

# Chemical Properties Changes of Barbary Bread during Storage

Mohammad Hojjati<sup>1</sup>, Behzad Nasehi<sup>2</sup>, Hossein Jooyandeh<sup>3</sup>

**Abstract-** The extent of staling of the main flat bread types in Iran (Barbary) were followed during 1, 2, 3 and 4 days storage periods at room temperature. Measurements included loss moisture, total soluble solids, swelling powers, soluble starch. The results show that the chemical methods are suitable for Barbary bread. Measuring swelling power, due to high correlation with sensory analysis ( $r = 0.98$ ), high sensitivity, low cost, and the time which is needed, with respect to other chemical methods is the best.

**Keywords-** Iranian flat bread, Barbary, staling

## I. INTRODUCTION

**B**AKERY products encounter Complex physicochemical changes after cooking that known as staling. Totally, bread staling is the major result of decreasing acceptability trend of bakery products. During this reaction, odor and flavor changes crust losses its tenderness and crumb flexibility decreases, as bread has a firm and dry mouth feel and it need large amount of saliva for swallowing [1]. But we must mention this important point that bread staling don't include the microbial spoilage. Research for bread evaluation and intensity bread staling is one the oldest cereal chemistry branches, as the role of moisture loss evaluated in bread texture changing in 1852. So, determination of loaf bread texture and its changes during storage has been accelerated for 40 years ago up to now that its result has been presentation of various methods such as chemical, mechanical, rheological, enzymatic, electrical and thermal [2], [3]. This research has been performed in order to make comparison among various methods and detection of the best laboratory method and standardizable for determination of staling in main Iranian flat breads.

<sup>1</sup>Mohammad Hojjati, Department of Food Science and Technology, Ramin Agriculture and Natural Resources University, Ahvaz, Iran (Corresponding author's phone: +98 61232243419169039716; fax: +98 6123224351. e-mail: hojjatim@yahoo.com)

<sup>2</sup> Behzad Nasehi, Department of Food Science and Technology, Ramin Agriculture and Natural Resources University, Ahvaz, Iran (e-mail: b\_nasehi@yahoo.com)

<sup>3</sup> Hossein Jooyandeh, Department of Food Science and Technology, Ramin Agriculture and Natural Resources University, Ahvaz, Iran (e-mail: hosjooy@yahoo.com)

## II. MATERIALS & METHODS

Barbary is one of kinds of flat breads that are used widely in many parts of the world such as Iran, Turkey, and some Arab countries. It is produced in a round or oval shape with thickness of 0.5 to 2 cm and up to 100 cm long [4]. Cooking of this bread with special formulate and in certain conditions was performed in Cereal & Bread Research Center. After producing, they were located in environmental conditions for cooling during 5-20 min. Another step was the packaging of breads in Poly ethylene two layer bags and storage in room temperature for 4 days. Then a number of samples were selected randomly and their properties were determined with application of chemical ways in each day.

Chemical evaluations including that comparison of moisture determination methods, Total soluble solids (TSS), soluble starch (SS) and swelling power (SP) of bread crumb. For moisture measurement was used AACC method number (44-16). Swelling power of bread crumb was determined according to the AACC method number (56-20) [5]. Mahmoud and Abou Arab (1989) method was applied to measurement of total soluble solid amount [6]. Morad and D'Appolonia (1980) procedure was used with modifications to determination of crumb bread soluble starch [7]. Statistical evaluation of results was performed with randomized Complete Block and factorial test. Using linear regression statistical method was determined correlation coefficient among the laboratory methods and sensory analysis. Methods sensitivity was determined with Duncan test.

## III. RESULTS & DISCUSSION

In Table I, moisture, total soluble solids, soluble starch, swelling power crumb of Barbary were reflected in natural conditions during 4 days storage. This experiment is applicable only for "Barbary" bread, because in this kind of bread, crust and crumb is separable. As it is shown, the moisture content decreases as storage time increases, and there is a loss moisture content including that 17.7, 13.9 and 7.4 percent in first, second and third day, respectively. In order to explain for this matter, there are two results: first, the moisture is transfers from crumb to crust because crust and crumb have 12 and 24 percent moisture, respectively. So according to the concentration gradient law, water transfers from crumb to crust and after that according to the osmotic pressure gradient evaporates. This transmission continues up to arrival to the humidity balance and since with time storage increase, moisture difference between crumb and crust bread is decreased then the speed of this

transfer decreased. Another reason for moisture decrease it is related to bread texture changes during storage that it is resulted in water position change in bread. The result agreed with others [4]. Fresh bread is a shapeless and elastic gel that it is converted to a firm texture during storage. In this case some water is surrounded in this texture and released from Free State. Of course, the moisture transfer from crumb to crust undoubtedly has more important role in lowering the water content during time storage. Others confirm these results that got in this research [6], [8].

