

STUDY ON INFLUENCE OF BAKING PARAMETERS ON BREAD QUALITY

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Abstract: For thousands of years the baking process has remained almost unchanged. But, along with the industrial revolution of the 20th century and appearance of big bakeries, the baking process began to change. In the present context, the main goal of this paper was to investigate the impact of different baking methods and processes on the white bread quality. Two types of traditional wood-heated ovens, one of bake stone type and the other of roll type, were used. As modern ovens, a forced induction oven and bread-making machine where heating is done by means of an electrical resistance were used. The influence of different types of baking on more determining parameters was studied: bread growth, volume, losses during baking, density, porosity, elasticity, moisture content. Another aim of this paper is to investigate whether modern baking techniques succeed in providing bakery products with sensorial characteristics close to those of the traditional ones.

Keywords: oven, bread, baking time

Introduction

The bakery industry has gone through a revolution in the last 150 years. Small hand-made bakeries existing in almost every village are giving place to highly technologized bakery industry since it is considered that the bread made this way is more efficient. Productivity has become the key of success this period of time. New baking technologies have been developed to comply better with the new demands of the market. 1. New materials and ingredients were introduced in bread composition while the research made constant and impressing progress in the bread baking process. Continuous improvement of baking technology has led firstly to higher quality products, superior from the nutritional and economical point of view. Bakery products differ from other products by the fact that they are fermented or grown to obtain low density pastry products. Dough fermentation is done by CO₂ produced by yeast fermentation. Dough fermentation takes place only if the gas is caught in a system which remains and extends together with it. Consequently, great part of baking technology is related to the engineering of food structures, by forming proper dough, capable of maintaining the fermenting gases and fixing these structures by heat 1. Baking is the last but most important stage in the bread making process. During this stage a series of physical, chemical and biological changes take place such as: water evaporation, porosity formation, volume expansion, protein denaturation, and starch gelification, crust formation etc.

Temperature is the dominant factor which causes various physico-chemical changes during baking. Optimization of oven functioning is necessary to reduce the energy consumption and improve the quality of products. A common industrial practice is to bake bread in oven at constant temperature to obtain optimum baking. But, the prediction of optimum baking conditions is a difficult task, as the baking mechanism is not completely understood yet. Bread volume is one of the most important bread quality

indices. The literature reports and emphasizes the fact that there is a close dependence between the quality and lifetime of baked products and time and temperature of the baking process. In the next study 1, dough's of different sizes (big or small) were baked at the temperature of 219°C, for different time intervals and using different ovens (conventional oven, with improved convection or hybrids). During baking the temperature inside the dough was registered. Texture, thermal properties and consistency characteristics of the baked product, and baking conditions were looked into.

The goal of this study is to compare the characteristics of bakery products using different heating methods during baking. Three ovens with different heating ways were used to prepare two sizes of bread: 520g and 80 g respectively. The oven temperature was the same for all samples, while the baking time was determined by observing the crust and by calculating the baking time according to the method from 6.

Materials and methods

In view of determining the differences resulting from the application of different heat treatments the dough was repeatedly prepared according to the same recipe: Flour 500 g, Water 375 ml, Yeast 7 g, Salt 10 g, Oil 50 ml, Sugar 31,5 g l by strait method, mention being made about the fact that the baking process took place using the four types of oven described . Ovens used were (figure 1): traditional bake stone oven uses woody fuel, the wood supplying is done through the door the dough is introduced in the oven - SAMPLE 1; traditional oven with roll has as main advantage the reduced consumption of wood and the distribution of heat inside. As heating principle, baking is done in these ovens on the basis of conductive method in the inferior side and convective one in the superior side and lateral sides respectively - SAMPLE 2; electrical forced convection oven, meant to industrial bakeries, made by Helpan Forni Convection ovens are specially made for pre-baked or frozen bread as well as for products meant directly to bake - SAMPLE 3 and Bread making machine made by Heinner (model BM 950) and has a power of 700 W, the heating is done by means of an electrical resistance placed downside the oven, below the tray As heating method, bread making machine uses convection - SAMPLE 4.



a. Baking of bread in bakestone oven.



b. Baking of bread in roll oven.



c. Baking of bread in electrical forced convection oven.



d. Baking of bread in bread making machine.

Fig. 1. Baking of bread in different types of ovens

All the fourth samples of bread were analysed from technological characteristics and from physical-chemical point of view.

Results and discussion

The influence of type of oven on baking time

The baking time registered by the four types of ovens differs significantly (figure 1). Bread making machine required the longest baking time, of 60 de minutes, by 25 minutes longer that the time needed by the electrical forced convection oven which required only 35 minutes. This ascertains the efficiency and quality of this type of ovens and recommends them for producing units where the baking time is an important priority.

As regards traditional ovens, the baking time was of 40 minutes and 50 minutes respectively. Mention must be made about the fact that in the case of traditional ovens, the baking time may vary as against these times depending on the heating degree of the bake stone and of the roll respectively. Also, in the case of these ovens, an optimum baking is based on the experience of the person operating the oven.

