STUDY OF HYDRATION GERMINATED SORIZ FLOUR

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Abstract: Hydration capacity and water retention of germinated soriz flour increases with the increasing dispersion of flour, both in case of untreated and heat treated flour, maximum values of hydration were recorded for flour with granulation of 160 -140µ. Heat treatment of flour (tempering at 180^0C) causes partial gelatinization of starch and leads to more pronounced hydration of flour and the increase of water retention. During the hydration of flour occurs partial diffusion of proteins in the hydration environment.

Keywords: flour of germinated soriz, hydration capacity, water retention capacity, diffusion of proteins

Introduction

General trends of dairy products consumption show an increase in the consumption of dairy products, with added fruit, cereal products, vitamins, mineral salts or lactic bacteria. *(В. В. Ключкова, 2011)* The increase in consumption of dairy products and is also supported by changing nutritional habits: consumption oriented by natural products, gradual migration from eating almost exclusively oriented towards meat to dairy products.

In recent years, particular attention is given to obtaining dairy with cereal products (oats, rye, buckwheat, rice and others). Cereal products increase the essential contents of added amino acids, vitamins (especially those from groups B and PP), vegetable fats, carbohydrates, dietary fibre, ameliorate the nutritional and organoleptic properties of enriched dairy products. *(З. Р. Ходырева, 2011)* Cereal components in dairy products are usually administered in the form of flour (in a state of powder) or liquid suspension.

In view of that dairy product containing cereal products are dispersed heterogeneous systems (suspensions), unstable, cereal preparation and stabilization additives requires a series of technical and technological measures. In order to perform complex liquid dairy products, homogeneous and higher stability, as well as the active principle (addition of cereal products) to be distributed uniformly evenly throughout the external phase into turbulences (milk) for a sufficient period of time should be taken into account a number of factors, determining the particle size, wetting ability and water retention. The latter determines the settling velocity of particles dispersed and stability of the finished product.

In the present paper as an additive to fermented dairy products was used germinated soriz flour. Soriz is an annual cereal crop hybrid origin of perspective for the Republic of Moldova because it is resistant to drought, productive, and beans have high nutritional qualities. *(Gh. Moraru, 1998)*

Soriz of malt flour is obtained by grinding and sifting seeds of germinated and dried soriz. The process of hydration of germinated soriz flour depends on the degree of dispersion, size and structure of particles. It was investigated the influence of temperature, duration of hydration and flour granulation on hydration and water retention.

Materials and methods

Germinated soriz flour. Germinated soriz was grinded in the laboratory mill У1-ЕМЛ. Fractional operation after granulosity was achieved by sifting installation РЛ-3М and flours were obtained withdifferent granulation: 1250 μ; 180 μ; 160 μ;140 μ.

Organoleptic characteristics of flour were:

Color **-** yellow with caramel hue.

Odor **-** specific malt flour without strain smell, rancid or mould;

Taste - savory, sweet malt, special malt flour, without strain taste, slightly sour or bitter.

Chemical composition of germinated soriz flour is shown in Table 1.

Table 1.Chemical composition of germinated soriz flour

	Chemical composition	Value
1	Dry matter content, %	9,90
2	Fat content, %	3,88
3	Starch content, %	59,23
4	Sugar content, %	2,25
5	Cellulose content, %	4,52
6	Protein content, %	11,69

Hydration of flour was made in milk (flour ratio: milk = 7: 1). 5 g (± 0,02 g) of flour have been suspended in 35 ml of liquid in centrifuge tubes of 50 ml and incubated for 10 min at predetermined temperatures (20, 30, 40, 50, 60, and 70^{0}C) in water bath. The content of the tubes has been well mixed over every 5 min. The suspension was subsequently centrifuged 15 min to 1000 revolutions per minute. After centrifugation the supernatant was removed, and the precipitate-weighed. *(Andreas Markus Kratzer, 2007)*

Hydration capacity of flour was calculated from the relation:

$$c_{hydration} = \frac{m_{l1} - m_{l2}}{m_p} \times 100, \qquad (1)$$

where: $c_{hydration}$ *– hydration capacity of flour, %;*

m_{l1} *– the initial quantity of milk, g;*

m_{l2} *- quantity of milkafter centrifugation, g;*

m_p *– the sample offlour, g.*

Water retention capacity (WRC) was determined by planimetric pressing.

