QUALITY PROPERTIES OF GROUND HAM CURED BY ATMOSPHERIC PRESSURE PLASMA TREATMENT

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Abstract – The objective of this study was to investigate the possible use of atmospheric pressure plasma (APP) treatment for an addition of nitrite in meat products. Ground hams were cured with sodium nitrite, pre-converted celery powder, and plasma treatment. The L*, a*, and b* values of ground ham were similar among treatments (P>0.05). Sensory properties of ground ham cured by plasma treatment were similar with those cured with celery powder, and received higher score in terms of taste and overall acceptability than ground ham cured with sodium nitrite. Therefore, the APP can be used as curing process for an addition of nitrite in meat products.

Key Words – Atmospheric pressure plasma, curing, nitrite, ground ham

I. INTRODUCTION

Curing with nitrite is a general step for production of various meat products because nitrite can develop cured color and flavor, reduce lipid oxidation, and inhibit the growth of spoilage and pathogenic microorganisms such as *Clostridium botulinum* in meat products [1]. Two types of curing source, synthetic and natural, have been used in meat product industries. However, the synthetic and natural curing sources have drawbacks of toxicity and allergy, respectively [2, 3]. Recently, atmospheric pressure plasma (APP) was suggested as new curing process [4]. In previous studies, the water treated APP had similar effect with sodium nitrite as nitrite source in emulsion type sausage [5]. In addition, the nitrite content in meat batter was increased when meat batter was directly treated with APP [4]. However, the quality properties of meat products cured by APP has not yet been identified. Therefore, the ground ham is produced with APP treatment as curing process, and the quality properties of ground ham is investigated in this study.

II. MATERIALS AND METHODS

Ground ham was manufactured as follow. Meat batters containing general additives were cured with three different nitrite sources (sodium nitrite, ground ham cured with sodium nitrite; celery powder, ground ham cured with pre-converted celery powder; plasma treatment, ground ham cured by plasma treatment for 30 min). Meat batters were filled in steel can and sealed. Cans were placed inside the retort machine and heated for 45 min ($F_0 \geq 5$). The nitrite content of all treatment was equal (42 mg kg^{-1}). The color and sensory properties of ground ham were evaluated according to the method described by the Jung et al [5].

Data were analyzed using the PROC GLM procedure of SAS software (version 9.3, SAS Institute Inc., Cary, NC, USA) Specific comparisons were performed by Tukey's multiple range at $P < 0.05$ and results are reported as least square mean values and standard error of the least square means (SEM).

III. RESULTS AND DISCUSSION

The nitrite content of meat batter was increased with the increase of APP treatment time (data not shown). The nitrite content of meat batter after APP treatment for 30 and 60 min was 40.42 and 60.50 mg kg^{-1}, respectively. The cured pink color of ground ham developed in all treatment and there was no significant difference of L*, a*, and b* values of ground ham among treatments. Nitrite added to meat product is reduced to nitric oxide which combines in meat pigment, myoglobin to form nitrosilmyoglobin. Nitrosilmyochrome is developed from nitrosilmyoglobin by heat treatment and develops cured pink color in meat products [7]. Sensory properties of ground hams cured by APP treatment were similar

with those of ground hams cured with celery powder. However, the taste and overall acceptability of ground ham cured with sodium nitrite received significantly low score compared with those of ground ham cured with celery powder or plasma treatment.

Table 1 The color of ground hams cured with sodium nitrite, celery powder, and plasma treatment

Treatment	L*	a*	b*
Sodium nitrite	69.37	6.31	12.14
Celery powder	68.98	6.65	12.69
Plasma treatment	69.63	6.67	12.14
SEM[1]	0.295	0.180	0.372

[1]Standard errors of least square mean.

Table 2 Sensory evaluation of ground hams cured with sodium nitrite, celery powder, and plasma treatment

Treatment	Color	Flavor	Taste	Texture	Overall acceptability
Sodium nitrite	4.89	4.16	3.95[b]	5.14	4.31[b]
Celery powder	5.04	5.32	5.01[a]	5.35	5.31[a]
Plasma treatment	4.99	5.37	5.06[a]	5.25	5.26[a]
SEM[1]	0.211	0.270	0.277	0.300	0.267

[a,b]Different letter within the same column differ significantly ($P < 0.05$).
[1]Standard errors of least square mean.

IV. CONCLUSION

The ground ham cured by APP treatment showed similar quality in terms of color and sensory properties compared to the ground ham cured with sodium nitrite and pre-converted celery powder. Therefore, APP treatment can be used as curing process for a replacement to nitrite addition.

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