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Strong flour improvement using malt flour

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Abstract

The influence of malt flour on dough's behaviour depends on the flour composition. We studied the effect of malt flour on a strong flour with alpfa-amylase deficiency. As well as dextrins, glucose and proteins derived from the cereals, malt flour is rich in diastase and is added to wheat flour with low diastatic activity (a measure of the ability of flour to produce maltose from its starch by the action of its own amylase). This sugar is needed for yeast fermentation.

Flours poor in alpha-amylase have small capacity for starch hydrolysis and for form sugars; products obtained from it have lower quality, low volume and porosity, pale crust and dry crumb. Also, this products pass quickly and have a crumb without flavor.

Our determinations were made with a sample of flour type 650 analyzed in accordance with the methodology applied in the romanian standards in force: STAS 90-88, STAS 6124-73, STAS 6283-83 and SR ISO 3093:1997 and rheological behavior of dough with malt flour added was determined with the Chopin Alveograf according to SR ISO 5530-4:1998 and Farinograf Brabender according to SR ISO 5530-1:1998.

Keywords: malt flour, strong flour, improvement, alpfa-amylase, diastatic activity, starch hydrolysis.

1. Introduction

All There are three sources of alpha-amylase:

- malt alpha-amylase (cereals) – active till 80ºC;
- fungal alpha-amylase (Aspergillus oryzae) – active till 70ºC;
- bacterial alpha-amylase (Bacillus subtilis) – active till 90ºC;

Malt flour is used since 1886 for improve flour with low diastatic activity. It is defined as germinated barley or wheat, in dried form. Barley malt flour has high diastatic activity and is excellent at improving bread obtained from flour with alpfa-amylase deficiency. Malt flour are light in colour and have a low flavour level. Into bread dough the malt flour breaks down starch and produce maltose and other sugars which act as yeast foods, enhancing yeast performance during fermentation.

Standard analytical measurements (ash, moisture, wet gluten, gluten's deformation, Falling Number) and rheological investigations (Chopin Alveograf, Farinograf Brabender) were used for flour and dough characterization.

Flour used for testing have the following characteristic:

Table 1. Flour parameters

Parameters	**Flour F_1**
Ash , %	0.7
Moisture, %	14.5
Wet gluten, %	27
Gluten's deformation, mm	10
Falling Number, sec	272

In our testing we used flour malt from SC ENZYMES & DERIVATES SA, known as BELPAN MALT. It is an malted enzymatic wheat flour obtained from grains of common wheat cleaned, gauged, soaked.

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Maximum amylasic activity is granted with a slight malted taste. BELPAN MALT used in testing have moisture less than 10%, particle size 200 μm and mineral matter less than 1,4 % on dry matter.

2. Materials and Method

All the determinations were made with a wheat flour type 650, a strong flour, poor in alpfa-amylase. The main factor which influence the power of flour is protein substances (it influence also dough's rheological properties). Strong flour has high elasticity, low extensibility and high resistance to stretch [2]. These properties may become normal in addition of malt flour because it contains besides alpha amylase (present in large quantities) and proteolytic enzymes.

We used a sample without addition of malt flour and we named M – sample and five samples with different content of malt flour:

- the first sample, F_1, have an addition of 50 grams malt flour (0.05%);
- F_2 contains 100 grams of malt flour (0.1%);
- F_3 contains 150 grams of malt flour (0.15%);
- F_4 have an addition of 200 grams malt flour (0.2%);
- the last one, F_5, contains 250 grams (0.25%).

We made determinations using Falling Number, Chopin Alveograph, Brabender Farinograph and Mixolab.

3. Results and Discussion

Strong flours gives doughs with high elasticity and resistance and with small extensibility. It leads to dense and undeveloped products. This flours absorb a quantity of water relatively high, the dough obtained keeps very well rheological properties during fermentation and kneading and also this dough has the capacity of holding back gases [1] (sample M). So, once with the addition of malt flour (F_1- F_5), flour absorbs relatively little water to obtain a paste of normal consistency.

Table 2. Values of Farinograph, Alveograph and Mixolab

	M	**F_1**	**F_2**	**F_3**	**F_4**	**F_5**
Falling Number	482	335	297	287	248	230
Farinogram						
Hydration capacity	62.2	61.6	61.4	61.3	61.5	61.7
Stability, min.	12	11.45	11	9.15	9	9.30
Soaking, E, min.	40	50	45	60	60	70
Power, V	65	54	52	50	49	45
Farinogram with interruption						
Soaking, E	170	185	190	200	220	220
Power,V	36	35	37	33	32	30
Alveogram						
Maximum pressure, P, mm	116	102	108	107	109	115
Length , L, mm	44	46	34	40	35	32
Relation between P/L	2.64	2.22	3.18	2.67	3.11	3.59
Total quantity of absorbed energy, W	203	185	156	178	163	159
Ie	48.3	49.6	0.0	49.6	0.0	0.0
Mixolab						
C1	1.10	1.10	1.10	1.10	1.10	1.10
C2	0.47	0.45	0.43	0.28	0.26	0.27
C3	1.87	1.78	1.70	1.39	1.34	1.31
C4	1.82	1.52	1.14	0.69	0.58	0.54
C5	2.83	1.96	1.52	0.78	0.66	0.58

We can see in farinogram with interruption that when we add malt flour the dough's consistency is reduced and the reological properties are modified.

Small doses of malt flour have positive effect on bread quality (samples F_1, F_2, F_3). In high doses (F_4, F_5) the dough's elasticity decreases and it's extensibility increases. This effect due to proteolytic activity and to fact that maltose (formed by starch hydrolysis) acting on dough's gluten (leads to an dehydration action). So, the amount of free water of dough increases, which reduces the dough's consistency and worsening it's rheological properties. This fact is visible in the mixolab analysis on the C_3 parameter. Also in mixolab analysis we can see on C_2 parameter that, because of heating, the proteins are weakening. This parameter is a new indicator of quality, an indicator of proteins power.

Conclusion

The advantage of using malt flour can be summarized in the following conclusions:

- adds moderate proteolytic activity to the dough that assists in dough conditioning and gluten development during fermentation;
- insure maltose formation from susceptible starch after heat inactivation of the yeast in the oven, thus improving the loaf of bread, texture and crust colour;
- increase the moisture-retaining properties of the finished product, thus enhancing freshness and keeping quality;
- reduce the potential for buckiness, wildness or stickiness in dough without lowering absorption

The effects of malt flour addition were found in:

- changes of water absorption and dough consistence during farinograph kneading;
- increase dough's stickiness and decrease tolerance against overmixing in farinograph;
- decrease elasticity and increase extensibility in alveograph;
- increase bread volume;
- change bread shape and sensorical characteristics;
- increase bread freshness during storage test.

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