0,3 g of wet precipitation of flour were placed on a polyethylene film, which was covered with filter paper and a plate of glass, over what was a mass of 1 kg and 10 min to be under pressure. After pressing the flour was separated from the filter paper and have been marked with a pencil outline of production spot and the contour of wet spot. (*Grau R., Hamm R. 1953)*

Water retention capacity was calculated from the formula:

$$c_{retention} = \frac{m_{retained\ water} - (S_1 - S_2)}{m_{sample}} \times 100, \qquad (2)$$

where: $m_{retained\ water}$ - *mass of retained water, g;*
S_1 - *surface of wet contour, cm²;*
S_2– *surface of flour contour, cm²;*
m_{sample} – *sample mass, g.*

Dosing of proteins in milk was performed by the method of titration with formaldehyde, which consists of blocking the protein groups with amino-formaldehyde and release of carboxyl groups, followed by their neutralization with 0.1 n NaOH solution. Volume (ml) of NaOH (0,1 N), consumed in the second titration multiplied by coefficient1.94is the amount of total proteins, expressed in % of the total mass of milk product. *(ГОСТ 25179-90)*

Results and discussions

Influence of granulation and heat treatment of flour on the capacity of hydration and water retention

It was determined the capacity of hydration and water retention of heat untreated soriz flour and heat treated at 180°C for 10 minutes. As a hydration medium has been used milk with fat content of 2,5%. The results are shown in Figures 1 and 2.

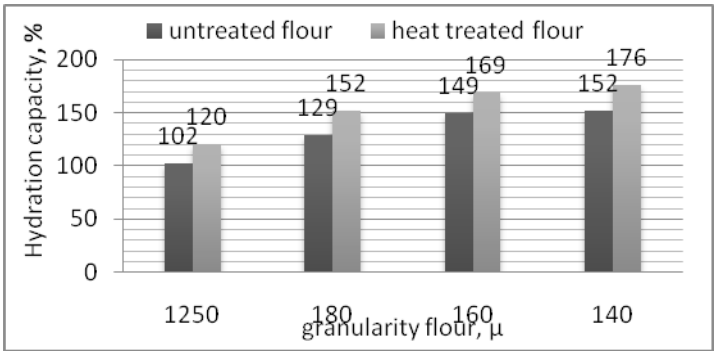

Fig. 1. Influence of granulation and heat treatment of flour on the capacity of hydration

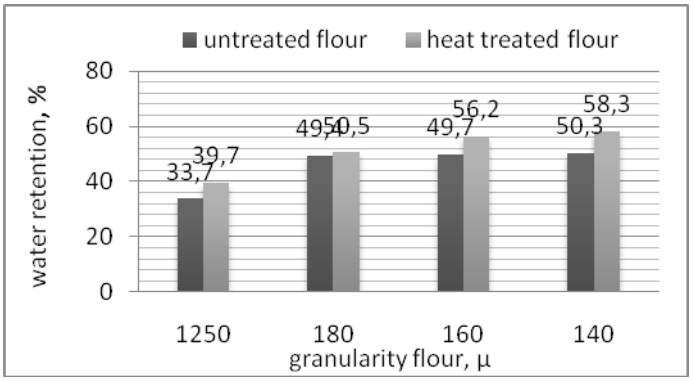

Fig. 2.Influence of granulation and heat treatment of flour on the water retention

Hydration capacity of flour grows with the increase the degree of dispersion of flour, both in the case of untreated and heat treated flour, maximum values of hydration being recorded for flour with granularity of 160-140µ. Variation of hydration capacity depending on flour granularity is largely determined by specific surface area, which increases with the degree of flour dispersion. It is not excluded that, under the geometrical effect, the capacity of hydration is affected and by the biochemical composition of flour. It is known *(Hebrard A. and of, 2003)* that the fractions of flour with high granulation are richer in protein, pentozans and contain more starch granules damaged during milling, which have a significant contribution in the process of hydration.

Comparing the hydration capacity of untreated and heat treated flour, it is observed that the second has a higher hydration capacity. Heat treatment of flour possibly cause partial gelatinization of starch and leads to stronger hydration of flour.

So, in the case of flour with the granularity of 140µ preliminary heat treatment applied to the flour leads to an increase in the hydration capacity of flour by 15,8%.

WRC index reflects the water content retained in hydrated product and expressed as a percentage. WRC is influenced by the contents and the structure of proteins. The character of retention capacity of water depending on the degree of dispersion of flour is similar to that for hydration capacity. Heat untreated flour with granularity of 140µ has a water retention capacity of 50.3% and heat treated flour - 58. 3%.

The influence of temperature and the soaking time on the hydration capacity and water retention

In the production of fermented milk the flour may be introduced to the following technological steps:

- The standardized milk (temperature 60°C) before mixing;
- Before pasteurization (milk temperature: 80-95°C);
- The seeding phase of milk at a temperature of 42-45°C.

The process of flour hydration was pursued for 60 minutes at 20, 30, 40, 50, 60 and 70°C. As a medium for flour hydration was used the milk with fat content of 2,5%. The milk was mixed with the flour in a proportion of 1 to 10.

The results of the influence of temperature on the hydration capacity and water retention of soriz flour with granularity of 140µ are shown in Figures 3 and 4.

