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## **INCREASING SHELF LIFE OF SALT-CURED BEEF MEAT USING THE PRACTICE OF MODIFIED ATMOSPHERE PACKAGING – MAP**

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*This paper is analysing the possibility for increasing the shelf life of salt – cured beef meat applying the process of modified atmosphere packaging. For the purpose of this experiment two mixtures of gases have been used: 7 4% O<sub>2</sub>, 6 % N and 20 % CO<sub>2</sub> I 78% O<sub>2</sub>, 5% N I 17% CO<sub>2</sub>. Changes in the microbiological quality (total quantity of bacteria) pH and sensory characteristics have been recorded. The results from the experiment are pointing out that the meat packaging applying the mixture of gases consisted of 74% O<sub>2</sub>, 6% N and 20% CO<sub>2</sub> performed better in terms of microbiological quality and sensory characteristics.*

**Key words:** beef meat, microbiological quality.

*Эта статья анализирует возможность увеличения срока хранения мяса говядины за счет применения упаковки с модифицированной газовой средой. Для реализации целей настоящего эксперимента были*

использованы две смеси газов: 74 % O<sub>2</sub>, 6 % N и 20 % CO<sub>2</sub>; 78 % O<sub>2</sub>, 5% N и 17 % CO<sub>2</sub>. Оценку качества осуществляли по изменению микробиологических показателей (общее количество бактерий), pH и органолептических показателей. Результаты эксперимента показывают, что для мяса упаковка с применением смеси газов, состоящих из 74 % O<sub>2</sub>, 6 % N и 20 % CO<sub>2</sub>, работает лучше в плане микробиологических показателей и органолептических характеристик.

Ключевые слова: мяса говядины, микробиологические показатели.

### Introduction

The technology of fresh meat packaging evolved in the last 20 years especially the modified atmosphere packaging. The practice of modified atmosphere packaging as an alternative technology of vacuum meat packaging used to be applied only on pork and mutton meat but afterwards more and more on beef. MAP basically serves as a vacuum packaging. The difference is that at vacuum packaging inner that inhibits the microbe is developed in the packing itself, whereas at MAP there is an initiation of gasses blend to create the same conditions. If strict conditions for hygiene and temperature exist, sustainability similar to the one with vacuum packaging will be acquired.

Modified atmosphere packaging is applied in the foodstuff industry for more than a century, it became modern form of conservation around the end of the 20<sup>th</sup> century. It is used intensively in Europe (in Denmark widely used from the late 1970s), Canada and USA recently. In ex-SFRJ republics the importance of this kind of packaging became notable in the last 50 years of the century.

MAP may be defined as an elimination of air from the package and its interchange with certain gas or blend of gasses. Using packaging in modified atmosphere the following may be achieved: extension of the product sustainability, obstruction or decrease of biochemical processes (oxidization of fats, the formation of metamioglobine), the increase of bacteria and the level of product respiration, decrease of calla). Numerous literature facts indicate that in the MAP technology several gasses, as are carbon dioxide, nitrogen, oxygen, carbon-monoxide, are used separately or in different combinations (Yam 1999 Sorheim I sar 1997).

In Macedonia the package of fresh and salt-cured meat overruns other meat packing. The objective was to analyze the sustainability of salt-cured pork meat packed in modified atmosphere and conserved at a temperature of +4 °C.

### Materials and methods of work

After the butchering and primary workmanship beef halves are cooled down to a temperature of +4 °C. Boneless beef pieces are separated into two groups, first and second, and are salt-cured using pickle injectors. After this procedure the pieces of meat are stored in polystyrene containers. Afterwards pieces of meat are packed in modified, conserved atmosphere and kept for 9 days at a temperature of +4 °C. The first group was being packed using the following blend of gasses: 74 % O<sub>2</sub>, 6 % N and 20 % CO<sub>2</sub> and the other group used the following percentage of gasses 78 % O<sub>2</sub>, 5 % N and 17 % CO<sub>2</sub>.

pH levels and the temperature of meat pieces was examined the 1<sup>st</sup>, 5<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> day from setting the experiment, the pH level was measured potentiometrically using pH meter EBRO HT-810 with hybrid electrode and built-in sonde-thermometer for simultaneous measure of pH and temperature.

Microbiological status of meat pieces was examined on the 1<sup>st</sup> and 9<sup>th</sup> day after the experiment setting. Sensor analysis was being performed by 5 experienced graders according to the VNIMP method-Moscow. Microbiological examinations are being carried out in compliance with the effective ISO methods. The examinations covered the entire number of bacteria (UBB), E.coli, Salmonella spp., L.monocytogenes, Proteus spp. and clostridium sulfide reductores

### Results and discussion

Results of monitoring changes in pH and temperature are shown in Table 1

**Table 1 – Change of pH and temperature of beef packaged in MAP during storage**

Days	First group		Secound group	
	pH	t °C	pH	t °C
1	5,6	2	5,5	2
5	5,7	3,2	5,8	3,5
7	5,8	4,3	5,8	4,5
9	5,9	4,5	5,9	4,7

The table shows that in both groups of packaged beef from one to nine-day growth of pH and temperature. There are no statistically significant differences between pH and temperature in both groups of products ..

**Table 2 – Microbiological status of pickled beef packaged in MAP**

Days of storage	First group Mikrobioloski status	Secound group Mikrobioloski status
1	0,2 log cfu/cm <sup>2</sup>	0,2 log cfu/cm <sup>2</sup>
9	5,2,5 log cfu/cm <sup>2</sup>	5,4 log cfu/cm <sup>2</sup>

From table number 2 shows that in both groups of cured piece of meat is not a large number of total bacteria. None of the samples cured pork meat enrollment rate in MAP was not revealing the presence of pathogenic bacteria throughout the experiment (*E. coli*, *saSalmonella* spp., *L. monocytogenes*, sulfitereduction clostridia).

Results of sensory analysis are given in Table 3.

**Table 3 – Sensory evaluation of cured beef meat packed in MAP**

Days of storage	First group	Secound group
Color	7	5
Smell	7	5
Discharge	6	4
Medium value	6,66	4,66

The table shows that a better sensory evaluation were given pieces of cured meat in the first group in all three parameters studied sensory properties.

The second group was somewhat lower grades in contrast to the first group in all three parameters studied sensory properties.

Hopke and Weber (1980) reported that beef is hygienically produced from the initial pile of 103 seeds per 1 g. Packed in atmosphere CO<sub>2</sub> and O<sub>2</sub>, has a much greater storage (less loss of juice, and the subsequent appearance of gray at the surface) of the commercially packaged meat preserved under the same conditions of cooling. Greater sustainability of meat in an atmosphere of CO<sub>2</sub> and O<sub>2</sub>, the authors explain braking gram – negative plants with a mixture of gases. The results we obtained are in agreement with (Brod 1999; Sorheim et al. 2000; Eusttace 2001; Becman et al. 2006; Capita et al. 2006).

### Conclusion

From the results that we obtained can be concluded in good production conditions (cold chain / skladisternje) and constant control of hygiene and the application (GHP / GMP) in the whole process of productions give very good results in extended viability and organoleptic properties of such a packed cured pieces beef

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