MANUFACTURING FEASIBILITY FOR CHINESE-STYLE SAUSAGE PREPARED FROM CRYOPROTECTED PRE-RIGOR PORCINE MEAT

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SUMMARY

Feasibility for frozen (-20¢J) cured pre-rigor porcine ground meat for preparation of Chinses-style sausage was evulated. Physicochemical characteristics of pre-rigor meats were stable to frozen storage by taking advantage of the cryostabilization potential from formulation especial in 8% sucrose and 0.5% sodium polyphosphate(STPP), of this product. On the base of the results, pH, TBA vlues, shear force, color and cooking loss, we suggest that pre-rigor porcine meatight be cryoprotected by the formulation of this sausage. Furthermore, Chinese-style sausage prepared from frozen/thawed pre-rigor porcine meat might accomplished by addition of sucrose alone or in comination of STPP before frozen storage.

INTRODUCTION

Chinese-style sausage stemmed from the ancient China and nowaday has constituted the major proportion of all the Chinese-style processed meats that are manufactured and consumed in Taiwan. This product is characterized by high sugar content (4-10%) in the formulation and the processing is achieved by curing ground porcine meat and backfat dices for 3-5 days, followed by stuffing in the porcine casing and drying at medium-high temperature (45-55C°) for 4-6 hours. Therefore, the sweet taste and unique flavor are notably different from the West-style sausage.

As the quality of Chinese-style sausage concerns, the curing condition and the quality of raw meat for preparing this product play the major role to meet the Chinese National Standard (CNS) and Chinese Agriculture Standard (CAS) requirement in Taiwan. To keep market economic and wholesome advantage, product prepared from thawed cured sausage meat after long term frozen storage has been suggested. Freezing or frozen storage may produce profound effects on the physicochemical (Verma *et al*, 1985) and enzymatic properties (Kang *et al*, 1983) of muscle foods which have the potential for significant influencing the functionality and flavor (Brewer *et al*., 1992). Fortunately, the cryoprotective potential derived from the ingredients of Chinese-style sausage may overcome the adverse effects on meat during frozen storage. Similar cryoprotective technology to this product has also been practiced in surimi or surimi-like meat products (Synch *et al*., 1990).

For the purpose of labor and energy cost saving, utilization of pre-rigor meat for meat processing may satisify the issue. In addition, the functional properties such as water-holding capacity (WHC), gelation and texture of meat products improved by pre-rigor meat has been confirmed (Hamm and Grabowska, 1980). However, Chinese-style sausage made from pre-rigor porcine meat is thus of practical interest. The objective of this paper is to evaluate the cryostabilization of Chinese-style sausage formulation to frozen pre-rigor porcine meat and the feasibility for the sausage by using the meat.

MATERIALS AND METHODS

Preparation of samples

Pre-rigor boneless hams were excised from carbon dioxide (CO_2 stununed and freshly salaughtered pork carcasses obtained and prepared at a local commercial slaughterhouse. The meats were trimmed of external fat, connective tissue and coarse ground in 1 h postmortem. To the per kilogram of pre-rigor ground meat, 150 ppm nitrite and 15 g salt were added and was mixed thoroughly. The cured meat was divided into a control (C) and 3 treatments to which 8% sucrose, 0.5% STPP alone or in combination were added, respectively. All

sample were packaged and stored at -20¢Jfor desiged period (0, 3, 6. 9 and 12 weeks) and followed by thawing. The remaining meats are stored overnight at refrigerated temerature and identified as post-rigor meat, then frozen as mentioned.

Preparation of Chinese-style sausage

Before porcine backfat dices (8-10mm) were added, all thawed samples were standardized according to the formulation (80 parts of ground meat, 20 parts of backfat dices, 0.015% nitrite, 1.5% salt, 0.5%STPP, 8% sucrose and 0.25% spice). The remainder procedure for preparation of Chinese-style sausage followed by stuffing, linking (8-10 cm) and drying in a 50-55 C°, 70-75%RH smokehouse for 5 hours.