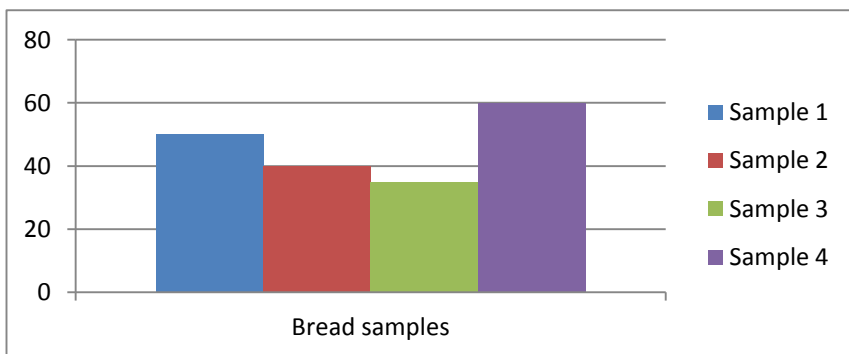


Fig. 2. The influence of type of oven on baking time

The influence of type of oven on technological bread characteristics

As it can be seen from Figure 2, the bread baked in roll has a significantly higher volume as compared with the other bread. This volume is by 12% higher than the volume of the bread baked in bread making machine and by 7% higher than the average volume of the other bread. The minimum volume was registered by the bread baked in the bread making machine. To emphasize the reasons that brought about to these differences of volume, we shall take into consideration only the extreme cases (maximum volume and minimum volume). A possible cause of the significant difference of volume is due to the heating way and to the direction which heat comes from. Thus, in the case of roll, heat is emitted from five directions (upward, downward, backward and sideward). In the case of bread making machine, the heat source (electrical resistance) is placed at the inferior side of the oven, making the temperature lower in the superior side. Another aspect which has significantly influenced the difference of volume is the dimension of ovens as against the size of tray wherein the breads were baked. Thus, in the case of roll, the tray being high, the superior surface of dough was at small distance from the superior wall that is from the heat source. This fact stimulated the dough growth and higher volume implicitly.

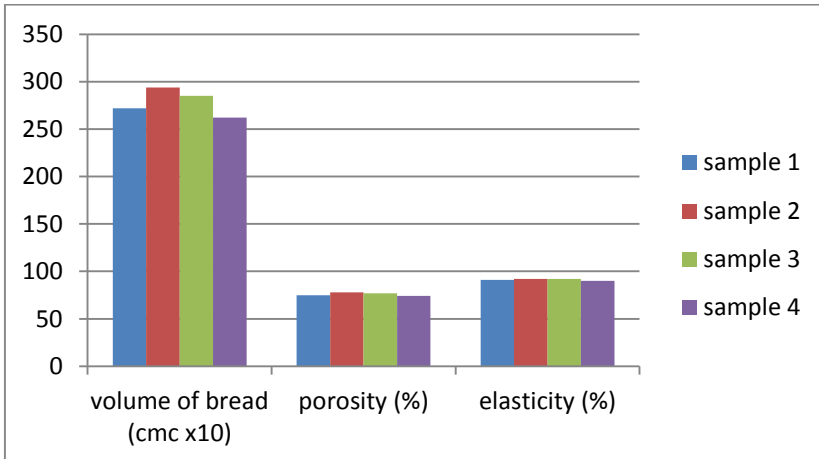


Fig. 3. The influence of type of oven on technological parameters of bread

The data referring to porosity of four breads are shown also in Figure 2. It is noticed that the bread baked in roll has higher porosity, and that baked in bread making machine has the slightest one. These findings are obvious visually too, as it can be seen from the section referring to the porosity of bread crumb. As it can be seen, The data referring to elasticity fall into between 90% – 92%.

Evaluation of losses during baking

It is well known that during baking the dough loses from its weight as a consequence of evaporation of some part of water.

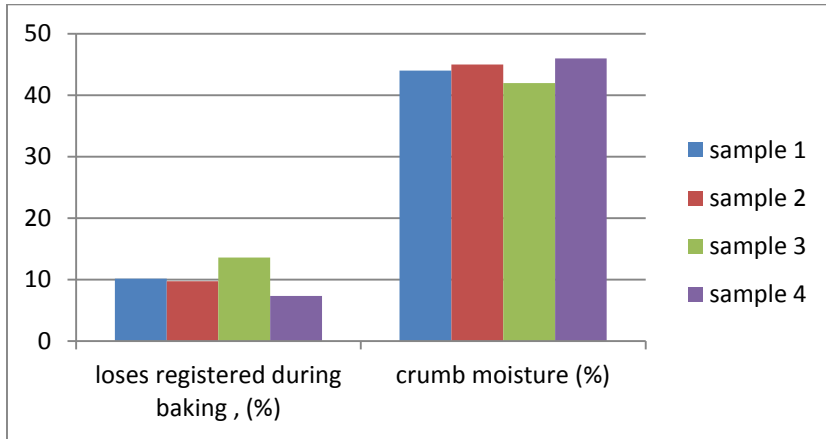


Fig. 4. The relation between losses and moisture crumb

The graphic representation of losses for all four baking methods is shown in Figure 3. It is found out that the bread baked in bread making machine has the highest moisture 46%, whereas the bread baked in the electrical oven has the smallest moisture of 42%. These results confirm the fact that the big weight of bread baked in the bread making machine, reduced weight of bread baked in the electrical oven respectively is due to high moisture, low moisture respectively.

Conclusions

This paper has in view to investigate how different baking methods can influence the quality of white bread. Thus, in the context of a strongly industrialized production of bakery products, we tried to compare traditional baking methods with the present day ones. In this scope, the dough was baked in two types of traditional ovens, bake stone oven and roll one, both being heated by wood. Also, two types of electrical ovens were used as well: an electrical oven with warm air jet and a bread making machine.

The analysis results have shown that there are significant differences of volume, weight, density, porosity, moisture, crumb structure, crust structure but from the organoleptical point of view as well. Thus, the bread baked in electrical forced induction oven has the shortest baking time and also an extremely pleasant exterior aspect, by making this type of baking is very suitable for commercial users. Instead, it registered the greatest losses during baking.

Regarding the bread baked in traditional ovens, this registered average baking times, weight and losses. Also, it is found out that the use of these ovens is much more difficult, involves more effort and requires good knowledge of the oven. Instead, the bread baked in such ovens makes the difference in terms of flavoured taste, having high potential in drawing consumers' attention.

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