



STUDIES ON INFLUENCE OF WATER ON DOUGH RHEOLOGY AND BREAD QUALITY

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Abstract: The water content is a very important parameter of the dough. The consistency of dough depends on the amount of free water in the dough, which facilitates the enzymes mobility, reported to the substrate and therefore the intensity of biochemical processes. Too little water will lead to a too high viscosity and this will cause difficulty during dividing, handling and molding. Too much added water will lead to dough with a low viscosity and it will stick to processing equipment. The present paper aimed is studying the influence of water on the rheological characteristics of bread dough and quality of bread was studied.

Keywords: bread dough, water content, consistency

1. INTRODUCTION

Water absorption in baked products can be defined as the amount of water addition required to produce a dough optimum for processing. Moisture levels in bread formulations influence the rheological properties of the bread dough as well the textural properties of the baked bread. It is thus important to produce a dough with an optimum water level. Too little water will lead to a too high viscosity (the dough will be stiff) and this will cause difficulty during dividing, handling and molding. Too much added water will lead to dough with a low viscosity (the dough will be too soft and may not retain its shape) and it will stick to processing equipment. Dough water levels are also dependent on bread variety, bread making process and processing methods.

In the baked bread, moisture content contributes towards the textural properties. Perception of freshness is generally linked to the moisture content of the crumb, although bread stored under the proper conditions for several days will have the same moisture content as that of freshly baked bread. [4]

Water is regarded as one of the critical factors that contribute to bread staling. Another major factor is starch. The overall staling process can be divided into two sub processes: firming of the crumb caused by moisture transfer and intrinsic firming of the cell wall material, which is due to starch retrogradation. Bread with lower moisture content does stale faster than that with higher moisture content.

The water levels are critical when referring to bread spoilage. Too little water would accelerate staling and too much water would encourage spoilage by moulds.

If there is an excess of water, the dough will have small consistency and bread obtained will be flat

2. INFLUENCE OF WATER CONTENT ON RHEOLOGICAL DOUGH PROPERTIES

Rheological properties of the dough play an important role in the production process, in which the dough is subject to action of forces which causes stress and strain.

Water is an essential component of the dough, primarily because when mixed with flour results a mixture whose mechanical behavior enables the desired formation in the bread making process, and secondly because after the baking there is more or less water in bread, water which plays an important role in determining the texture.

Absorbed water from flour in the mixing process is in the form of water related, an integral part of the structure of dough, and partly as free water, responsible for the fluidity of the dough.

Related water represents 30-35% of the total amount of water in dough, the remaining of 60-65% being under the form of free water. [1]

Largest amount of water from bread dough is related to gluten and starch. The formation of dough, the gluten must be hydrated. Optimal time for mixing grows at small dough humidity, like we can see on table 1.

Grow of time for dough development is bigger when the flour used are much stronger. [2] Rheological properties of the dough, elasticity and viscosity, increase up to certain values of water content, corresponding to maximum swelling of

the proteins, then their value decreases. Optimum consistency is obtained when the dough contains enough water to swelling flour components. An insufficient amount of water on the dough not achieved optimal swelling of gluten proteins; dough is obtained with reduced elasticity, and the final breads will have volume and porosity underdeveloped.

Table 1 Influence of water content on time of dough develop [3]

Water, %	Time for dough develop, s
36,52	260
38,52	300
40,52	350
42,52	415

Influence of dough humidity on viscosity and storage module are presented in table 2

Table 2 Influence of dough humidity on rheological characteristics of dough [3]

Dough Humidity, %	Rheological parameters of dough	
	Viscosity η , [Pa · s ⁻¹]	Storage module [G], Pa
36,52	1,9 10 ⁶	1675
38,52	1,6 10 ⁶	1640
40,52	1,2 10 ⁶	1602
42,52	1,2 10 ⁶	612

3. MATERIALS AND METHOD

Materials

Three commercial wheat flour samples (FA₁, FA₂ and FA₃) of varying quality characteristics were procured from the local market, and used in the studies.

Methods

Flour analysis: moisture, ash, protein content, gluten and acidity characteristics were determined, characteristic shown in table 3.

Bread formula and ingredients

Bread dough was prepared using direct method preparation. It was preparing dough's with different consistency: dough with normal consistency, dough with soft consistency (+10% water from hydration capacity) and dough with strong consistency (-10% water from hydration capacity).

Preparation of the dough

For preparation of bread dough was used flour, water, yeast and salt. The ingredient was mixing using the Spiral Mixer Silver 50, for 8 minutes at 90 rpm, and next for 4 minutes at 180 rpm. After resting, the dough was baked at 200°C for 40 minutes.

