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Research Article

Research on the Room Temperature and Vacuum Preservation of Fresh Beef Treated by Multiplicate Methods

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Abstract: After being treated by surface processing, vacuum package and hot water sterilizing respectively, the sample fresh beef was well preserved at normal temperature. The shelf life was up to 27 days. Methods used in the surface processing included Acetic acid and formic acid, ginger juice, lactic acid and maltose coating. Evaluating on the PH value, TVB-N content, the total number of colonies, HS's determination, the experiment showed that the acetic acid and formic acid group is the best one for freshment preservation, the second is the ginger juice group and the third is the lactic acid group and the last is the coating group.

Keywords: Fresh beef preservation, hot water sterilize, normal temperature preservation, vacuum package

INTRODUCTION

The amount of meat has been keeping on increasing since 1978 in China. In 1990, it came to 28,570,000 ton. And in 2014 it increased to 85,400,000 ton. The national gross output of meat has come to 43.89 million tons in the previous half year of 2015, which increased by 2.8%, compared to that of last year. It is expected that the average production will reach 63 kg in 2015 (Han *et al*., 2014). The quick increasing meat production has promoted the development of processing industry greatly. It is inferred that the 40-70% of total amount of meat products is in developed countries, while there is only 2-5% in China. Therefore, enhancing the technology of meat preservation becomes urgent (Zhang *et al*., 2012).

An essential criterion of meat quality is its hygiene status, which is determined decisively by the presence and activity of microbes (Zhang *et al*., 2013). During maturity and storage, flavour and odour substances, as well as biogenic amines may be formed. At present, the common method of storing the fresh meat is using the single way, such as refrigerating, the liquid immersing, drawing the theca, the spirit adjusting and the vacuum package. Among these methods, vacuum package is the simplest and is the most extensively adopted. However, on one hand, the meat packed by vacuum would result in an anaerobic environment, which is just right for the anaerobic microbe to grow (Kim *et al*., 2013). So the pure vacuum-package can't prolong the period of preservation obviously (Wang, 1998). On the other hand, because anaerobic environment would deoxidize beef MYO and hemoglobin, the color of fresh meat would become dark purple which influences the organs seriously (Jung *et al*., 2013). The bright red or cherry red colour in meat is one of the most important quality attributes influencing the consumer's decision to purchase. Such perceived freshness primarily determines the retail shelf life. Extending this period should improve retail saleability.

In order to prolong the period of preservation, the meat prevented with acetic acid and formic acid, ginger juice, lactic acid and maltose coating respectively and combining vacuum package would be used to prevent the microbial incursion, then adopted the short time surface low temperature. By sterilizing, surface handing and vacuum package normal temperature we explored the compound preservation methods (Ali, 2011; Stelzleni *et al*., 2013).

MATERIALS AND METHODS

Experiment material and equipments:

Beef: Meat samples of the throat, from five different animal slaughters of young bulls (20-24 months old) were taken for analysis. And eliminated acid at 0°C in 72 h (supplied by Haoyue Corporation).

Drug: Acetic acid, formic acid, lactic acid, fresh ginger, distilled water, salt, glucose maltose dextrine.

Vacuum package bag (two layer bag, interior layer is LDPD while exterior layer is PVDC).

Fresh meat preserving methods:

Fresh meat surface process: Pre-processing fresh meat with acetic acid, formic acid, lactic acid, fresh ginger, maltose dextrine coating respectively and prolonging the preserving period with vacuum package and short-time surface sterilization at low temperature.

Double-layer package: Double-layer vacuum package method was adopted, the interior layer is LDPE with

Low permeability and the exterior layer is PVDC with high permeability. With this package, the meat was preserved in vacuum environment, so it would not become stale in a relatively long preserving period. The fresh meat's exterior package would be removed. The external oxygen would penetrate through the interior package coating and react with the fresh meat. The meat would turn bright red after absorbing oxygen and be better for sale.

