variation of the falling number depending on the storage duration when storing at 10° C**

This time, the values of the falling number increase at the same time with the storage duration in the first 9 months. We can notice a very slow growth in the first 3 storing months, relatively quick in the period between 3 and 6 months and slow again between 6 and 9 months. In the period between 9 and 12 months, the falling number decreases slowly to an inferior level to the one registered after 6 months, but superior to the one registered after 3 months of storage.The last temperature level analyzed, the one of 20º C has registered a variation of the falling number compared to the storage duration; results are highlighted in *figure 3:*

In the graphic in *figure 3*, we notice an almost linear variation of the falling number compared to the storage duration. Still, we can notice an accentuated increase in the period between 3 and 6 months from storage. In order to verify the correlation between the 2 variables we use the statistic analysis

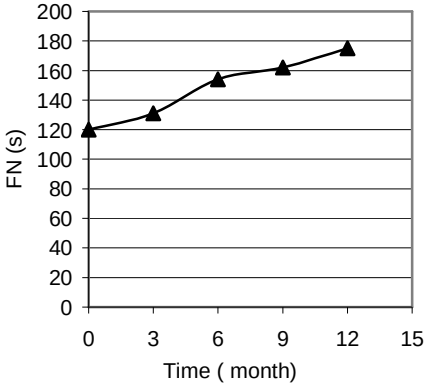

Figure 3 **Variation of the falling number depending on the storage duration when storing at 20° C**

We have used specific instruments of statistic calculation and we have calculated the correlation coefficient between the values of the falling number and the storage duration. Results are centralized in *table 1*.

Table 1

The correlation coefficient between the values of the falling number and the storage duration of Dropia wheat depending on the storage temperature

No	Storage temperature, (^{o}C)	Correlation coefficient r
1	5	0.63
2	10	0.63
3	20	0.98

As we can notice from data in table 1, the correlation coefficient has the maximum value for samples stored at 20º C, its values being close to 1. For the storage between 5 and 10º C, the values of the correlation coefficients are equal, but lower than the storage at 20º C. This denotes a closer correlation between the storage duration and the values of the falling number, when storing Dropia wheat at 20º C.

Next figure have been obtained analyzing the variation between the storage duration at 5, 10 or 20º C and the values of the falling number.

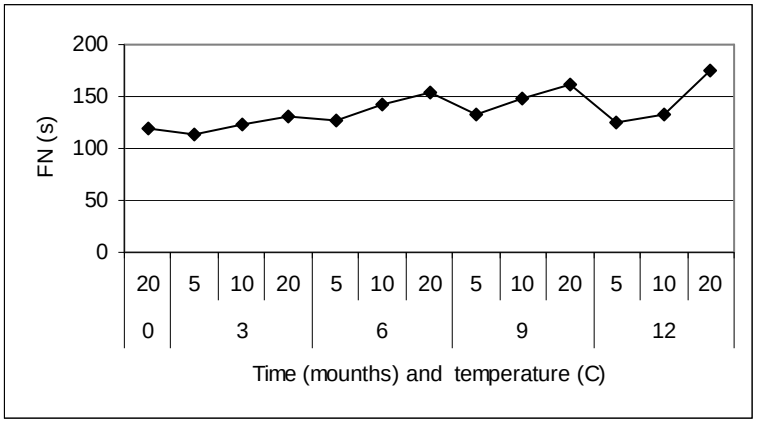

Figure 4 **Variation of the falling number depending on temperature, when storing wheat for 12 months**

We can notice in *figure 4*, an increase of the value of the falling number together with the increase of the temperature of storing cereals after 3 months. After 6 months we notice the maintenance of the increased value of the falling number together with the cereals storage temperature, but a smaller difference between the values registered at the analyzed 3 temperature levels. After 9 months of storing Dropia wheat, we notice the same increasing tendency of the falling number values, together with the temperature increase having the same increased specification, accentuated from 5 to 10º C, compared to the 10-20º C interval. After 12 months of storing Dropia wheat, the values of the falling number increase

together with the storage temperature, but different from the time intervals previously analyzed, the increase of the analyzed index is lower between 5 and 10º C and higher between10 and 20º C.

Using the instruments of mathematical statistics, in order to calculate the correlation coefficient between the variation of the falling number and the storage temperature depending on the storage duration, we have obtained the following results, highlighted in table 2.

Table 2

The correlation coefficient between the values of the falling number and temperature depending on the storage duration of Dropia wheat

No. crt.	Storage duration, (months)	Correlation coefficient (r)
1	3	0.97
2	6	0.96
3	9	0.97
4	12	0.98

From the analysis of the correlation coefficients, we can notice that during the storage period, the correlation between the falling number and temperature is very strong.

CONCLUSIONS

We notice that Dropia wheat had a correlation coefficient very close to 1, in the case of storing wheat at 20º C, meaning a very strong correlation between the storage duration and the falling number, when using this temperature level for preserving the cereal samples. Dropia wheat has registered values of the correlation coefficient higher than 0.6 for all temperature levels used for storage, meaning a strong correlation between the storage duration and the falling number in this case.Taking into account that the falling number spotlights the activity of the alpha-amylases upon starch, we can suppose that the maximum values of the falling number registered by Dropia wheat when stored at 20º C shows that this value is the closest to the optimal temperature of the enzyme taken into consideration.The differences between the values of the falling number corresponding to the temperature of 10º C, recommended by the preserving method through chilling, to different periods of storage [3,4], is situated in the limits known from the specific literature.This proves that the method of cereal preservation through chilling succeeds in keeping the activity of alpha-amylases of the stored wheat in normal limits [2]. Taking into account that the activity of alpha-amylases is an indicator of the properties of starch gelatinization with direct influence upon the process of formation of bread core and bakery products, we can conclude that the method of cereal preservation through chilling preserves from this point of view the bakery properties of the stored cereals.

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