

Water Content and Water Activity of Bakery Products

Anca TULBURE¹⁾, Mihai OGNEAN²⁾, Claudia F. OGNEAN²⁾, Ioan DANCIU²⁾

¹⁾Extra Sib SA, 70 Alba Iulia Av., Sibiu, Romania; anca.tulbure@extrasib.ro

²⁾Faculty of Agricultural Sciences, Food Industry and Environmental Protection,
“Lucian Blaga” University, 10 Victoriei Blvd., Sibiu, Romania

Abstract. Water is a main ingredient in bread making and in many bakery products water represents, by weight, the most important constituent after starch. After baking, water is very important for the shelf life of product. It influences the microbiological stability of products and, also, the sensorial properties of products, especially the texture. The water level in bakery products is expressed as water content. Water content did not explain some processes and, in some cases, water activity of product is more important. The aim of this work is to measure the water content and water activity of some bakery product and investigate theirs relation. Water content was measured by oven drying at 100°C and water activity was determined with Novasina LabMaster apparatus. Gingerbread with different recipes was prepared in lab and we evaluated the relation between water content and water activity. The common breads analyzed had a water content which lay between 44 and 46% while the water content of biscuits lay between 4.8 and 6.5%. Other bakery product, as gingerbread, made in the lab, have water content between 10.6 and 16.3%. Weak correlation could be established between water content and water activity for the samples analyzed. Water content of bakery product influenced the water activity but also product composition is important.

Keywords: water activity, bakery, gingerbread, biscuits

Introduction. Water plays different roles in the process of breadmaking and also in bakery products. Water is determinant during gluten formation and influences the dough rheology. Other processes imply the presence of water. The main roles of water in bakery production imply conservation and shelf life of products. Bakery products have a various amount of water, depending of their specific. The water from bread has a very important role in starch retrogradation and retards the staling of crumb. Migration of water from the crumb to the crust reduces the crispiness. High water contents are essential to keep the freshness of breadcrumb.

Aims and Objectives. We wanted to analyze the water content of different bakery products and their water activity and find if some correlation could be established between these data.

Materials and Methods. The water content of product was measured by indirect method through drying at 100°C until constant weight, the water activity was measured with a Novasina LabMaster apparatus, at 25°C, 4 min stability for temperature and 3 minute stability for water activity. Gingerbread recipes are presented in the table 1.

Results and Discussions. The common breads analyzed had water content that lay between 44 and 46% while the water content of biscuits lay between 4.8 and 6.5%. Other bakery product, as gingerbread, made in the lab, had water content between 13.2 and 16.3%. Water content of bakery product isn't it very important if the preservation is the main concern. More relevant is the water activity. The water activity of breads and biscuits analyzed was 0.963 ± 0.001 and 0.409 ± 0.051 . Weak correlation have been observed between the water content and water activity of breads, $R^2 = 0.656$. For biscuits, the linear correlation was stronger, $R^2 = 0.892$.

Tab. 1

Gingerbread recipe and the water content and water activity of final product

Recipe	Wheat flour, (g)	Sodium bicarbonate, (g)	Ammonium bicarbonate, (g)	SAAP, (g)	Salt, (g)	Lecithin, (g)	Glycerin, (g)	Sugar invert syrup, (g)	Caramel, (g)	Sugar, (g)	Sorbitol, (g)	Glucose, (g)	Glucose monohydrate, (g)	Water, (ml)	Water content, %	Water activity
R ₁	250	3.5	1.8	1.8	0.9	28	2.4	153	30	-	14.5	-	-	-	13.8	0.642
R ₂	250	3.5	1.8	1.8	0.9	28	2.4	153	30	98	14.5	-	-	53	10.7	0.532
R ₃	250	3.5	1.8	1.8	0.9	28	2.4	153	30	108	-	-	-	58	13.3	0.624
R ₄	250	3.5	1.8	1.8	0.9	28	2.4	153	30	-	-	131	-	34	14.5	0.655
R ₅	250	3.5	1.8	1.8	0.9	28	2.4	153	30	-	-	-	118	48	16.8	0.677

In *Table 1* are presented also the water content and water activity of gingerbread prepared in lab. The recipes R2 to R5 were tailored to have a double amount of total sugar as gingerbread prepared in recipe 1, with different kinds of sugars, and the same water content. We observed a relation between water content and water activity of samples. Higher water content led to higher water activity. If we analyzed all data the linear regression factor R^2 was 0.8913. The factor suffered minor improvement if the data corresponding to first recipe were eliminated ($R^2=0.9155$). The water activity of gingerbread is very important for their preservation as, usually, no preservatives are added to recipe. Water activity depends strongly to water content but could be influenced through inclusion of different ingredients in recipe.

Conclusion. Weak correlation have been established between the water content and water activity of products, which confirmed that the water activity depend on water content but also the composition of product have a very important impact on water activity (Couvain, 2000). Water activity of breads is very high and it is necessary use different method of preservation to prolong the shelf life. To investigate the full relation between water activity, water content and recipe it is necessary to determine the sorption properties of product (Cervenka, 2008) because the crude samples have different water contents and activities.

Acknowledgments. This work was co-financed from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007-2013, project numbered 76851 "Harmonization of Romanian academic valences to those of European Community

REFERENCES

1. Cauvain, S., Young, L. (2000). Bakery food manufacture and quality: water control and effects, Blackwell Science Ltd.
2. Cervenka L., Rezkova, S., Kralovsky, J. (2008). Moisture adsorption characteristics of gingerbread, a traditional bakery product in Pardubice, Czech Republic. *Journal of Food Engineering*. 84:601–607.