Published February 1, 2019

2017 Reciprocal Meat Conference – Meat and Poultry Processing, Ingredient Technology and Packaging

Meat and Muscle Biology™

Color Changes in High Pressure Processed Ground Beef with Different Nitrosylmyoglobin States and With or Without Added Reducing Compounds

J. Gupta[1], C. G. Bower[2]*, G. A. Cavender[3], and G. A. Sullivan[2]

[1]Department of Food Science and Technology, NE, USA; [2]Department of Animal Science, University of Nebraska-Lincoln, Lincoln, NE, USA; [3]Department of Food Science and Technology, University of Georgia, Athens, GA, USA

Keywords: colorimetry, high pressure processing, raw ground beef
Meat and Muscle Biology 1(3):49–50 **doi:10.221751/rmc2017.046**

Objectives

A major challenge of ground beef processors is the control of *E. coli* O157:H7 and other Shiga toxin producing *E. coli*. High pressure processing (HPP) has emerged as an effective non-thermal pasteurization technique. The use of HPP in raw meat is limited due to color changes. The state of myoglobin and bound ligand can influence myoglobin stability and reducing compounds can improve the color stability of fresh meat. The objective was to determine effects of myoglobin (nitrosyl or nitrosylmet) state and reducing compounds on color stability in HPP treated ground beef.

Materials and Methods

Boneless USDA Select beef top rounds were ground and mixed with cure ingredients, such as, sodium nitrite or celery juice powder and packed under vacuum (VP) or oxygen permeable wrap (OPW) to achieve nitrosylmyoglobin or nitrosylmetmyoglobin. Additionally, reducing compounds (sodium erythorbate or cherry powder) were added to selective treatments.

T1: Sodium nitrite 156 ppm/VP

T2: Sodium nitrite 156 ppm + sodium erythorbate 547 ppm/VP

T3: Celery juice powder (equivalent to 100 ppm nitrite)/VP

T4: Celery juice powder (equivalent to 100 ppm nitrite) + cherry powder (equivalent to 469 ppm ascorbic acid)/VP

T5: Sodium nitrite 156 ppm/OPW

T6: Sodium nitrite 156 ppm + sodium erythorbate 547 ppm/OPW.

After 48 h, T5 and T6 were VP just prior to HPP treatment. To each of the treatments above, patties were subjected to HPP treatments: no HPP treatment, 600 MPa for 3 min, 600 MPa for 6 min, and 450 MPa for 3 min. Patties placed in dark stored at 4°C throughout the study. Color was measured (CIE L*, a*, b*, DE) through the vacuum pouch before HPP and on d 3, 7, 12, 14, 19, and 21 storage after HPP. Three independent replications were manufactured on separate days. Statistical analysis (SAS GLIMMIX; SAS Inst. Inc., Cary, NC) was run to see the main effects of ingredient treatment and HPP treatment and their interactions within each day of storage. Means separation was conducted for significant effects ($P < 0.05$) using the Tukey adjustment.

Results

Regardless of ingredient treatment (T1-T6), HPP had a detrimental effect on the color of the beef patties with all 3 pressure and time combinations. Lightness (L*) increased ($P < 0.001$), a* decreased ($P < 0.001$), b* increased ($P < 0.001$) after HPP. Color change (DE) with respect to non-HPP treated samples was similar for all 3 HPP treatments. The effect remained the same throughout the course of the study. However, the redness after HPP was retained better by samples treated with reducing agents (T2, T4, T6) than those without reducing agents (T1, T3, T5). Both inorganic and natural sources of nitrite and reducing agents (T1 *vs* T3 and T2 *vs* T4) performed similarly to maintain the redness ($P > 0.05$). Nitrosylmetmyoglobin states (T5 and T6) had less change in redness ($P < 0.001$) as compared to nitrosylmyoglobin states (T1 and T2) and this pattern became more profound during storage.

Conclusion

While the addition of nitrite compounds to ground beef did not stabilize color during HPP treatment, reducing compounds may lessen the color change associated with HPP treatment of ground beef.