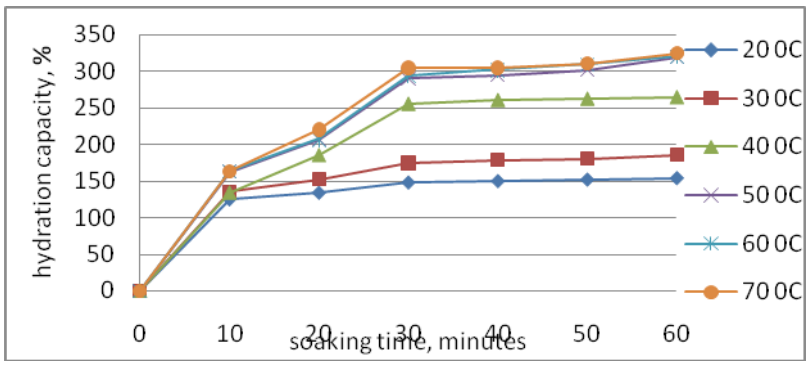

Fig. 3. The influence of temperature and soaking time on the hydration capacity of heat untreated flour

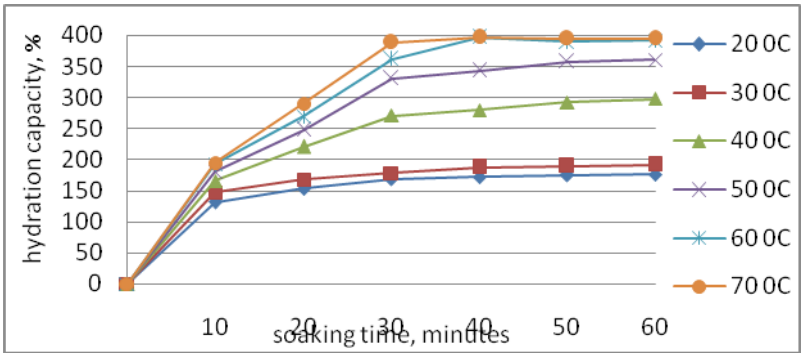

Fig. 4.The influence of temperature and soaking time on the hydration capacity of heat treated flour

So with the increase of temperature from 20^0C to 70^0C, the degree of hydration of flour rises, reaching the maximum temperature of 70^oC to 329% for heat untreated flour and 395% for the hardened (an increase of about 30%).

Note that the process of flour hydration in the first 10 minutes is relatively intense and less depend ant on the temperature of ambient liquid. Further hydration rate decreases and the degree of hydration is obviously dependent upon the ambient temperature. The maximum value of hydration is established after about 30 min of soaking.

From the results presented above is that the optimal soaking of germinated soriz flour is:

- Temperature of 60^oC, becausea higher temperature does not influence significantly the hydration capacity of flour;
- Duration of 30 minutes, which corresponds to the period of establishment of hydration by the balance of flour.

Diffusion of protein substances in the flour in the environment hydration

During the process of flour hydration takes place partial diffusion of milk of soluble substances, including proteins. The mechanism of proteins transfer in the hydration is convective and involves both a mass transfer by molecular diffusion in flour particles and by stagnant fluid layer, as well as thee mass transfer through the layer of fluid in motion. *(И. В. Рогов, 2000)*

To follow the diffusion of protein substances in the flour into the milk was taken 140 μ of granulary flour. The relationship between protein content in the hydration (steady hydration) and the hydration temperature is shown in Figure 5.

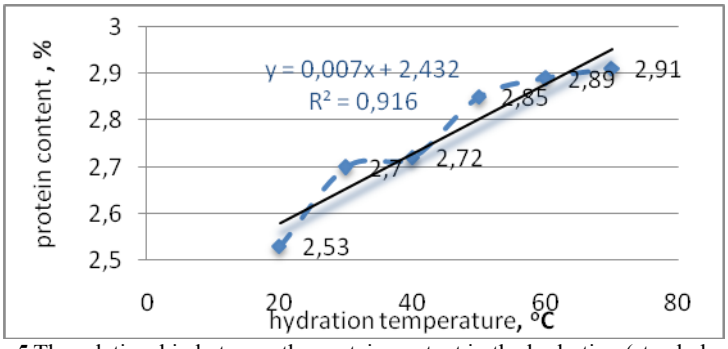

Figure 5. The relationship between the protein content in the hydration (steady hydration) and the hydration temperature

The protein content in the in the space of hydration increases from 2.53% to temperature by 20°C up to 2,91% at a temperature of 70°C. Therefore, we can assume that in the continuous phase passes a part of soluble proteins of ovalbumin-flour.

Conclusions

1. Hydration capacity and water retention capacity of germinated soriz flour grows with the increasing the degree of flour dispersion, both in case of untreated and heat treated, maximum hydration values were recorded for flour granularity of 160 -140μ.

2. Heat treatment of flour (tempering at 180^{0}C) causes partial gelatinization of starch and leads to stronger hydration of flour and the increase of water retention.

3. During the flour hydration occurs the partial diffusion of protein in the hydration environment.

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