Experiment preparation:

- Confecting the acetic acid aqua 500 mL of which density is 0.6%
- Confecting the formic acid aqua 500 mL of which density is 0.046%
- Confecting the lactic acid aqua 100 mL of which density is 0.2%

Flash ginger was peeled, sliced up, shattered, pressed, filtrated and then centrifugal separated. Taking the pure liquid of upper level confecting 1:10 mixture by the distilled water.

Experiment procedures: Each part was divided into nine pieces of 250 g weight and 3 cm thickness. On the appropriate sampling day, 5 g of core were removed. This plug of meat was a complete cross section of the sample and included both exterior surfaces (Nasri *et al*., 2013; Wang *et al*., 2013)

The meat was cut and divided into several groups. Each group was respectively treated with acetic acid and formic acid in surface with lactic acid and with ginger juice, at last it was vacuum-packed. 40 pieces were conserved in each group. 4 pieces from each group would be analyzed every week.

Confected solution was preserved in a clean atomizer. Sprayed it in the surface of the beef symmetrically. The samples were vacuum-packed on the vacuum-packed machine.

The way that hot water disinfecting: Put the fresh vacuum-packed meat into hot water of 80°C. Took it out after 10-30 min.

Preserving method: Stored at the normal temperature.

Statistical analysis: All statistical tests were performed with the statistical program SPSS 16.0. Oneway Analysis of Variance (ANOVA) was applied with Tukey's posthoc comparisons. The data were expressed as mean±SD in triplicate.

RESULTS AND DISCUSSION

PH detection: Except the controlled the PH of other tested groups were under 6.0 in 18 days. PH of Acetic acid and formic acid group were still under 6.0 after 24 days. While controlled group was 6.28 on the 15th day and was 5.99 on the 12th day. Compared to controlled group, the preserved time of acetic acid, formic acid and ginger juice groups were 9 days longer. The time of the other 2 groups were 6 days longer than controlled groups (Fig. 1).

H2S detection: Controlled group showed dark brown by the acetic acid lead test paper, which means the beef is not fresh. While other groups showed dark brown 18 days later. The acetic acid and formic acid groups showed dark brown 21days later. The tested group was 3-6 days longer than the controlled group (Table 1).

TVB-N content detection: The controlled group became stale after 15 days while the acetic acid and formic acid groups turned stale after about 24 days. The controlled group becomes corrupted after 2 days while acetic acid and formic acid groups turned stale after about 30 day (Fig. 2).

Amounts of bacteria detection: The average amounts of bacteria of both controlled and tested groups were

