Studies on the Techniques of non-vacuumized Ham Processing

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ABSTRACT

Some advanced meat vacuum-processing facilities have been imported into China. Since the higher investment and energy consumption, economic benefits of factories had been affected. In order to enhance the rate of finished products and benefits for enterprises, some processing facilities, techniques and ingredients had been improved, and also vacuum facilities had been replaced by general facilities. The structure-resilience, rate of fat loss, moisture, salt soluble proteins and water-holding capacity of hams from vacuum and non-vacuum processing methods were tested, and also structures in and outside hams were tested with sensory scores. It was found that hams from non-vacuum processing with low humidity, low heating and higher-pH curing had no obvious differences in quality scores from those made by vacuum processing($p>0.05$).

Subject Words:
Meat Processing; Meat Quality; Vacuum Processing; Ham.

INTRODUCTION

Ham is a higher grade of snack meats. It has got more and more attention from consumers and meat researchers.Many meat processing factories in China,recently, have imported some food processing facilities, which need more in-vestment and higher energy consumption. Especially, when they were not in order,the income of factories would get some loss. There was littile research about non-vacuumized ham processing, which affected the effective using of general facilities. The aim of the project is to make good use of food processing fecilities by studies on processing methods, ingredients and functions of general facilities, in order to make the quality of hams from non-vacuum processing as equal as those from vacuum processing, and also to get some useful consults for enterprises.

MATERIALS AND METHODS

Meat

About 10 kg of meat (mainly biceps femoris, quadriceps, semimembranosus and semitendinosus muscles) from round portion of adult swine carcass of good finish were obtained within 5 h of slaughter. The meat was chilled at 4℃ for 20 h. After removal of sepable fat and connective tissues, the meat was cut into some 100 g of pieces. Similar meat samples from a single carcass were utilized for each trial of the experiment.

Additives

Laboratory grade soduim chloride (NaCl), tetrasoduim pyrophosphate anhydrous (SPP), soduim tripolyphosphate (STPP) and blends of these phosphates in different proportions were used.

Processing

(1) Non-vacuum trial

Lean meat —100 g pieces→ Curing —ph 6.68, 6℃ / 36h→ Massaging —30 Min non-vacuum→ Mixing —10 Min non-vacuum→

Stuffing → Cooking —82℃ / 2 h, RH 80 %→ Ham (ready-to-eat).

(2) Vacuum trial

Lean meat —100 g pieces→ Curing —pH 5.90, 6℃ / 36 h→ Massaging —30 Min vacuum→ Mixing —10 Min vacuum→

Stuffing → Cooking —105℃ / 2 h, RB 92 %→ Ham (ready-to-eat).

Analytical methods

The pH of the pickle was determined by using reference and glass electrodes (Electro pH meter: model 120).

Moisture and fat content were estimated by CPMI (1987). Salt soluble proteins (SSP) by the methods of Knipe et al. (1985) and water-holding capacity (WHC) was measured according to Arnold (1980) with slight modifications. The finely minced sample (5 g) was accurately weighed into a 25 ml stainless steel centrifuge tube, which was then centrifuged at 4℃ for 30 Min in a MSE coolspin centrifuge at 36,000 rpm.After centrifugation, the exuded liquor was weighed into a previously dried and weighed evaporating basin, which was then placed into a vacuum oven at 65℃. The meat pellet left in the tube was also transferred to another preweighed dish and placed in the oven until constant dry weight. The moisture contents of both pellet and exuded juice were estimated by weight difference. Water-holdint capacity (WHC) was defined as the fraction of the total moisture content remaining after deducting the total exudate loss, expressed as a percentage basis.

For texture measurement, hams chilled at 4℃ for 5 h were cut into rectangular strips of 1 × 4 × 0.2 cm and the texture strength was assessed with an elasticity-meter (Y161). Organoleptic texture determination was based on the numbers of different capsules (containing fat, water or air) on the strips.

Statistical analysis

The data were subjected to analysis of variance and critical differences were calculated to compare the means to establish the treatment effect on various parameters.

RESULTS AND DISCUSSION

The effect of vacuum and non-vacuum processing on ham qualities was mainly on some aspects, such as texture, water-holding capacity and emulsion stability. Results of the experiment are presented from table 1 to 3.

Water-holding capacity

The WHC of hams vacuumized (86.92 %) was a litile higher than that of those non-vacuumized (86.40 %), but the difference was non-significant. This was due to the effect of pyrophosphate in increasing WHC, which was based on (a) an increase in pH and ionic strength and (b) its ability to sequester divalent metal ions, to bind meat proteins and to dissociate actomyosin (Hamm, 1960).

Texture strength

The texture strength of hams vacuumized was a bit higher than that of those non-vacuumized, yet the difference was not significant. This corroborates the findings of Trout et al. (1984), which emphasised that the effect on pH and ionic strength are probably the most important reasons why polyphosphates (PP) improves WHC and meat particle-particle binding.

Emulsion stability

The treatments of vacuum and non-vacuum had no significant ($p > 0.05$) effect on the ham emulsion stability (average fat loss o.15 _ 0.16 %). The less fat loss was due to the increase in pH and in the extractability of SSP by phosphates which interacted during heating to form a strong, heat-set matrix (Siegel et al., 1979) and a fat binding effect which reduced fat separation on heating (Pepper et al. 1975).

Emulsifying capacity

Compared to vacuum processing with low-pH controls, non-vacuum processing with higher pH and low-heating could get same emulsifing capacity. The organoleptic texture qualities on the surfaces of strips of hams were not significant ($p > 0.05$) between the two treatments, due to the stable emulsion which resulted in increasing meat particle binding (Hamm, 1960; Pepper et al. 1975).

Moisture content of hams

Moisture retention was not significantly different between vacuum and non-vacuum treatments ($p>0.05$), due to the higher pH and low-heating in non-vacuum treatment in agreement with the results of Hamm (1960).

CONCLUSIONS

Hams made by non-vacuum processing with low humidity, low heating and higher-pH curing were not significantly ($p>0.05$) different from those made by general vacuum processing. In order to improve the guality of hams, the effects on pH, ionic strength of the pickle and on heating treatment are probably the most important reasons for the stable emulsion of the cooked ham.

TABLE 1

Effect of the Treatments on Physico-chemical Properties of Hams

Treatments	No.	pH	Moisture (%)	WHC (%)	SSP (%)
Non-vacuum					
	1	6.68	63.40	87.50	10.40
	2	6.68	63.67	85.02	10.32
	3	6.68	64.01	86.69	10.47
Vacuum					
	1	5.90	64.11	87.80	10.11
	2	5.90	64.21	85.60	10.07
	3	5.90	64.38	87.35	10.20

TABLE 2

Effect of Treatments on the Emulsion Stability of Hams

Treatments	No.	Fat contents in hams		Fat loss	
		uncooked	cooked	%	$\overline{X}$
Non-vacuum	1	9.08	9.63	0.17	
	2	9.87	9.69	0.18	
	3	10.25	10.11	0.14	0.16
Vacuum	1	9.08	9.66	0.14	
	2	9.87	9.70	0.17	
	3	10.25	10.13	0.12	0.15

TABLE 3

Effect of Treatments on the Organoleptic Texture of Hams

Treatments	No.	Texture strength		Crackles	Capsules	$\overline{X}$
		Gram	$\overline{X}$			
Non-vacuum	1	37.5		0.30	0.30	
	2	36.1		0	0.75	
	3	36.9	36.84	0	0.30	0.45
Vacuum	1	38.3		0	0.30	
	2	35.2		0	0.60	
	3	37.5	37.02	0	0.30	0.40

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