TABLE I. CHEMICAL PROPERTIES CHANGES OF BARBARY BREAD DURING 4 DAYS STORAGE

Day Method	First	Second	Third	Forth
% moisture	45.22	37.21	32.03	29.65
% swelling power	791.3	686.3	596.1	554.7
% Total Soluble Solids	7.4	6.8	6.4	6
% Soluble Starch	5.17	4.25	3.97	3.35

Swelling power content representing crumb ability in absorbing and holding water, it has reverse relationship with time storage, as in second, third and fourth days has been decreasing trend such as 13.3, 13.2 and 7 percent, respectively. The reason of this fact must be searched in bread texture changes. Bread starch is in the form of swollen and amorphous after baking that in term of energy has unstable state. As a result of moisture release from crumb during storage, starch changes to more stable state or crystal form. In other words, starch gradually is obtained with less solubility and less swelling power. On the other hand, during baking a number of cross linkage is formed between starch and gluten. These bonds during storage, because of kinetic energy loss increase and this fact cause's crumb ability for water absorbing gradually decrease. Another researchers obtained similar results [6], [9].

Evaluation of research found in Table 1 shows that total soluble material and soluble starch in crumb decrease during storage. This fact was also predictable because starch crystallization occurs and bonds between starch and gluten increase results in expanding the texture and entrapping the free material. Other studies have reported similar results [1], [6].

#### IV. CONCLUSION

For Introduction of one method or special property which it shows bread stale intensity effectively, we must notice to: trend of changes, correlation with sensory method, method sensitivity, cost of experiment, time of experiment. The goal of this research is introduction of method that it is regular changes, and has good correlation with sensory method and high sensitivity and it needs low

cost and little time for performing.

Final evaluation of chemical methods in staling determination of Barbary bread has been shown; determination of crumb swelling power is popular as an excellent method in comparison with other methods.

#### REFERENCES

- [1] H.A. Alman and R.M. Mahmoud. Comparative Study on the Extent Staling in the Common Types of Bread in Saudi Arabia. *Ecol Food Nutr.*, vol. 31, pp. 115-125, 1993.
- [2] A.E. Baker, W.T. Doerry and K. Kemp. Graphical Presentation of Instron Factor on Crumb Firmness. *Cereal Food World.*, vol. 31, pp. 193-195, 1986.
- [3] C.W. Bice and J.B. Thompson. Studies on Bread Staling. IV. Evaluation of Methods for the Measurement of Change Which Occur During Bread Staling. *Cereal Chem.*, vol. 26, pp. 440-443, 1949.
- [4] M. Majzoubi A. Farahnaky, and Sh. Agah. Properties and Shelf-life of Part-and Full-baked Flat Bread (Barbari) at Ambient and Frozen Storage. *J. Agr. Sci. Tech.*, vol. 13, pp. 1077-1090, 2011.
- [5] Anonymous. Approved methods of American Association of Cereal Chemists. 10<sup>th</sup> ed, Arlington, USA: *American Association of Cereal Chemists* (AACC). 2000.
- [6] R.M. Mahmoud, and A.A. Abou Arab. Comparison of Method to Determine the Extent of Staling in Egyptian – Type Breads. *Food Chem.*, vol. 33, pp. 281- 289, 1989.
- [7] M.M. Morad and B.L. D'Appolonia. Effect of Surfactants and Baking Procedure on Total Water-Solubles and Soluble Starch in Bread Crumb. *Cereal Chem.*, vol. 57, pp. 141-144, 1980.
- [8] A. Xu, O.K. Chung, and J.G. Ponte, Jr. Bread Amylograph studies. I. Effect of Storage Time, Shortening, Flour and Surfactants. *Cereal Chem.*, vol. 69, pp. 495-501, 1992.
- [9] T. Inagaki, P.A. Seib. Firming of bread crumb with cross-linked waxy barley starch substituted for wheat starch. *Cereal Chem.*, vol. 69, pp. 321-325, 1992.

**Dr Mohammad Hojjati**, born in 1975, graduated with BSc and MSc in Food Science and Technology, from Isfahan University of Technology (1996) and Tarbiat Modares University (2001), respectively. He received his PhD degree in Food Biotechnology from University of Tehran in February 2011. He is working in department of food science and technology as faculty member since 2002. He is assistant professor of food science and technology and dean of faculty of animal science and food technology of Ramin Agriculture and Natural Resources University since May 2011. He is working on extraction and functional of plant essential oil and some properties of breads.