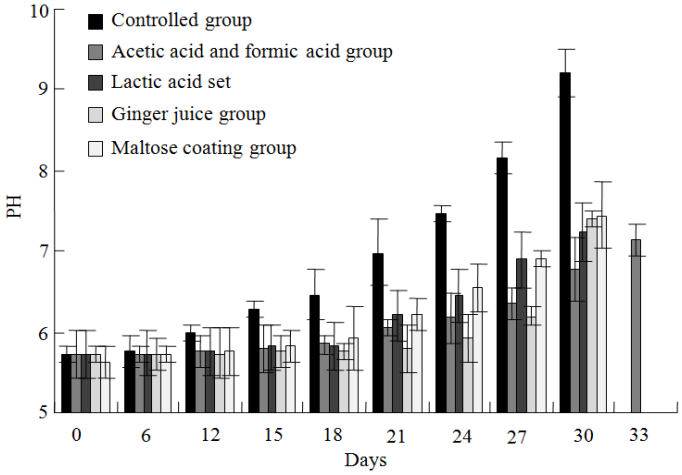

Fig. 1: Influence on the PH of beef with different treatment

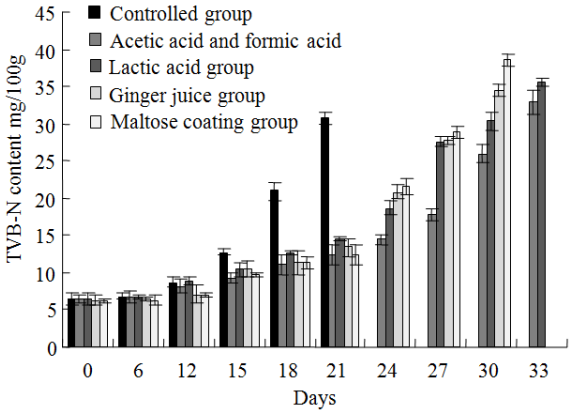

Fig. 2: Influence on the TVB-N content of beef with different treatments flash meat ≤15 mg/100 g; less flash meat15-30 mg/100 g; Corrupted meat ≥30 mg/100 g

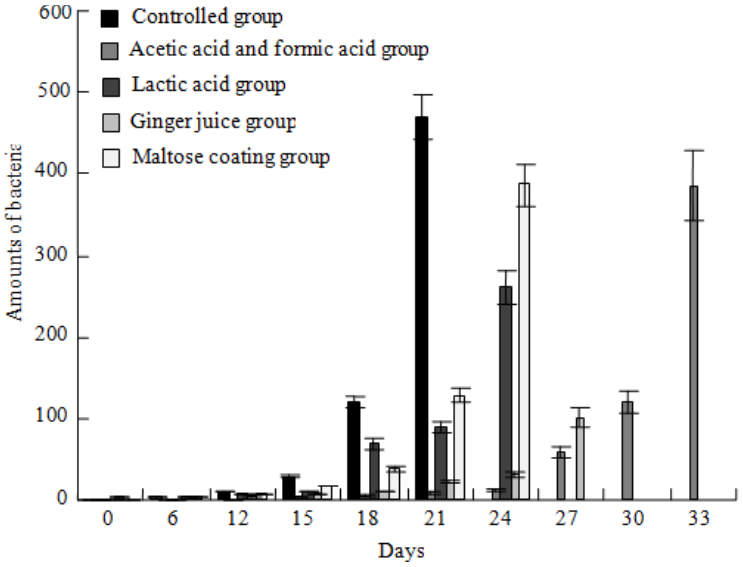

Fig. 3: Influence on the number of colonies with different treatment (flash meat: TNBC ≤106)

Table 1: Influence on the H2S content of beef with different treatments

	Days									
Group	0	6	12	15	18	21	24	27	30	33
Control	A	A	A	A	B	B	C	C	C	C
Acetic acid and formic acid	A	A	A	A	A	A	B	B	C	C
Latic acid	A	A	A	A	A	A	B	C	C	C
Ginger juice	A	A	A	A	A	A	B	C	C	C
Maltose coating	A	A	A	A	A	B	B	C	C	C

A: No change; B: dark brown; C: black

steadily fewer than 106 before the first 15 days. The number of controlled group was above 106 after 18 days. The amount of bacteria of acetic acid and formic acid group and preserving time was above 10^6 about 30 days. Other groups also needed longer time (Fig. 3).

The quality of controlled group is better and longer than those of the controlled group. Different methods have different preserving periods. The results of tests show that acetic acid and formic acid are the best methods for preservation, less better is ginger juice and the last one is coating group.

CONCLUSION

This research has synthesized three kinds of fresh meat preserving methods; surface processing, vacuum packed and hot water sterilization respectively. Then the beef was kept under normal temperature for preservation. The shelf life was 27 days.

The PH value, the content of TVB-N, bacteria amounts and H2S of beef handled with different methods were compared. The longest preserving period without surface processing is 15 days. The average

preserving period with vacuum package and hot water sterilizing is over 18 days and the longest period can reach to 27 days.

The results of tests show that acetic acid and formic acid group is the best one for preservation. The second is ginger juice group and then is lactic acid group. The last third is coating group.

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