

## The evolution of sensorial characteristics of meat in vacuum packaging

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### Abstract

The evolution of the sensory characteristics is influenced by the preservation technology used in strong connection with the changes of physical, chemical, biochemical and microbiological nature that take place during the processing and preservation of the food product. In our experiments, we compare the sensory characteristics of meat in various conditions of packaging, storage time and temperatures. Comparatively with the meat preserved in classic refrigeration conditions the vacuum packaging presented more advantages regarding the sensory qualities. During the entire storage in refrigerating conditions the vacuum packed meat maintained its faded-pink color, a fresh smell and an acceptable appearance and consistence. In order to evaluate the vacuum storage efficiency it was determined the evolution of the surface microbiological loading before and after the storage, unpacked and vacuum packed.

**Keywords:** sensory characteristics, preservation, meat, storage, vacuum packed, unpacked

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### 1. Introduction

The preservation of food was initially manifested empirically. In time there have appeared and imposed preservation techniques conditioned by the social evolution and the industrial development [1-3]. The preservation techniques of foods developed and mingled the purpose being just one: ensuring the stability of food products for a longer period of time, without affecting their initial quality [8]. The existence of an equilibrium between the internal and external factors determines the optimum conditions that ensure the preservation of products for a longer period of time [9]. Food preservation is in fact a stage in the technical circuit of merchandize (from supplier to beneficiary) that depends on a series of influential factors both internal (agregation state, structure, density, humidity, chemical composition, resistance to the action of the corrosion agents, behaviours regarding acids, basis and oxygen) and

external factors (biological, mechanical, the type of package and nature of manufacture, the storage conditions) [4-7].



**Figure 1.** Pork muscle before slicing

## 2. Materials and method

In the researches we used like raw material pork muscles in a refrigerating state (from 0 to 24 hours after the slaughter). The samples was prepared like in following figure:

Pork muscle – Slicing - Weighting- Vacuum packaging – Storage - Sensory examination



**Figure 2.** Pork muscle vacuum packed

Like packaging materials we used plastic with characteristic shown in table nr.1.

The packing was realized in vacuum at atmospheric pressure, using home type equipment Vacsy System produced by Zepter International. The appreciations of meat quality is done by sensory methods the using of these methods represent an compulsory stage in the sensory quality appreciation of a food product and alones the establishing of the general clear characteristics that differ the fresh products from the one touched by time storing and the underlining of the particular traits of individual or mixed compounds that give the taste and the flavors of a specific food product.

**Table 1.** Characteristic of the plastic package used for the vacuum package

Package	Package traits (at 23 <sup>0</sup> C and 0% U.R.)		
	Permeability at O <sub>2</sub> (cm <sup>3</sup> /m <sup>2</sup> 24 h atm)	Permeability at CO <sub>2</sub> (cm <sup>3</sup> /m <sup>2</sup> 24 h atm)	Permeability at H <sub>2</sub> O vapors (cm <sup>3</sup> /m <sup>2</sup> 24 h atm)
Zepter	< 30	150-200	unspecified

Usually no equipment or instrument can perceive the complex sensation as those perceived by the consumer through his perception organs. Due to the fact that the measure instrument is represented by the human perception organs (with their specificity and physic or variation the sensory methods have a subjective character). The sensory examination consists in the registration of the olfactory (smell) gustative (taste), tactile and optical (appearance, color) sensations, determined in the process of sample examination.

The establishing of the sensory characteristics of meat is done in a certain order being underlined the appearance, the color, the consistency, the smell. For microbiological evaluation it was used the standard methods for isolation, identification and cultivation of lactic, proteolytic and anaerobic bacteria. It were used personality grows media, and the Petri plate were stored in standard conditions of temperature and time.

