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Bread's Shelf Life Enhancement

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Abstract: The objective of this study is to monitor the effect of storing, handling and adding chemical improvers on bread's shelf life, through studying the change on bread's quality parameters (taste, color, odor and texture) with time. Two types of bread (A and B) were baked; one with addition of chemicals (Banda Mixture of Enzyme and Additive) to its original ingredients (flour, yeast, sugar, salt and water) and the other without. Both types were baked at 260 ^{0}C at the bakery of Food Research Center, Khartoum _ Each type of bread was stored using three modes of storage: (1) open plastic bag (2) closed plastic bag (3) paper bag. Hence there were six samples (A1, A2, A3, B1, B2, B3). The samples were evaluated by 9 semi trained tasters for 24 hours at 8 hours' intervals. The test results of the six samples were analyzed statistically using SPSS software version 16.00. The study concluded that the chemically improved bread (sample A) is better than the unimproved one (sample B) as it maintained its taste, color, odor, and texture over time. In terms of shelf life, paper bags provide relatively better quality for short period while plastic bags provide better shelf life for longer period.

Keywords: *Bread Shelf life; paper bag; plastic bag; tasters.*

1. INTRODUCTION

The bread is the oldest and the most popular food all over the world and over 1.8 billion people around the world consume bread every day (Qarooni, 1990, 1996). According to Sudanese Bakeries Union, Khartoum State consumes about 26 million piece of bread daily. The losses due to poor handling and storage account for more than 10%.

During storage, bread is subjected to a number of changes which lead to the loss of its freshness. The factors that govern the rate of freshness loss in bread during storage are mainly divided into two groups: those attributed to microbial attack and chemical.

Or physical changes. The chemical and physical changes lead to the progressive firming up of the crumb, commonly referred to as 'staling'. Consumer's habit is to consume fresh bread. The objective of this work is to investigate the handling and storage methods to improve shelf life.

Several techniques have developed to improve shelf life: Use of chemical additives and enzymes (e.g., emulsifiers, hydrocolloids, and enzyme) (Ribotta et al., 2008); (Bareness and Rosell, 2006 and 2007); (Azizi et al., 2003); (Caballero et al.2007).

1. Optimization of baking process variables (Fravolini et al., 2003) and (Flander et al., 2007)
2. Post bakery handling besides these TECHNIQUES many investigations took special attention on the rheological properties of dough, the structural properties of finished products and shelf life.

A large number of substances of various chemical structures have been used. Some additives are focused on improving dough machinability, like pentosanes and other like hydrocolloids and enzymes (amylases, hemicelluloses, and lipases) that are added in order to extend the freshness of the product during storage.

Moreover, different emulsifiers could be used to improve bread volume, crumb texture and dough rheological proprieties such as dough strengthens and crumb softeners.

2. Material and methods

2.1. Materials

The commercial wheat flour (Sayga Alawal) samples and chemicals were purchased from the local market. The flour composition is shown in the table (1).

Table 1. The Flour Composition

Materials	Quantity
Protein	**12 14%**
Carbohydrates	**60 70%**
Fats	**0.9 1%**
Energy	**334 cal/100gram**

The chemical improver is type "Banda Mixture of Enzyme and Additive". It is manufactured by the company BeyAb Gıda Mühendislik Ürünleri San. Tic. Ltd. Şti.˙ It is composed of Hemicellulose, Fungal alpha Amylase, Pentosanase, Lipases, Glucose Oxidase and Ascorbic Acid E300.

2.2. Methods

2.2.1. Description of project environment

The laboratory work was made at the Food Researches Centre. The average ambient temperature and relative humidity were 32˚C and 56% respectively.

2.2.2. Bread making Procedure

A number of methods of determining baking quality of flours have been developed and standardized throughout the world. In particular, they have been elaborated by the scientific bodies of the ICC "International Association of Cereal Science and Technology", (Vienna, Australia, www.icc.or.at) and AACC international. They are regularly checked and optimized in special study groups. So when making comparisons it is always important to use the latest issues of the collections methods. The ingredients of materials carried used are shown in Table (2).

Table 2. The Ingredients (the flour sample is 3kg**)**

Materials	Quantity (g/kg flour)
Compressed Yeast	16
Salt	8
Sugar	10
Chemical Additives (Banda)	0.1
Water	625 ml/ kg flour

According to ICC, bread was produced by the following procedure:

1) Mixing all ingredients for 10 minutes with cold and moderated water (to make an overall temperature equilibrium which affects the yeast activity positively).
2) Fermenting for 60 min (firstly at 25°C for 15 min, secondly in the fermentation device at 30°C for 45 min at 75–85% relative humidity).
3) Dough dividing (50 g dough loaf weight) and rounding.
4) Baking in furnace at 260°C for 13 minutes.
5) Packing bread samples in closed polyethylene, opened polyethylene and paper bags, stored at room temperature, and evaluated after two hours after packing.

Two kinds of samples were prepared; one with additive (Band improver) and the other without.

2.2.3. Sensory Assessment

Sensory evaluation was conducted on the breads to study possible effects of the methods of storing and handling and adding chemical improvers on the shelf life extension of bread. Sensory evaluation was performed by 9 semi trained tasters (Senior Students at University of Khartoum, Faculty of Agriculture, Department of Food Science and Technology). The overall quality of bread was evaluated using a ranking scale with scores ranging from 1 (least pleasant bad) to 5 (best pleasant – excellent) and the bread samples were analyzed for odor, color, texture and taste.

2.2.4. Statistical Method

The results were reported at four different times during 24 hours with 8 intervals in order to assess significant differences among samples in a base of number of tasters agreeing with an evaluation. The data were analyzed statistically using SPSS software version (16.00).

