SHELF LIFE EXTENSION OF FRESH BEEF BY MODIFIED ATMOSPHERE

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AIM:

Test effects of high oxygen Modified Atmosphere on color of koshered fresh beef in Israel during storage at 0oC and effects of pre-treatment with lactic acid to control bacterial proliferation, on meat color.

MATERIALS AND METHODS:

Meat source: Entire neck of cow, kosher processeded on third day after slaughter.

Storage: 12 days at 0oC in cooler; packaged in glass.

Treatments: 100 g slices of neck meat were placed with sterile forceps into one liter capacity autoclaved canning jars. A modified atmpsphere (MA) of 65% 02+15% C02 was injected into the jars pushing, out excess air. Concentration of the modified atmosphere in the jars was determined using a gas chromatograph. In Control jars the meat slices were stored in air. Two lactic acid (L.A.) treatments, 1.2% and 3% were used as a wash in the L.A. treated meat. The meat slices were soaked15 seconds in the appropriate L.A.solution, then allowed to drain 1 minute in a sterile hood prior to packing.

The meat was stored for 12 days. Color and pH were tested on days shown in table below. Microbiological tests were made at the begining and end of the storage.

Color of the cold stored meat was monitored with a Hunter Color Difference meter. Three readings each were taken on 5 cm diameter areas and averaged.
pH was measured on the same samples tested for color by grinding the meat and diluting with distilled water.
Total bacterial counts and counts for various pathogens were made on 25 cm2 swabbed areas of randomely picked slices of meat in the 4 treatments.
All tests were carried out on triplicate meat slices. Curvilinear regression equations were developed to predict color changes in the koshered fresh beef meat treatments with time of refrigerated storage.

Results and Discussion;

Table 1 shows in all treatments, including controls, there were undulations in color values throughout the storage period. In the L.A. pre-treatments the red color turned brown after 4 days but towards the end of the storage period the red color returned . This was accompanied by increases in pH values from 5.3 to 5.5 for the L.A. 1.2% treatment and from 4.9 to 6 for the L.A.3% pretreatment. Total bacterial counts in the Control and MA stored beef reached 1.7 &1.8 x 107 C.F.U./cm2 respectively at the end of the storage period and 1.6x 105 C.F.U./cm2 for the L.A. treatments.

Table 2 is a model proposed for predicting the color of the meat from the day of storage. This is a combined model of gamma type function and an exponential function. The gamma type function describes the effect of time on color and the exponential part describes the effect of pH levels affecting the color changes.

The suggested model is: $Y(t) = [(A-B)+(B+C*t)*\exp(D*t)]*\exp(E*pH)+ e(t)$

Figure 1 shows the predicted and observed Hunter 'a' values of the control and treatments.
Y(t) is the 'a' value of meat, t is time from storage, pH is the level measured at each color observation, and e(t) is the error term.
A,B,C,D and E are parameters to be estimated.

The model is applicable for each treatment, since color data was collected with days of storage and the levels of pH were determined simultaneously.

The suggested model is non linear in parameters, consequently a non linear regression was used in order to obtain estimates of the model's parameters by treatment.

The results of the non linear regression are judged by the reduction of error sum of squares.

Discussion and CONCLUSIONS:

1. In the lactic acid pre-treatmentst the red meat color turned brown after 4 days storage with the higher L.A.concentration. This could be due to the acidic conditions created by the treatment. Lanari and Zaritsky (1988) reported sorbic acid treatment of fresh meat increased meat discoloration. The koshering process was carried out on the meat after cut up. According to Seideman et al, 1983, salt oxidizes Mb. However red Mb02 color returned after 10 days storage. The development of the red color at that time was not accompanied by increased numbers of bacteria using up oxygen and creating a reducing atmosphere as reported by Saterlee and Hansmeyer (1974) and Seideman et al. (1983).

3. The return of the red color could be explained by the reducing activity of enzymes which remained in the flesh and acted to transform metmyoglobin back to oxymyoglobin. Seideman etal (1983), Hagler et al. (1979) and Faustman and Cssens (1989) reported there is an interaction of myoglobin and surviving enzymatic reducing activity of cytochrome enzymes.

4.The rise in Hunter "a" values color in the L.A. treated meats was accompagnied by rises in pH values to 5.5 and 6. According to Faustman and Cassensm (1989), the reduction of myoglobin in meat is greatest at pH 6.3. According to Livingston et al., 1985, optimum myoglobin cytochrome b5 binding is at pH 6.5. Chen et al, 1990 noted that higher pH results in lower met-myoglobin formation in meat.

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