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A study regarding the slowing of the degradation process of the pastry products by packing them in active atmosphere

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Abstract

In this paper we experimented two package systems: the normal atmosphere packing and the active atmosphere packing in the presence of ethanol generator. As a pastry product we chose the gingerbread. The role of these packagings is to improve the preservation and the microbiological security of the food stuff. In the case of active packing the package atmosphere was changed by placing the ethanol generator bags in the package. As a package material we chose the polypropylene foil which was determined from the point of view of its water vapors and gases permeability the heavy metals global migration and the heavy metals ceding (Cu and Cd). The gingerbread was analyzed from the physico-chemical and microbiological point of view. The conclusions drawn from the experiments regarding the active packing of the gingerbread in the ethanol generator system prologues a lot the shelf life from the microbiological point of view in comparison with the witness sample and the polypropylene foils are from the indicators point of view proper according to the laws regarding the materials that come in contact with the foodstuff.

Keywords: atmosphere packing, foodstuff, microbiological, permeability

1. Introduction

Many foods require special atmospheric conditions for to maintain their quality and freshness during their storage. That is why by increasing the food quantity in a protective atmosphere with a specific gaseous mixture the optimal quality and security of the product is ensured [2]. When we take into account the food package concept we have to consider the entire dynamic interaction between the foods, package material and the environment atmosphere [1].

All the undesired changes that take place during the storage are called aging [3]. The active packaging is defined as a packaging technique that modifies constantly and actively both the permeability properties of the packaging plastic materials and the concentration in the volatile compounds and gases in the free space of the package to which there are added antimicrobial and antioxidant compounds or other flavour and taste enhancing substances for the food products [4]. In this study there are taken into account only two of the diffusion properties of the plastic materials specifically: the gases and water vapors permeability and the migration, phenomena that corresponds to the mass transfer from the package to the food stuff or from the foodstuff to the package.

2. Materials and methods

- the gingerbread fabricated in the laboratory;
- PP bags (polypropylene) of 40μm;
- encapsulated ethanol (Ethicap).

The obtained gingerbread was analyzed after 3 hours of baking and was packed as it follows: in polypropylene (PP) microperforated foil, of 40 μm thick (TM); sample - in microperforated polypropylene foil (PP) of 40 μm thick, in the

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presence of the ethanol generator (10 ml ethanol at 300 g product) (T1).

The storage temperature was of 180C. For the realization of the components global migration tests there were used as extraction environments the following food simulants: simulant A- distilled water; simulant B-acetic acid 3 % (m/v); simulant C: isooctane 10 % (v/v). The migration test conditions in simulant A (distilled water) and simulant B (3% acetic acid) were of 1 hour at 1210C, and for simulant D (isooctane) for 48 hours at room temperature. The ceded mass of substance from the material subdued to testing in the extraction environment, simulant, was gravimetrically determined by the simulant evaporation and residue weighing. The Pb and Cd specific migration determination was realized with the atomic absorption spectrophotometer the toxic metals content (Pb and Cd) being released in an 3% acetic acid solution kept in contact with the surface that comes in contact with the foods during the using. The water vapors permeability tests were led with a Dansensor L80-5000 and the gases permeability determination was done with the Dansensor L100-5000.

3. Results and discussion

The physico-chemical indicators of the gingerbread obtained during the experiments were the following:

Table 1. The physico-chemical indicators for the gingerbread

Type of package	I day			III day			V day			X day		
	Humidity (%)	Acidity (grades)	Peroxide indicator (meq/kg)	Humidity (%)	Acidity (grades)	Peroxide indicator (meq/kg)	Humidity (%)	Acidity (grades)	Peroxide indicator (meq/kg)	Humidity (%)	Acidity (grades)	Peroxide indicator (meq/kg)
T_M	11,8	2,8	3,70	11,8	2,8	3,84	12	2,92	4,21	12,6	3.4	5,9
T_1	-	-	-	12,0	2,8	3,94	12.0	3,0	4,42	12,4	3,6	5,11

Table 2. The microbiological quality indicators of the gingerbread obtained

Type of package	Yeasts and molds, ufc/g			
	I day	III day	V day	X day
T_M	< 10	< 10	Visible mold	-
T_1	< 10	< 10	< 10	Visible mold

Table 3. The evaluation of the results of AAS heavy metals migration

No.	Name / Source	Extraction environment	Extraction conditions/ Extraction ratio	Global migration, ppm	Metals ceding,	
					Pb	Cd
1.	PP microperforated foil bags	Distilled water	10 days, 40 ^oC/	5,25	-	-
		3% acetic acid	10 days, 40 ^oC/	5,5	0,014	<LD
		Isooctane	48h, t.c./ 1:2	7,25	-	-

Table 4. The gases and water vapors permeability

No.	Sample	Gr. µm	Gases permeability (cm^3/m^2/day)				Vapors permeability (g/m^2/day)	
			oxygene (23 ^0C) cm^3/m^2/day	KO_2 cm^3 *µm /cm^2/day	nitrogen (23 ^0C)	CO_2 (23 ^0C)	Water vapors (23 ^0C)	Water vapors (38 ^0C)
1	PP microperforated foil	40	1503,10	$4,34x10^{-3}$	-	-	0,262	1,766

For the witness sample we couldn't observe any major modifications neither for the acidity nor for the peroxide indicator. At the polypropylene packed sample in the presence of ethanol generator the acidity as well as the peroxide indicator presented slightly increasements without influencing the organoleptic properties (only in the X th day a slightly alcohol smell appeared).

At the witness sample the organoleptic properties were kept for the first three days and in the fifth day the visible mold appeared (in the case of the gingerbread packed in polypropylene foil).

At the gingerbread packed in polypropylene samples in the presence of ethanol generator the organoleptic properties were maintained till the ninth day. In the tenth day a modified taste and smell were remarked as well as the presence of mold.

By analyzing the global migration level we saw that all the values are under the limit of 10 mg/dm^2 (of the material surface), imposed by the existent laws (90/128/EEC).

The evaluation of the results of AAS heavy metals migration analysis indicates values that are situated under the detection limit of the device with 1 exception for the Pb that indicates a slightly increasement.

The oxygen permeability values for the PP microperforated foils 40 μm thick, are situated at a similar level the permeability coefficient being comparable with the indicated data base value for polypropylene (KO_2 = 4,66 x 10^{-3} (cm3 /μm/cm2.day), but a bit smaller than this.

The decreased permeability values obtained in the case of PP microperforated foil 40 μm thick corresponds to a good water vapors barrier (< 4,5 g/m^2. day).

4. Conclusions

Taking on account the fact that one of the most important facts regarding the pastry products is the humidity transfer from the product to the environment after baking, it is recommendable for the packing foil used to present an average water vapors permeability value. The global migration tests and the oxygen and water permeability of the polypropylene bags respect the requirements imposed by the MS Order no. 975/ 1998 and the Norms in HG no 1197/ 2002. The active packing interacts with the product by using ethanol vapors generator fact that leads to the increasing of the shelf life of gingerbread and to the maintenance of its quality and preservation.

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