IMPACT OF PACKAGING ON BREAD QUALITY AND CONSERVATION

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The experiment observes bread aging and extension of validity term through water and water steam proof packaging and by preservation at a temperature of 15-20° C and relative air humidity in the store house of below 80%.

By preserving the bread under proper conditions and in special packing, PE, PP, PP sterilized, paraffin paper,ethylic alcohol treated paper and complex material, the validity term has been extended to 6 days at most, when the first depreciation signs of sensorial (taste, colour) and physical (consistency-the core becomes brittle), the smooth and rigid crust becomes wrinkled, elastic and soft, the odour and the taste gradually disappear and the taste becomes flat or stuffy and sometimes even sour.

The introduction of ethylic alcohol as well as the packing in proper materials determines the extension of bread validity term to 30 days when the first signs of mould appear.

Key words: *packaging materials, bread conservation , ethylic alcohol*

Bread moulding is caused by numerous moulds, the most frequent of them being from the Aspergillus, Mucor and Penicillium species. The colours of bread moulds go from white to golden and to dark green. The contamination with mould spores happens at the end of the baking process when the spores in the air lay on the bread crust or when the product gets in touch with various spores contaminated objects, such as: conveyor belts, cases, the workers' hands.

The moulding process is favoured by a series of factors: the relative air humidity that determines the hygrometric balance humidity, the most important factor that influences mould development on the bread crust. The storage temperature, the reduction of temperature in the store house extends bread validity until the moulds appear. The mould species that infects the bread. The production hygiene conditions. When packed in plastic bags or cut in loaves, bread can be infected with spores from the knives.

Bread moulding can be prevented by several methods:

- rigorous observance of production hygiene conditions,
- air-conditioning in the store house of finite products (reduction of relative air humidity and of the temperature in the store house),

- increase of bread acidity, respectively lowering of pH level,
- used of anti-fungi agents as preservatives. They can be added to the dough, used for crust white-washing or for packing impregnation.
- used of ethylic alcohol as preservatives.

To use ethylic alcohol agents at the surface of the product is much better than to introduce them in the dough. The operation consists of spraying the crust with a preservatives solution after cooling. [3,4]

MATERIAL AND METHOD

Within the experiments achieved, there were prepared 6 samples of white bread with a weigh of 0.5 kg, using water, flour, yeast and salt. No ingredient was used as preservative or for extending the validity term.

In view to determine the freshness degree and the moment when moulds appear, the bread samples were packed in various materials and stored until the appearance of the first alteration signs.

The samples were packed in PE and PP paper bags, PP 150°C thermo-sterilized paper, paraffin waxed paper, alcohol sprayed paper and a complex material of Paper/PE. The packed bread was stored for a period of 10 days, at a temperature of 18-20°C, a relative air humidity of 65-70% and natural ventilation.

PE is a very resistant material, having good mechanical proprieties, reduced water and water steams permeability (18 g/m^2, 24 h) but rather unfit for gases.

PP has a more reduced water and water steams permeability than PE (8-10 g/m^2, 24 h), presents better resistance to heating as compared to other thermoplastics, a high melting point of 165-170° C and a softening point of 140-150° C.

The paraffin waxed paper is obtained by coating the paper with hydrophobic water and water steam impermeable paraffin; the PE coated paper has good mechanical resistance, chemical inertia and reduced water and water steams permeability (11,8 g/m^2, 24 h). [1,2,7]

In the cases when the bread is stored for longer periods of time than 4 weeks, paper packed products have been sprayed with ethylic alcohol and immediately hermetically packed in polyethylene bags.

The bread packed was introduced in hermetically closed polyethylene bags and stored at a temperature of 18-20°C, relative air humidity of 65-70% and natural ventilation. [5,6,8]

RESULTS AND DISCUSSIONS

For establishing the freshness degree and the validity term, the products were submitted to sensorial and physic-chemical tests: aspect: crust, core, taste, odour, water content, acidity of products.

