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The Effect of Potassium/Sodium Lactate (Pl/Sl), Sodium Erythorbate (Nae), and Sodium Bicarbonate (Sb) on Quality of Aerobically Stored Beef Trimmings

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Objectives

The objective of the study was to investigate various concentrations of solutions that can be applied to aerobically stored beef trimmings as a processing aid to prevent further deterioration of color, lipid, odor and/or microbial growth.

Materials and Methods

Beef trimmings (~15 kg) were fabricated from beef forequarters and aerobically stored (5°C) for 6 d in a plastic container covered with linear low-density polyethylene film (LLDPE; Oxygen Transmission Rate: 5,000 cc/m^2 per 24 h at 25°C and 0% R.H.) to simulate the collection, storage, transportation and receipt of a combo of beef trimmings. A total of 12 treatments (4 solutions × 3 concentration levels) consisting of PL and SL at 0.1, 0.2 and 0.5 M; NaE at 1, 2, and 100 mM; and SB solutions at 0.1, 0.2 and 1.5 M; and a control (water). Concentrations of the solutions were based on previous research. After aerobic storage the beef trimmings (~20% fat) were coarse ground (12 mm) and 9 mL of each treatment and control solution was applied to ~454-g samples. The treated samples were reground (3 mm) placed into Petri dishes and overwrapped with LLDPE film. The patties (2 per treatment/control (13) × 2 storage d; N = 52 per replication) were stored under simulated retail conditions: 5°C under cool white fluorescent light (200 to 300 lux) and analyzed at 0 and 5 d of storage to assess the effectiveness of each treatment solution in preventing further quality deterioration. Objective color (L*, a*, b*; metmyoglobin concentration, MMB), 2-thiobarbituric acid (TBA) determinations, GC–MS identification of volatile compounds for off-odor assessment and aerobic plate counts (APC) were conducted. The results of 2 replications were analyzed using one-way ANOVA and Tukey HSD with a significance level of $P < 0.05$.

Results

No differences were observed for treated and control patties for color, lipid oxidation or microbial analyses on storage d 0. Additionally, no differences were observed between treatments and the control for any volatile off odor compounds (ketones, aldehydes and acids) at 0 and 5 d of storage ($P > 0.05$). Samples treated with varying concentration of PL did not significantly impact any quality factors evaluated ($P > 0.05$). Analyses of SL, SB and NaE treated patties at 5 d of retail storage exhibited differences in color, lipid oxidation and microbial growth ($P < 0.05$). Pattie samples treated with SB (1.5 M) exhibited the highest a* value (13.63) and lowest MMB content (33.92%) compared to other treatments ($P < 0.05$). Samples treated with NaE (100 mM) had the lowest TBA value (0.79) compared to other treatments and control. Samples treated with SL (0.4 M) exhibited the lowest AM and AP counts (8.4 and 7.4 $\log_{10}$ CFU/g, respectively) compared to other treatments and control.

Conclusion

In conclusion, samples treated with the SB (1.5 M), NaE (100 mM), and SL (0.4 M), had the greatest effect on improving color stability, reducing lipid oxidation, and controlling microbial spoilage, respectively at 5 d of retail storage. Results of this study suggest that a solution could be developed as a processing aid using a combination of SB, NaE, and SL to prevent further deterioration of beef trimmings prior to use in the manufacturing of ground beef products.