Table 3 Characteristics of flour used

Characteristic	FA ₁	FA ₂	FA ₃
Moisture, %	14,03	14,00	13,98
Ash, %	0,58	0,61	0,49
Proteins content, %	13,29	13,46	13,12
Gluten, %	29,3	29,9	29,5
Acidity, %	2,4	2,5	2,4

Measurement of influence of consistency on bread

After baking we measured the volume, porosity, acidity of the bread, and were also carried out a sensorial analysis of bread obtained. The results are shown in table 4.

Table 4 Characteristics of bread obtain

Sample	Characteristics Measured	Dough with Normal Consistency	Dough with Soft Consistency (+10% water from hydration capacity)	Dough with Strong Consistency (-10% water from hydration capacity).
FA ₁	Volume	305	320	290
	Porosity, %	79	82	73
	Acidity, degrees	2,7	2,9	2,6
	Sensorial Analyses	Taste and smell specific; uniform porosity	Taste and smell specific; uniform porosity	Taste and smell specific; brittle crumb
FA ₂	Volume	290	275	263
	Porosity, %	73	75	70
	Acidity, degrees	2,5	2,7	2,4
	Sensorial Analyses	Taste and smell specific; uniform porosity	Taste and smell specific; uneven porosity	Taste and smell specific; brittle crumb
FA ₃	Volume	320	308	304
	Porosity, %	76	79	75
	Acidity, degrees	2,5	2,6	2,3
	Sensorial Analyses	Taste and smell specific; uniform porosity	Taste and smell specific; uneven porosity	Taste and smell specific; brittle crumb



Figure 1 Dough with strong Consistency



Figure 2 Bread from dough with Normal Consistency

4. RESULTS AND DISCUSSION

The results are presented in graphic form.

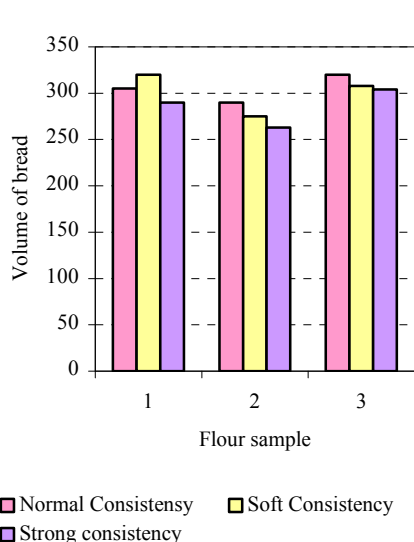


Figure 3 Influence of water added in dough on bread volume

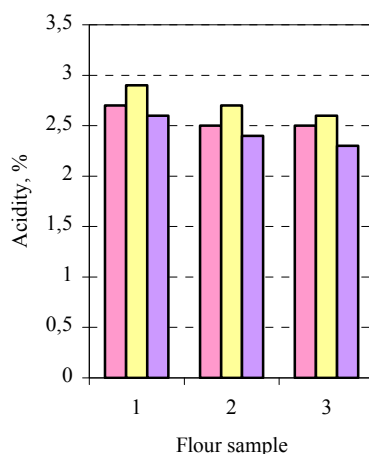


Figure 4 Influence of water added in dough on bread acidity

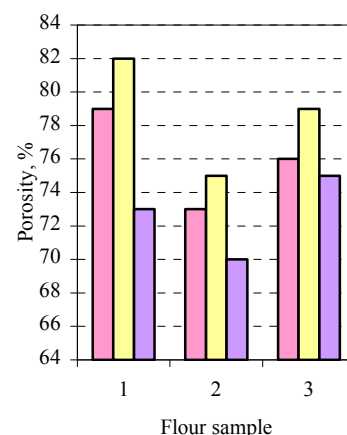


Figure 5 Influence of water added in dough on bread porosity

CONCLUSION

The result obtain under modification of dough consistency realized with added water with 10% to much than hydration capacity of flour, respectively with reducing with 10% of water content than hydration capacity, we can observe that the quantity of added water can influence the quality of the bread.

It has observed that for the bread obtain from flour FA₁ and FA₂ with grow of quantity of water comparatively with hydration capacity have a positive influence on volume and porosity of the bread. Insufficient amount of water on the dough has a negative influence on the bread.

The organoleptic points of view the bread obtained from all 3 types of flour with added water have suffered the same modification; the taste and smell were specific to the bread.

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