## 3. Results and Discussion

1. *The sensory qualities* of meat were appreciating taken into account the following characteristics: the color, the flavor (smell and taste), freshness consistence, texture. The evolution of the sensory characteristics is influenced by the preservation technology used in strong connection with the changes of physical, chemical, biochemical and microbiological nature that take place during the processing and preservation of the food product. The intensity of the changes that can be induced by a preservation technology at the level of the sensory characteristics of a product it is considered to be criteria of appreciation of its efficiency. On the other hand, the changes of the sensory characteristics signal both the possible appearance of some defects as well as the reason for the altering of the product. In order to exam the influence of vacuum packaging on meat quality, we compare the samples which were storage unpacked and vacuum packed at 0-40C (table 2).

Comparing the evolution of the sensory characteristics for unpacked and packed meat depending on the storage conditions (0-40C) and storage time we can draw the following conclusions: the vacuum packed meat does not suffer significant color changes during the storage time, unlike the unpacked meat kept in the same storage condition. The color of the unpacked meat gradually transforms negatively along with the growing period of storage time.

The pH maintenance at low values determines a “closed” meat structure as well as the modification of water distribution in the extra and intra cellular spaces so that percentage of light reflected increases and the color of the meat becomes brighter. The smell of vacuum packed meat has a series of particularities due to the microbiological and biochemical modifications that take place during the storage.

The smell profile established after the sensory experiment has the following basic components: the sour/ acid smell and the smell of unfreshness.

The presence of other odors characteristic to the altered meat wasn't noticed.

Generally the smell of vacuum packed meat was appreciated as pleasant, characteristic for a fresh meat.

During the storage, due to the modifications that take place in the proteic system there was also identified the unfresh smell whose intensity was less strong against the unpacked meat.

Comparatively with the unpacked meat the consistency of the vacuum packed samples was stronger. Starting with the 4 th day of storage after finger pressing a finger print remains because the tissue has lost from it flexibility.

**Table 2** The sensory characteristics of meat depending on the storage condition (0- 4°C) and the storage time.

Characteristic	Storage time	Vacuum packed meat	Unpacked meat
<b>Appearance</b>	Initially	At the surface the meat is slightly humid in the section it is slightly humid; at finger pressure it give a sensation of cold without being sticky; the fat is white, pink – white, soft and when touching it gives a grease sensation.	At the surface the meat has a dry covering; in the section it is slightly humid; when pressing with the finger it gives a coldness sensation without being sticky; the fat is white or pink-white colored, soft and when touching it is gives a grease sensation.
	2 days	At the surface it is partially covered by a mucus, the fat has an opaque color; in the section it is slightly humid	At the surface it is partially covered with a mucus in small quantity; the fat has an opaque color and in section is slightly humid
	4 days	At the surface the meat has a humid coverage and also sticky due to the mucus formed; in the section it is slightly humid; the fat is opaque.	At the surface the meat has a humid and sticky cover due to the formed mucus; in the section is slightly humid; the fat has an opaque color
<b>Color</b>	Initially	At the surface there is a normal pink faded color; in the section the characteristic color is pink – red.	At the surface it has a normal pink faded color; in the section the characteristic color is pink-red; the muscle juice is hardly obtained but it is clear.
	2 days	At the surface the color is pink faded in the section the color is opaque pink the muscle juice is not very clear.	At the surface the color is opaque, pink-reddish; in the section it is opaque pink; the muscle juice is not so clear
	4 days	At the surface the color is pink but it can be observed a discoloration against the initial color.	At the surface the color is pink but it can be observed a discoloration against the initial color.
<b>Consistency</b>	Initially	Both compact and flexible at the surface as well as in the section; there are no finger prints left after pressing.	Both compact and flexible at the surface as well as in the section, there are no finger prints left after pressing.
	2 days	The meat is both flexible and soft at the surface as well as in the section; the finger prints left after pressing easily disappear.	The meat is flexible and soft both at the surface as well as in the section; the traits left after finger pressing easily disappear.
	4 days	Diminished consistency; both at the surface as well as in the section the finger prints left after pressing persist longer.	Diminished consistency at the surface and in the section, the traits left after finger pressing persist longer.
<b>Smell</b>	Initially	Pleasant characteristic for fresh meat; after cooking the smell of the meat was appreciated as very pleasant specific for steak in general.	Pleasant, characteristic to the species, after cooking the smell of the meat was appreciated as very pleasant specific for steak in general.
	2 days	The smell is a little bit different from that of the initial meat and it is a little bit sour.	The smell is a little bit different from that of the initial meat it is a little bit sour.
	4 days	At the surface it is perceived a sour/acid smell.	At the surface it is perceived a sour acid smell and a little bit as the one of un fresh meat.