Determination of physicochemical characteristics of samples and sausage

The pH values and color (Hunter "L, a, b") of samples accomplished by using glass electrode pH meter and spectrocolorimeter, respectively. For measuring shear force , thawed meats were stuffed to a collage casing in a 20 mm diameter x 50 mm length and follwed by drying as mentioned. Determination of shear force accomplished by using a Warner Bratzler shear. The lipid oxidation of sample were determined by 2-thiobarbituric acid (TBA) method. Salt soluble protein of samples extracted with 8% sodium chloride solution and followed by centrifugation at 10000 rpm , 4 C° for 15 min , then determined by using biuret method. Cooking loss of Chinese-style sausage was measured the weight loss after the sausage roasting in a 175C° conventional oven till 72 C° internal temperature was monitored.

RESULTS AND DISCUSSION

pH and color

The pH value of pre-rigor and post-rigor meat before freezing was 6.46 and 5.72, respectively. After addition of nitrite and salt, pH values decreased slightly. Pre-rigor meat mixed with sucrose, STPP or in combination wtih both, the pH values elevated. Similar phenomenon also observed in post-rigor meat treatment and might result from the alkaline phosphate and buffering capacity of STPP. However, pH values of all the pre- rigor samples decreased significantly ($p<0.05$) after 6 weeks' frozen storage. No sigificant difference of pH value was observed among pre- and post-rigor treatments in the following storage as show in Figure 1. The Hunter "L" value (lightness of sample) in post-rigor meat was higher than pre-rigor and increased with storage. Hunter "L" of all samples were stable to freezing and no markedly difference wasw obsevered in Chinese-style sausage, expcet the control. Change in Hunter "a" value (redness of sample) of the sample as show in Figure 2. The Hunter "a" value of pre-rigor meat was higher than of post-riger before freezing. In sucrose and STPP trearments , the Hunter "a" value of meat were more stable than of control. In Chinese-stylea sausage, the Huter "a" value of all treatmets decresed and might be probable to partial heat denaturation of nitrosomyoglobin and browning effect that resulted from soluble meat protein and partial hydrolysis of sucrose. Furthermore, the Hunter "a" value of sausage prepared from pre-rigor meat that cryoprotected by sucrose and/or STPP were significant ($p<0.05$) higher than of post-rigor and control.

Shear force and cook loss

The shear force of model sausage decreased during fozen storage as show in Figure 3. In pre-rigor meat, the forces of STPP treatment were evidently higher than of other treatment. This evidence might be due to cryoprotectant alleviate the extent of denaturation of meat protein (Molins *et al.*, 1987). To the contrary, the shear force of control significantly ($p<0.05$) decrsed with frozen storage and was possible to result from denaturation of meat protein and destoru of meat structure that enhanced by salt and freezing, respectively. The cooking loss of Chinese-style sausage made from control (18.8%) and post-rigor meat (25.2%) were more significantly ($P<0.05$) higher than others.

TBA and Salt soluble Protein

The change of TBA in pre- and post-rigor meat during frozen storage. In control, the value incresed with storage and mainly due to the prooxidative effect of salt on lipid. On the other hand, the cell structure of muscle might be destroyed by grinding, therefore, oxidation of lipid enhanced. Although the oxidation of lipid in STPP

treatment was stable to frozen storage, the neutralization effect of STPP might interfer the results as determined. The content of salt soluble protein of samples decrease with storage as show in Figure 4. Nevertheless, this content of pre-rigor meat cryoprotected by sucrose was maximium among threatments. It is believed that sucrose was potential to increase intermolecular space or volume so as to prevent meat proteins from self aggregation/denaturation during frozen storage. Furthermore, the -COOH and -OH from sucrose might banlance the ionic strength on freezing and stablize the electrolytes in meat system, hence, the degree of unfolding of meat protein decreased on freezing.

CONCLUSION

Cured pre-rigor porcine meat might cryoproteced by adding sucrose and STPP before -20 C° storage. Although the pH value, shear force, Hunter "a" value and salt soluble protein decreased with storage, the physicochemical properties of above were superior to post-rigor and without adding cryoprotectant. The cooking loss and Hunter "a" value of Chinese-style sausage prepared from cryoprotected pre-rigor meat were also better than other treatments. On the base of results, we confirmed that it is feasible to utilize cryoprotected frozen pre-rigor porcine meat for preparation Chinese-style sausage.

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