STUDY OF HERBAL SUPPLEMENTS EFFECT ON AMYLOLITIC FERMENTS' STRENGTH OF YEAST-LEAVENED DOUGH

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Abstract. The work confirms the use perspective of dry supplements obtained from potato processing by-products (hereinafter referred to as PPBP) in the process of yeast-leavened goods' making. It is proved that during low-temperature PPBP processing the easily fermentable sugar is accumulating and it can be used during the process of yeast-leavened dough making as a growth environment for preliminary yeast activating. The supplement effect on amylolitic ferments' strength in the yeast-leavened dough was studied. It is proved that herbal supplement adding at a rate of 5% on the flour weight ensures the better starch destruction during the dough-making process as well as facilitates the starch amylolysis intensifying, the specific volume increasing and reducing the fermentation time to (60…90)·60 sec.
Keywords: potato processing by-products, dry potato supplement, preliminary yeast activating, yeast-leavened dough, saccharogenic activity, gas retaining ability.

Introduction

In the global baking industry of the economically developed countries the implementing of the new intensive technologies focused on small and mini-bakeries gets more and more extensive. These technologies are more flexible comparing to the traditional ones and allow quick feedback to the market requirements for population providing with fresh goods, as well as allows establishing bakeries and mini-bakeries with shortened process also at the supermarkets, hotels, restaurants etc. In the developed countries of the world the major share of baked and yeast-leavened goods is produced in the mini-bakeries.

The enhanced dough process methods are of the greatest current interest in the technologies of yeast-leavened goods making in the small bakeries which work only during one shift [1-3].

Thus, the development of the bakery industry by means of small bakeries' establishment is promising and creating the new technologies of yeast-leavened goods making for those bakeries is of vital importance.

Method

The saccharogenic activity of the flour was calculated based upon the number of milligrams of maltose educed in the flour-water suspension after 1 hour of maturation at 27^0C. The suspension was prepared of 10g of flour and 50ml of water. The generated amount of sugar in terms of maltose was expressed in milliliters (units).

The gas retaining ability was studied by changing the dough amount in 250 cm3 measuring cup in the thermostatic cabinet at 30ºC during $4 \cdot 60^2$ sec of fermentation and thus the specific dough volume was calculated.

Results

The supplements using in the technologies of yeast-leavened goods' making at the phase of yeast activating or directly during the dough kneading requires special attention.

In the previous works we offered to use the dry potato supplement (hereinafter referred to as DPS) obtained from potato processing by-products (PPBP) during the yeast activation phase in the technologies of yeast-leavened goods' making. The positive effect of DPS on biotechnological properties of yeast due to availability of easily fermentable reducing sugars in DPS was proved.

Herewith the earlier performed studies [3] determined that max accumulating of the reducing sugars is achieved in case of product's mashing and its further blast chilling at - 40°C during 90·60 sec.

For preventing the tyrosine amino acid's oxidizing when exposed to the tyrosinase ferment it was decided on the preliminary PPBP treatment with 2.5% solution of citric acid.

For obtaining the dry product the analysis of PPBP drying kinetics was performed in order to get dry potato supplement (DPS) by means of the radiation method in the thin fixed layer [13]. It was determined that PPBP drying up to 12% of moisture content is to be performed during (50…51)·60 sec at heat flow density of IR-radiation of 875 W/m^2.

As a result of performed studies we received DPS with 12% moisture content.

The objective of this work is defining DPS effect on the saccharogenic activity and gas retaining ability of the yeast-leavened dough as well as the intensity of sugars accumulating and assimilating in the dough.

The key transformations occurring in the carbohydrate-amylase mass of dough during its maturation ensure the fermentation intensity and in as a result define the quality of final goods. Thus the analysis of the starch hydrolytic decomposition intensity under the effect of the activated yeast is very important and requires detailed studying.

For studying the effect of DPS on the intensity of maltose accumulation the comparison of saccharogenic activity value in the samples of wheat flour (lot #1 and lot#2), as well as their mixes with DPS of 1; 3; 5 and 7% content on the flour weight was performed. The study results are specified in the below table (Table 1).

Table 1

The saccharogenic activity of the flour and its mixes with DPS, mg of maltose/10g of flour

Parameter	Reference sample	DPS content			
		1%	3%	5%	7%
Top-grade wheat flour (lot #1)					
Initial sugar content	110	112	114	118	121
Saccharogenic activity	240	248	251	269	295
Maltose content growth	130	136	137	151	174
Top-grade wheat flour (lot #2)					
Initial sugar content	108	110	113	116	120
Saccharogenic activity	235	243	247	262	292
Maltose content growth	127	133	134	146	172

The data analysis (Table 1) process that the most reasonable DPS content in the flour samples from both lot #1 and lot #2 is 5% from the flour weight; the saccharogenic activity value at the aforesaid content increased by 27-29% what is within the normal limits. It proves that DPS availability in its reasonable content enhances β-amylase strength and intensifies the dough fermentation process.

It is to be highlighted that the supplement content increasing to 7% results in increasing the saccharogenic activity value by 55-57% what from process point of view causes the degradation of final goods' quality (foxy crust and defected).

In view of saccharogenic activity value increasing in case of DPS availability it is feasible to study the supplement effect on starch amylolysis and rate of sugars' fermentation with the yeast. For this we performed the studying of dynamics of sugars accumulation in the dough with DPS added and its influence on the sugars' fermentation intensity.

The yeast-leavened dough was prepared following the straight method and baking test recipe; DPS was added in the amount of 1; 3; 5 and 7% from the lot #1 and lot#2 flour weight (Tables 2-3).