The organoleptic test for determining the freshness degree is achieved according to the standards (STAS 91-83) and consists of evaluating the organoleptic properties of bakery products by means of senses.

Table 1

Organoleptic characteristics of bread samples by 3 days

Organoleptic characteristics	P1	P2	P3	P4	P5	P6
Shape	Specific to the kind of product, non-flatted, non- deformed and uncrushed. Round, slightly bulging, with no defects, characteristic for the product.					
Crust						
- aspect	Uniform, no cracks, no burning marks, no bubbles.					
- colour	Well baked, golden yellow characteristic for the product.					
Core						
- aspect / section	Smooth, uniform, elastic pore mass.					
- colour	Golden yellow, characteristic for the product.					
- consistency	Elastic, easily coming back to the initial shape after delicate pressure, it does not preserve the finger shape. Dense core, non-detachable from the crust.					
Smell	Pleasant odour of fresh and well baked bread, no strange or rancid smell.					
Taste	Pleasant, characteristic for fresh and well baked bread, no sour or bitter taste, no teeth gnashing due to mineral wastes.					

Table 2

Organoleptic characteristics of bread samples by 10 days

Organoleptic characteristics	P1	P2	P3	P4	P5	P6
Shape	Round, slightly bulging, with no defects, characteristic for the product.					
Crust						
- aspect	The smooth and rigid crust becomes wrinkled, elastic and soft.					
- colour	Characteristic for coloured spotted products, according to mould species.					
Core						
-aspect / section – consistency	Soft, compressing, when stored turns into brittles and becomes less compressing and rigid.					
- colour	Characteristic for coloured spotted products, according to mould species.					
Smell	Strange or rancid smell.					
Taste	The odour and the taste gradually disappear; the taste becomes flat or stuffy and sometimes even sour.					

The first aging signs are evident after 3 days since storing and become stronger with the extension of the storing period.

Bread aging is evident through the following:

1. the smooth and rigid crust becomes wrinkled, elastic and soft.
2. the soft, compressing core turns into brittles and becomes less compressing and rigid when stored.
3. the odour and the taste gradually disappear and the taste becomes flat or stuffy and sometimes even sour.

Humidity is determined in conformity with the standards STAS 91-83 and consists of establishing the mass loss by heating at 130-150 ±2° C.

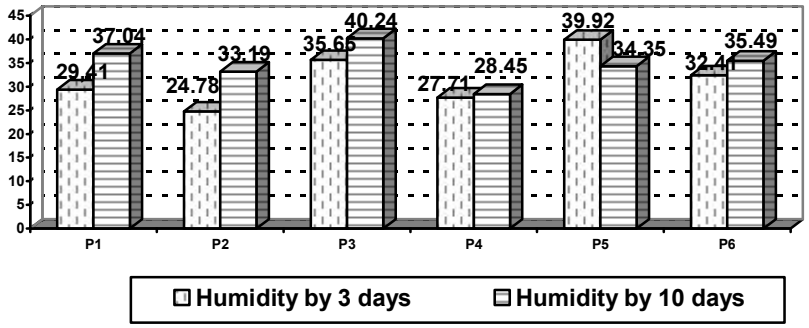

Figure 1 **Graphical representation of bread humidity variation**
P1 = PE, P2 = paraffin paper, P3 = PP, P4 = PP sterilized
P5 = ethylic alcohol treated paper, P6 = complex material

From the analysis of Figure 1, we notice that the PP packed bread has the highest degree of humidity, followed by the PE packed bread, complex materials, alcohol treated paper, paraffin waxed paper and sterilized PP.

The materials having the highest level of water steam permeability produce to the extension of freshness degree the less impermeable materials.

As a consequence of the difference in humidity between the core and the crust, the core humidity moves towards the crust and then towards the environment (the packing, in the present case), by means of external diffusion.

