AIR PERMEABILITY OF FOOD PACKAGING PAPERS

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Abstract: Paper and board are the cellulose materials most used in food packaging. Cellulose materials can be used as primary package (direct contact with the foods) or as secondary package (that give mechanical resistance). Food packaging papers are characterised by specialty properties, that are given by fibrous composition, mechanical modification of cellulose fibres (beating), different surface or mass treatments or are obtained by pasting with plastic or metallic foils. These paper grades should provide the barrier for odours, water and greases and can be characterised by different methods, such as: air permeability. In this paper, the research were developed on the variety of food packaging paper grades (paper base for pasting with metallic foils, silicon papers, glassine papers, aluminium foil coated papers, polyethylene coated paper) that were evaluated regarding the grammage, density, thickness, and air permeability using above mentioned methods. Are outlined some aspects regarding the air permeability of coated and uncoated papers, as well as efficiency and reproducibility of analytical used methods. After the analyse of obtained results, was observed that the aluminium foil coated and polyethylene coated papers are the best materials for food packaging, being practically impermeable.
Key words: air permeability, food packaging papers, barrier properties, paper coated.

INTRODUCTION

Paper and board are the cellulose materials that are the most used in food packaging. Therefore, these materials must to posed some specialty and functional properties that assure the barrier to odours, water and greases [1, 2]. To packaging of some products that require the flavour maintenance (coffee, tobacco etc.) it is necessary to use the packaging materials (complex papers), that are air impermeable.

The package is a protective barrier against air, humidity, microorganisms and some radiations from environmental to food and opposite, the diffusion and water, vapours, flavours and fats migration from food to environmental. [3]

The paper properties can be classified as follow: *structural properties* (grammage, thickness, air permeability and air pass strength), *mechanical properties* and as well as some *special characteristics*, such as: capillary absorption (Klemm method), water absorption (Cobb index) and permeability to water vapours [4]. Using the air permeability and Gurley air resistance, can be achieved a classification of papers in terms of air permeability.

Materials and methods

The research has been conducted on several paper grades for food packaging (base paper for metallization, glassine paper, silicone paper, polyethylene and aluminum laminated paper, vacuum metallized paper) which were determinate the grammage, thickness, density and air permeability using above mentioned methods (air permeability and Gurley air resistance).

The apparatus for measuring of air permeability are divided into two groups:

- devices that measure the air volume that pass of the paper sample (10 cm^2) during of settled time and pressure difference (60 sec. and 10 mm Hg) (DL-WEB, Frank, Lhomargy method – SR ISO 5636-2:2001);
- devices that measure the time for passing of settled air volume (10 cm^3) through a paper sample (6,45 cm^2) under the settled pressure (12,4 mm H_2O). (Gurley method SR ISO 5636-5:1996).

Results and discussions

Table 1 summarizes the results obtained after determinations performed on different food packaging papers.

Table 1 The properties of food packaging papers

Paper grade	Grammage, g/m^2	Thickness, mm	Density, g/cm^3	Air permeability	
				Method 1, µm/Pa.s	Method 2, Gurley, sec.
A. Papers					
Base paper for metallization	50,04	0,047	1,06	0,038	3302
Glassine paper	39,05	0,032	1,22	0,054	2324
Coated paper	95,5	0,083	1,15	0,186	682
Silicone paper	69,28	0,060	1,15	0,017	7614
PE laminated paper	58,59	0,082	0,71	0,026	4788
Aluminium laminated paper	69,84	0,072	0,97	0,100	1260
	67,04	0,070	0,96	0,093	1366
	48,36	0,039	1,24	Imp.	Imp.
	43,7	0,037	1,18	Imp.	Imp.
	43,96	0,037	1,19	Imp.	Imp.
Vacuum metallized paper	75,05	0,059	1,27	Imp.	Imp.
B. Films					
Plastic metallized film	28,24	0,031	0,91	Imp.	Imp.
Plastic film for wafers	31,0	0,035	0,89	Imp.	Imp.
C. Complexes					
Coffee complex	158,87	0,152	1,05	Imp.	Imp.
Butter complex	112,52	0,095	1,18	Imp.	Imp.

From these experimental data analyse, the following aspects can be outlined:

- Vacuum metallized papers, those Aluminium laminated papers and complexes are effective impermeable and silicone papers has the high Gurley permeability;
- The air permeability should not be confused with porosity
- A special method for water and greases sealing consists of parchmentizing (obtaining of glassine paper) or sulphonation (obtaining of vegetable parchment);
- The most sophisticated complexes are found without exception in food packaging because they require a preservation period from medium to high;
- As it can be observed from data presented in table 2, the metallized paper has a higher greases impermeability than vegetable parchment paper; these paper grade has a low resistance to water vapours [5,6]

Table 2 The functional characteristics of vegetable parchment paper and vacuum metallized paper

Characteristics	Vegetable parchment paper	Vacuum metallized paper
Grammage, g/m^2	63,7	70,0
Greases impermeability, sec.	1050	Totally

Conclusions

Each type of packaging material or package must to meet certain quality requirements according to protected product against storage and climatic conditions from area that the packaged products are destined.

Papers and vacuum metallized films present an efficient and ecological solution for foods packaging.

The air permeability, measured with Gurley device and method, is proposed as operative and reliable method used to characterization and classification of papers and complexes destined to food packaging.

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