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Extension of Pork Sausage Shelf Life Using Modified Atmosphere Packaging

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Summary and Implications

Modified atmosphere packaging (MAP), using 0.4% carbon monoxide(CO) and 99.6% carbon dioxide(CO₂), for fresh pork sausage products can be a useful tool to extend product shelf life. Color retention, reduction in lipid oxidation rates and total microbial loads are positive contributions to an extended shelf life. Pre-rigor pork sausage in MAP resulted in greater shelf life improvement in terms of color retention than post-rigor pork sausage in MAP. The MAP packaging resulted in superior color life for both pre-rigor and post-rigor sausage compared with the control samples in conventional packaging. Increased purge was observed in the MAP packaging in comparison to the control, which was the only negative attribute observed for the MAP treatment.

Introduction

Modified atmosphere packaging (MAP) is becoming popular for food companies in the United States because of the opportunities to extend product shelf life with combinations of safe gases. To utilize this new technology effectively for meat applications, research is needed to determine the safety and quality changes from the use of gas combinations on meat products. Pork sausage is a product that typically has a short shelf life due to lack of color retention, rapid rancidity, and other quality changes. Modified atmosphere packaging has potential to reduce these quality losses and consequently save money. Our hypothesis for this work is that modified atmosphere packaging with a 0.4% CO/ 99.6% CO₂ gas combination will increase pork sausage quality and microbial shelf life to achieve improved long-term acceptability in the market place.

Materials and Methods

The pork sausage was manufactured in the Meat Laboratory at Iowa State using meat provided by the Meat Laboratory (post-rigor meat) or meat supplied by Pine Ridge Farms in Des Moines, IA (pre-rigor meat). One-fourth pound patties were made and placed individually in either MAP bags with gas combination of 0.4% CO and 99.6% CO₂ or placed on foam trays with over-wrapping

(control). Bags and trays were stored at 2-4°C and displayed under fluorescent lights for the duration of the shelf life study. Observation occurred on days 1, 3, 6, 8, 10, 13, 15, 17, 20, 22, 24, 27, 29, and 31 post packaging. The experiment was replicated three times for each type of meat (pre-rigor and post-rigor meat) and all attributes were analyzed with standard statistical methods (SAS, 1999) to determine the level of significance between means.

To determine quality changes in the pork sausage: raw and cooked color were measured with the Hunter L*a*b* Scan, the amount of purge using AOAC method, and the amount of lipid oxidation using the TBA (thiobarbituric acid) procedure.

To determine the amount of microbial growth: total plate counts, anaerobic microorganisms, and psychrotrophic microorganisms were performed using standard microbiology methods.

Results and Discussion

Pre-rigor Pork Sausage

MAP with a 0.4% CO/ 99.6% CO₂ gas combination, in comparison with control packaged pork sausage patties, increased quality shelf life by 14 days for color retention and by 7 days in terms of lipid oxidation. MAP also increased microbial shelf life 10 days due to reduction in total micro-organisms, 5 days from reduction of anaerobic microorganisms and 14 days from reduction in psychrotrophic microorganisms. By day 10 MAP patties resulted in a 2% increase in amount of purge over the control packed patties.

Post-Rigor Sausage

MAP with a 0.4% CO/ 99.6% CO₂ gas combination, in comparison with control packaged pork sausage patties, increased quality shelf life by 10 days for color retention and by 7 days relative to lipid oxidation. MAP also increased microbial shelf life 10 days due to reduction in total micro-organisms, 5 days from reduction of anaerobic microorganisms and 14 days from reduction in psychrotrophic microorganisms. By day 7 MAP patties showed a 2% increase in the amount of purge over the control packed patties.

Table1: Number of Days of Shelf Life Increase accomplished by MAP-CO Packaging in Comparison to Over-wrap Packaged Pork Sausage Patties

| <i>Attribute</i> | <i>Pre-Rigor</i> | <i>Post-Rigor</i> |
|-------------------------------|------------------|-------------------|
| Raw Color | 14 | 10 |
| Lipid Oxidation | 7 | 7 |
| Total Plate Count | 10 | 10 |
| Anaerobic Microorganisms | 5 | 5 |
| Psychrotrophic Microorganisms | 14 | 14 |

Acknowledgements

Pre-rigor meat was supplied by Pine Ridge Farms of Des Moines, IA which is a division of Johnsonville Company.