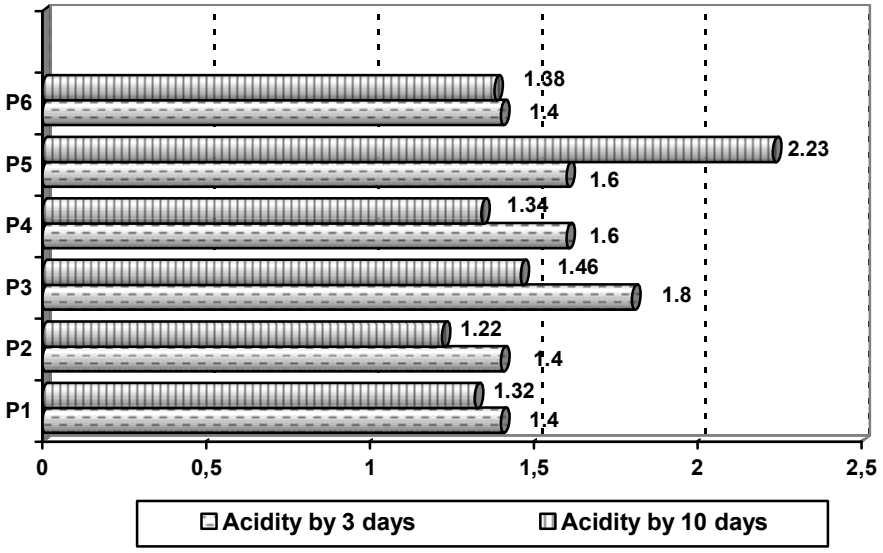

Figure 2 **Graphical representation of bread acidity variation**
P1 = PE, P2 = paraffin paper, P3 = PP, P4 = PP sterilized
P5 = ethylic alcohol treated paper, P6 = complex material

The analysis of the data in Fig.2 shows that the bread packed in alcohol treated paper, in PP, in complex material, in sterilized PP, in PE and in paraffin waxed paper has the highest degree of acidity.

To conclude, we can say that the determined acidity of the samples varies between restricted limits, irrespective of the packaging type.

Based on the results obtained, the following maximum storage periods have been established:

- the bread packed in PE preserves its freshness for a period of 4 days and the mould appears on the 7^{th} day;
- the bread packed in PP preserves its freshness for a period of 5 days and the mould appears on the 6^{th} day;
- the bread packed in complex material preserves its freshness for a period of 6 days and the mould colonies appear on the 7^{th} day;
- the bread packed in paraffin waxed paper preserves its freshness for 2 days.

Although the paraffin waxed paper is a sterile environment that does not allow mould development, it preserves the freshness of bakery products for a short period of time.

At the bread packed in PP sterilized at 150°C, the first mould signs appear after 10 storage days. The sterilization of PP determines the modification of its structure (catena depolymerisation) and implicitly the increase of water steam permeability level, fact that allows water steams to migrate in the exterior. Steam water migration is accompanied by a reduction of the humidity that delays mould appearance.

The best results were obtained by means of ethylic alcohol exterior sterilization of the bread. This packaging modality extents the storage duration by 30 days, as the ethylic alcohol sterilizes the product surfaces and prevents mould appearance, while the polyethylene film preserves its freshness due to its reduced permeability to water steams. The core aging process is very slow and limits to a certain extent the storage duration of the packed products.

CONCLUSIONS

The conservation under proper conditions and the protection by means of impermeable packing lead to a delay in the mould appearance by 10 days and to the extension of freshness degree by maximum 6 days, when the first depreciation signs of sensorial (taste, colour) and physical (consistency-the core becomes brittle), he smooth and rigid crust becomes wrinkled, elastic and soft, the odour and the taste gradually disappear and the taste becomes flat or stuffy and sometimes even sour.

The introduction of the ethylic alcohol and the proper packaging have determined the extension of the product durability by 30 days.

To conclude, the introduction of ethylic alcohol substances together with the packaging in proper materials represent the best means for longer conservation.

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