Table 2

DPS effect on the intensity of sugars accumulating and assimilating in the dough of top-grade flour (lot #1)

Parameter	Reference	% DPS from the flour weight			
		1%	3%	5%	7%
Unyeasted dough: After kneading	2,19	2,22	2,28	2,32	3,12
In 4 hours of autolysis	4,45	4,89	5,16	6,10	7,47
The amount of generated sugars, % DS	2,26	2,67	2,88	3,78	4,35
Yeasted dough: After kneading	2,20	2,21	2,29	2,31	3,18
In 4 hours of autolysis	2,22	2,14	2,18	2,21	2,12
Amount of fermented sugars, % DS	2,28	2,74	2,99	3,88	5,41

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Table 3

DPS effect on the intensity of sugars accumulating and assimilating in the dough of first-grade flour (lot #2)

Parameter	Reference	% DPS from the flour weight			
		1%	3%	5%	7%
Unyeasted dough: After kneading	2,15	2,18	2,24	2,29	3,91
In 4 hours of autolysis	4,36	4,82	5,08	6,02	7,46
The amount of generated sugars, % DS	2,21	2,64	2,84	3,73	4,55
Yeasted dough: After kneading	2,16	2,19	2,23	2,30	2,92
In 4 hours of autolysis	2,15	2,05	2,12	2,18	2,78
Amount of fermented sugars, % DS	2,22	2,78	2,95	3,85	4,69

The data (Tables 2-3) prove that DPS adding significantly effects the mass content of sugars which were generated in the unyeasted dough within $4 \cdot 60^2$ sec of fermentation. Thus, the sugars accumulation increases with DPS content increase by 4-8% DS (lot #1) and by 4-10% DS (lot #2) in contrast to the check samples. Herewith, the mass content of the fermented sugars increased by 12-39% DS (lot #1) and by 17-23% CP (lot #2).

The most optimal amount of sugars accumulated in the dough within $4 \cdot 60^2$ sec of fermentation was in the sample with 5% of DPS on the flour weight from both analyzed lots. The increasing in the mass content of the generated sugars is likely a result of the activation of amylase released while proteins' hydrolytic decomposition as well as destruction of protein-starch complexes what enhances the amylase contact with starch molecules. The enrichment of growth environment composition with generated sugars and water-soluble nitrogenous compounds intensifies the alcohol fermentation in the dough and herewith the mass content of the fermented sugars is increased.

DPS content increasing to 7% ensures more intensive sugars accumulation what is explained by higher supplement content and availability of higher amount of own sugars but ultimately too high sugar content negatively impacts the dough rheology, inhibits the vital activity of the fermentative microorganisms of the dough what negative effects the final goods quality.

Thus it was specified that DPS using enhances the starch hydrolysis during dough-making process as well as the accumulation of the fermented sugars and their assimilation with the yeast only in case its content is feasible (5% on the flour weight).

Equally important parameter of the yeast-leavened dough is the gas retaining ability. Therefore further studies were performed with regard to defining the gas retaining ability of the dough depending on DPS content and flour grade. At (Fig. 1) there are the results of DPS effect on yeast-leavened dough's gas retaining ability analysis.

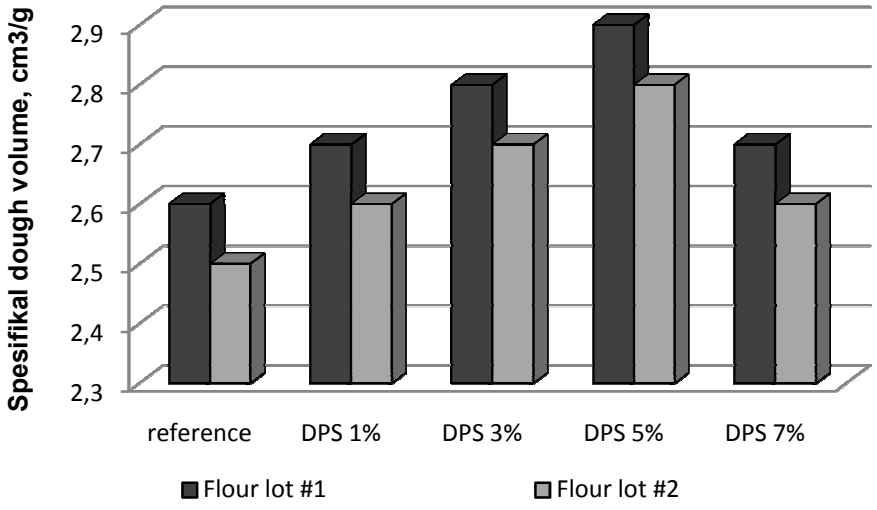

Fig. 1. DPS effect on yeast-leavened dough's gas retaining ability

It was defined that in case of DPS increase from 1 to 5% on the flour weight the specific dough volume increase is observed (max volume was at 5% of DPS content on the flour weight what differs from the reference value by 10%). It can be assumed that DSP facilitates the generation of hydrogen and hydrophobic bondings what results in increased ability of gluten network to retain CO_2.

Discussion

While studying DPS effect on amylolytic ferments strength in the dough it was defined that DPS using in 5% content on the flour weight ensures the saccharogenic activity value's increase by 27-29% as well as better starch destruction during dough-making process.

The study of DPS effect on startch amylolysis and rate of sugar fermentation with the yeast proved that DPS adding significantly influences the mass content value of sugars generated in unyeasted dough during 4 hour of fermentation. Thus, the sugars accumulation increases with DPS content increase by 4…10% and mass content of the fermented sugars is increased by 12…39% comparing to the reference samples.

Herewith the positive DPS effect on the gas retaining ability of the yeast-leavened dough is to be highlighted. DPS adding in 5% content on the flour weight enables specific volument increase by 10% and ultimately shortened fermentation period to (60…90)·60 sec.

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