SOME CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF MODIFIED ATMOSPHERE VACUUM - PACKAGED BEEF MEAT

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ABSTRACT

Fresh beef was stored in mixtures of carbon dioxide and oxygen, as well as one control - traditional packaging with film overwrap. Measurements were made of gas exchanges, color of the meat and some chemical and microbiological characteristics of different beef muscle parts during cold storage for 2, 7 and 14 days. Results indicated that low-oxygen carbon monoxide gas flush had a stabilizing effect for preventing the development of surface discoloration. Data from these studies indicate that MAP suppresses pathogen growth compared with controls . Meat packed in 60% O_2 and 40% CO_2 remained attractive for at least a week at + 4°C.

Key words: *beef, meet, microbiological, cold storage, modified atmosphere vacuum*

Introduction

Fresh meat packaging technology has evolved in the past 20 years and so, especially meat packaged in modified atmosphere – MAP.

Packaging in modified atmosphere (MAP) is a co alternative technology for vacuum packaged meat which was used only for pork and lamb in the beginning and more often for beef, later on. Basically MAP works like vacuumed packaging, the difference is that with vacuumed packaging internal milieu which inhibits microbes happens in the packaging itself, while with MAP the mixture of gasses initiates the same circumstances. If strict conditions of hygiene and temperature are been followed than a level of sustainability similar to the vacuumed packaging will be achieved.

MAP is being used in food industry for more than a century and it has become a popular way of conservation in the end of the 20th century. Its being intensively used in Europe (in Denmark since the late 1970es), Canada and USA, in former Yugoslavia the significance of this method of packaging is noticed in the 50es of the last century *(Savic 1950,* 1961, Otenhajmer, 1977).

MAP can be defined as air been removed out of the packaging and replaced wit a certain gass or a mixture of gasses. With modified atmosphere packaging we can achieve extension of the „best before" date, prevention or slowdown of biochemical reactions (oxidation of fats, forming metmioglobina), bacteria growth, failiure and degree of respiration of the product). Literature facts show that with MAP technology several gasses like carbondionoxyde, nitrogen, oxygen, carbonmonoxyde, are used separately or in different combinations (Yam 1999 Sorheim and sar 1997).

In the Republic of Macedonia fresh and cured meat packaging overtakes other meat packagings. The goal of this work was to examine the sustainability of cured pork meat packaged in modified atmosphere and maintained at a temperature of +4 ºC.

Materials and methods

After primal treatment of meat according to veterinary-sanitary conditions meet is collected in freezers on temperature from 0 to +4 °C. After cooling samples are collected for evaluation of chemical characteristics of the meat. Water holding capacity was analyzed by method by Pohja and Niinivaara (1957).

pH_{24} measurements were done 24 h after slaughter with a pH-meter (Lu-Co) in a water extract (distilled water), with a 1:1 meat to water ratio, after 1 h of extraction. Lipids are determined by standard method which is based on their extraction with organic solvent in Sokslet system, proteins by classical macro Kjeldal method, ash content determined after mineralization in muffle oven on 550-650 ºC and dry content until the constant weight in the oven on 105 ºC, AOAC (2003).

Results and discussion

In both groups of packaged beef from the first to the 14th day ph and temperature grow. There are no statistically significant differences between pH and temperature in both groups of products. Average temperature on day 2 in all groups is 2C and 14 day 4.5 S.pH 2 day averaged 5.5 and 14 day 5.9

Tab.1 Change of chemical composition of beef meat

Meat category	Days after slaughtering	Water	Fat	Proteins	Mineral matter
Beef round	2	7400±0,012	1,40±0,028	21,20±0,015	1,32 ±0,025
	7	73,52±0,012	1,32±0,08	22,10±0,012	1,35±0,018
	14	71,18±0,010	1,28±0,012	22,28±0,011	1,40±0,018
Beef chuck	2	73,020±0,012	1,35±0,012	20,82±0,010	1,28±0,025
	7	72,88±0,014	1,32±0,018	21,22±0,052	1,35±0,018
	14	71,50±0,018	1,30±0,022	22,50±0,058	1,48±0,022
Beef neck	2	73,020±0,012	1,37±0,012	20,020±0,018	1,22±0,015
	7	72,58±0,018	1,35±0,012	20,52±0,014	1,37±0,010
	14	70,52±0,022	1,32±0,008	21,58±0,005	1,47±0,002

Tab.2 Microbiological status of pickled beef packaged in MAP

Meet category	**Beef round**		**Beef chuck**		**Beef neck**	
Days after slaughtering	Total no. of colonies (log cfu/cm²)	enterobacteria (log cfu/cm²)	Total no. of colonies (log cfu/cm²)	enterobacteria (log cfu/cm²)	Total no. of colonies (log cfu/cm²)	enterobacteria (log cfu/cm²)
2	0,3	0	0,7	0	0,4	0
7	4,9	2,1	4,5	2,1	88,5	16,5
14	42,2	11,6	78,9	15	88,5	16,5

From Table 1 it can be seen that in all tested samples of meat while keeping water and fat content decreases and the content of protein and minerals increases

Table number 2 shows that in all groups of cured pieces of meat there is not a large number of bacteria. None of the samples of beef meat packaged in MAP was not revealing the presence of pathogenic bacteria throughout the experiment (E. Coli, salmonela spp, L. Monocytogenes, sulfitereduction clostridia).

Conclusions

Low-oxygen carbon monoxide gas flush had a stabilizing effect for preventing the development of surface discoloration Risk of CO toxicity from the packaging process or from consumption of CO treated meats is negligible.

Red color can be maintained in low-CO treated meats that have spoiled, emphasizing the need for adherence to label instructions for product shelf life and the use of odor and overall appearance as spoilage indicators.

This MAP method (high-oxygen and low-CO) is inhibitory to growth of spoilage and pathogenic bacteria during refrigerated storage compared with meats wrapped in PVC.

Due to the residual effect of CO_2 treatment to inhibit bacterial growth even after removal from packaging or when storage temperature is raised fresh meats in MAP containing CO_2 or CO_2 + CO would have less growth of spoilage and pathogenic microorganisms than meats in PVC packaging, if temperature control was temporarily lost during distribution.

Overall, inclusion of CO as a component of MAP systems has both advantages and disadvantages that must be thoroughly considered to develop a packaging technology benefiting both consumers and the meat industry.

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