2. The microbiology evaluation was necessary because it seems that exist a connection between the mucus appearance and the presents of typical bacteria for anaerobic conditions of preservation *Pseudomonas*, (*Ps. fluorescens*, *Ps. ambigua*, *Ps.*

*fragi*, *Ps. putrida*), *Aeromonas*, *Micrococcus*. Also it was necessary to determine if exist or no contamination with *Psihrobacter* Initially, the microbiological profile was spited in 35.30% aerobic bacteria and 34.70% lactic bacteria, enter bacteria

and anaerobic bacteria being under detection values. The results obtaining after 2, and 4 days of storage were represented in figure 3 and 4.

In case of vacuum packed meat, it was observed an increase of anaerobic and lactic bacteria correlated with a decrease of aerobic. Meanwhile, on the surface of unpacked meat the microbiological profile remain approximately the same.

Exception made by lactic bacteria which had an accentually decrease. So, it was obvious that in case of vacuum packed meat, the preservation strong effect that in case of unpacked meat was give by lactic acid provides by lactic bacteria with fermentative metabolism. In case of vacuum packed meat, it was observed an increase of anaerobic and lactic bacteria correlated with a decrease of aerobic.

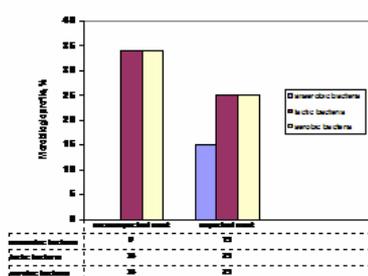


Figure 3. The microbiological profile of meat surface after 2 days of refrigeration storage

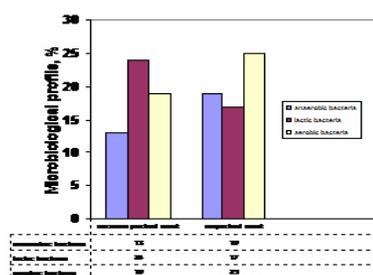


Figure 4. The microbiological profile of meat surface after 4 days of refrigeration storage

Meanwhile, on the surface of unpacked meat the microbiological profile remain approximately the same. Exception made by lactic bacteria which had an accentually decrease. So, it was obvious that in case of vacuum packed meat, the preservation strong effect that in case of unpacked meat was give by lactic acid provides by lactic bacteria with fermentative metabolism.

#### 4. Conclusion

After the experimental studies performed in order to identify the particular traits that the vacuum packaging as a preservation method has, we can draw the following conclusions regarding the evolution of the sensory characteristic as a result of the biochemical processes:

- Immediately after the packaging the meat presented different color traits against the fresh meat the cause of these modifications being probably the reduction of the partial oxygen pressure;
- Comparatively with the meat preserved in classic refrigeration conditions the vacuum packaging presented more advantages from the color maintenance point of view. Also, during the entire storage in refrigerating conditions the vacuum packed meat maintained its faded-pink color being observed a certain degree of surface discoloration against the inner layers of the muscular tissue;
- The smell of vacuum packed meat presents a series of features due to the microbiological and biochemical modifications that take place during the storage;
- From microbiological point of view, in case of vacuum packed meat it was observed a modification of microbiological profile on the meat surface because of O<sub>2</sub> consume and CO<sub>2</sub> accumulation through cellular respiration. The aerobic bacteria were replaced by lactic bacteria. So it could be say that the mucus is the result of biochemical transformation without connection with contaminations germs;
- In case of vacuum packed meat, the preservation strong effect that in case of unpacked meat was give by lactic acid provides by lactic bacteria with fermentative metabolism.

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