3. Results and discussions

The details of the results analysis are shown in the appendix. The quality parameters of taste, color, odor and texture were considered according to local tendency. The freshness of all samples has been determined individually at the four periods (6:00 pm, 2:00 am, 10:00 am, 6:00 pm). An accumulation rate was used to ease the data reporting. The data were ranked as 5 for best and 1 for poor. Table (3) shows the results of the samples A1 to A3 and Table (4) for sample B1 to B4. Table (5) shows the results of evaluation after 24 hours i.e. evaluated at 6:00 AM.

Table 3. Evaluation results for samples A1 to A3

Evaluation time	Color	Odor	Taste	Texture
Sample A1				
6:00 PM	2.47	2.53	2.40	2.27
2:00 AM	2.67	2.33	2.20	2.13
10:00AM	2.33	2.27	1.80	1.93
6:00 AM	2.33	2.27	1.53	1.20
Sample A2				
6:00 PM	2.80	2.67	2.80	3.00
2:00 AM	2.73	2.27	2.67	1.93
10:00AM	2.47	2.07	2.00	1.47
6:00 AM	2.33	2.06	1.93	1.46
Sample A3				
6:00 PM	2.87	2.67	2.67	2.53
2:00 AM	2.73	2.67	2.60	2.47
10:00 AM	2.60	2.33	2.40	2.13
6:00 AM	2.47	2.27	2.13	2.00

Table (4): Evaluation of samples B1 to B3

Evaluation time	**Color**	**Odor**	**Taste**	**Texture**
B1				
6:00 PM	2.6	2.33	1.8	1.67
2:00 AM	2.60	2.33	1.8	1.27
10:00AM	2.40	1.67	1.53	1.20
6:00 AM	1.16	1.60	1.40	1.20
B2				
6:00 PM	2.47	2.2	2.00	1.93
2:00 AM	2.4	2.07	1.87	1.47
10:00AM	2.33	2.00	1.60	1.67
6:00 AM	2.06	1.47	1.40	0.67
B3				
6:00 PM	2.47	2.40	2.07	1.07
2:00 AM	2.4	2.26	1.86	1.07
10:00AM	2.4	2.00	1.60	0.80
6:00 AM	2.33	1.87	1.67	0.60

Table (5): The best samples over the whole:

Parameters	**Samples**
Color	A1
Odor	A1 , A2
Taste	A1
Texture	A1

3.1. Bread taste

After the tasters checked the samples, the measured evaluations showed that all samples have a normal taste at the beginnings of the test. Only 3.7% of all of the evaluators in the first period said the samples are bad. (cf. Table 12 in the appendices). The improved samples A1, A2 and A3 had more acceptance than unimproved samples. This is due to the addition of chemical improvers; Banda mixture. It provides a good smell, taste and maintains flavours during the process of bread (cf. Table12).

The paper bag of improved bread (A3); were observed as the best quality samples in the first and second periods of evaluation, then it's quality dropped down attributing to storing circumstances. The paper bag samples were exposed directly to the surrounding environment hence they are exposed to light, loss of moisture, escape of volatile matter etc… Closed plastic bag of improved bread (A1) gives the highest score (cf. Table 12 in the appendices)), as it maintained its taste for a longer period of time.

3.2. Bread color

There was no extreme change on the samples color with time as no microbial damage was observed in 24 hours (24 hours of storage wasn't enough to allow bacteria and molds to grow). According to the scores achieved by the panelists; the color of all of the samples stayed acceptable for a simple Sudanese consumer (only "0.93 %") all the evaluators in all periods said a sample is bad. There was a good convergence between the scores of the closed plastic bag of improved (A1) and opened plastic bags of improved sample (A2) in the beginning of evaluations but eventually at the end of the test period sample A1 was 22.2% superior over A2 (cf. Table 10)).

3.3. Bread odor

Odor is an essential parameter in evaluating bread's quality. The tasters smelled the bread, and according to them "the smell of bread wasn't very bad relative to normal bread "; which were obvious in their evaluations (about 5.06% of the evaluators at all periods evaluated the samples as bad). This is due the fact that the storage period was not long enough for microbial damage (the growth of molds and bacteria) to occur. Leaving the bread to cool to ambient temperature prior to storage makes it dry and hence unfavored to bacterial growth.

A drop in bread's quality with time is generally measured (graded from the fresh samples to staled ones); but the improved samples (A1, A2 and A3) had a better smell than unimproved ones, because of the influence of Banda mixture (cf. Table 11 in the appendices).

3.4. Bread texture

In this study we used the sensory evaluation, instead of evaluating the texture according to the common method (texture analysis) due to lack of laboratory's equipment such as the texture analyser.

Texture analysis is primarily concerned with the evaluation of mechanical characteristics where a material Is subjected to a controlled force from which a deformation curve of its response is generated.

At the beginnings of the evaluation the improved samples (A1, A2 and A3) were acceptable relative to public taste. According to taster's scores, while the unimproved (B1, B2 and B3) samples had a bad texture (48 % of the tasters evaluated the unimproved samples as bad at the first period (cf. Table 13 in the appendices)). At the end of evaluations (at the last period of evaluation), (100%) of our tasters confirmed that the paper package of unimproved bread is bad, while the closed plastic package of improved bread (A1) maintained its texture for the longest time "according to the evaluators (cf. Table 13 in the appendices)".

4. Conclusion

By the end of experimental work, we conclude to:

- the chemically improved bread (sample A) is better than the unimproved one (sample texture over time.
- In terms of shelf life, paper bags provide relatively better quality for short period.

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