2019 Reciprocal Meat Conference – Meat and Poultry Quality

Meat and Muscle Biology™

Effect of Temperature on Oxymyoglobin and Metmyoglobin Denaturation Properties

T. S. Belem[1]*, B. Chaudhary[2], S. Mohanty[2], G. Mafi[1], D. VanOverbeke[1], and R. Ramanathan[1]

[1]Animal & Food Sciences, Oklahoma State University, Stillwater, OK, USA
[2]Chemistry, Oklahoma State University, Stillwater, OK, USA
*Corresponding author. Email: tsakomo@okstate.edu (T. S. Belem)

Keywords: cooked meat color, denaturation, myoglobin, premature browning
Meat and Muscle Biology 3(2):57

Objectives

Premature browning is a condition where the interior of patty/steak will appears fully cooked before the temperature necessary to kill foodborne pathogens is reached. Previous research reported that approximately 50% of ground beef retailed in the US is susceptible to premature browning. Myoglobin form present in the interior of steak or patties determines the cooked color appearance. Although previous studies noted that myoglobin denaturation is primarily responsible for the cooked color appearance, limited knowledge is currently available about the effect of temperature on oxymyoglobin and metmyoglobin denaturation properties. The objective of the current study was to determine the effects of myoglobin forms on thermal stability using circular dichroism spectroscopy.

Materials and Methods

Oxymyoglobin and metmyoglobin solutions at pH 5.6 in 50 mM sodium phosphate buffer were incubated in a continuous heat increment water bath for 10 min. At specific temperature points (65, 71, 73, and 76°C), myoglobin denaturation was determined by changes in myoglobin concentration and by protein unfolding (fluorescence and absorbance) methods. The myoglobin thermal stability was also determined by circular dichroism spectroscopy. Changes in secondary protein structure were determined every 2°C from 52 to 92°C. The data were analyzed as completely randomized using the Mixed Procedure of SAS. A significance level of 0.05 was used to determine differences between means.

Results

Oxymyoglobin had greater ($p < 0.05$) unfolding (as indicated by absorbance changes) than metmyoglobin at all temperatures. However, at 65, 71, and 73°C there were no differences ($p > 0.05$) in fluorescence intensities between myoglobin forms. Circular dichroism spectroscopy indicates that oxymyoglobin is more heat labile than metmyoglobin.

Conclusion

The results indicate that oxymyoglobin had greater denaturation and unfolding than metmyoglobin. Use of appropriate myoglobin denaturation quantification technique will help characterize premature browning.