Carbon Monoxide Packaging for Fresh Pork

A.S. Leaflet R1848

Travis R. Krause, Graduate Assistant, Animal Science,
Joseph G. Sebranek, Professor of Animal Science, and of Food Science and Human Nutrition,
Mark S. Honeyman, Professor of Animal Science.

Summary and Implications

Injected and non-injected pork chops were packaged in aerobic, vacuum and modified atmosphere [with and without carbon monoxide (CO)] packages to evaluate quality and shelf life during refrigerated storage. Color stability and attractiveness was dramatically improved by the carbon monoxide treatment over any other packaging treatment in this study. This effect permits use of high carbon dioxide atmosphere for packaging of fresh meat to achieve improved shelf life for both color and microbial quality.

Introduction

The use of modified atmosphere packaging (MAP) with high levels of carbon dioxide is recognized as a means of improving shelf life of refrigerated fresh meat. However, the amount of carbon dioxide used is limited due to discoloration effects on fresh meat. Carbon monoxide, at low levels of 0.5% or less, offers a means to preserve fresh meat color. Therefore, utilizing carbon monoxide with a high carbon dioxide atmosphere of 70% or more is hypothesized to increase both the color and the microbial quality of fresh meat to achieve an overall greater product shelf life.

Materials and Methods

Fresh pork loins were obtained from a commercial supplier. Twenty loins were injected with a salt/ phosphate/lactate solution and twenty were non-injected. Each group of loins was then sectioned into chops and packaged in aerobic (high oxygen-permeable film), vacuum (high barrier film), MAP with 20% carbon dioxide (80% nitrogen) and MAP with 0.5% carbon monoxide, 70% carbon dioxide and 29.5% nitrogen. All packages were stored at 0-2°C for evaluation of color, sensory quality, purge, rancidity and microbial growth during storage.

Results and Discussion

The color effect of each treatment on product redness is shown in figure 1. The a* values shown are a direct measure of redness and the long term stability of the bright red color produced by carbon monoxide is obvious. The initial redness of the aerobic package followed by color deterioration during refrigerated storage is typical for fresh meat. The low redness values for the vacuum and MAP packages are also typical. Color acceptability differences are also obvious in the sensory panel scores (table 1) where carbon monoxide treatments were scored higher than any of the others. Lipid oxidation was reduced by the carbon monoxide treatment though the differences were relatively small. Purge, however, was not reduced by the MAP-CO treatment. Microbial growth was reduced by the high carbon dioxide treatment for samples that were initially low in microbial counts. Thus, carbon monoxide in MAP offers the opportunity to use high levels of carbon dioxide at the same time with a combined effect of improved color life and improved microbial control for fresh meat products.

Figure 1 – Least squares means for the a* values of non-injected pork chops during storage. OW = overwrapped, Vacuum = vacuum-packaged, MAP = modified-atmosphere of 20% CO_2, 80% N_2, and MAP-CO = modified-atmosphere of 0.5% CO, 70% CO_2, 29.5% N_2 (S.E. = 0.23).

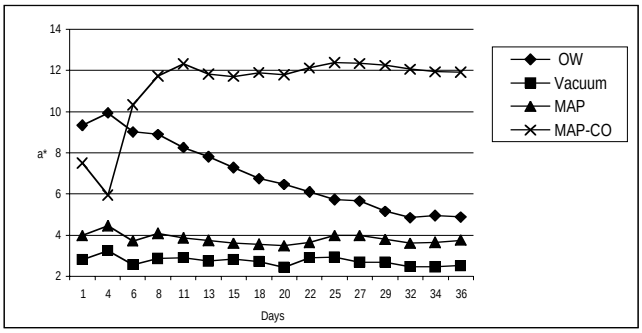

Table 1. The effect of packaging atmosphere on the least squares means for sensory characteristics (100-point scale) of pork chops.

Sensory property	Non-Injected chops				Injected chops				S.E. [a]
	OW	Vacuum	MAP	MAP-CO	OW	Vacuum	MAP	MAP-CO	
Color	62.47[c]	44.52[d]	42.42[d]	85.91[b]	57.70[c]	50.49[cd]	44.64[d]	86.19[b]	2.51
Appearance	62.73[b]	50.17[bc]	46.47[c]	60.12[b]	58.21[b]	55.78[b]	47.21[c]	61.37[b]	2.78
Odor	35.37[b]	34.19[b]	30.28[b]	32.20[b]	42.94[b]	36.68[b]	36.70[b]	32.23[b]	2.85

[a] Standard error of means.
[b-d] Means within the row with different letters, including both injection treatments, are significantly different at $P < 0.05$
Packaging atmospheres: OW = overwrapped; Vacuum = vacuum-packages; MAP = modified-atmosphere of 20% CO_2, 80% N_2; MAP-CO = modified-atmosphere of 0.5% CO, 70% CO_2, 29.5% N_2.

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