EFFECT OF CARROT AND RIPE PAPAYA PEELS ON QUALITIES AND RESIDUAL NITRITE OF CHINESE SAUSAGE DURING STORAGE

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Abstract – The objective of this research was to study the effect of carrot and ripe papaya peels (2.5 and 5.0%) on residual nitrite and qualities of Chinese sausage. The results showed that the addition of both carrot and ripe papaya peels significantly decreased the residual nitrite of Chinese sausage during storage. Addition of 5% ripe papaya peel showed the best reduction of residual nitrite during 3 and 7 days of storage (61.8 and 61.1% reduction, respectively). The addition of carrot and ripe papaya peels affected the increase in redness values. Results of sensory qualities showed that added carrot and ripe papaya peels Chinese sausage had lower scores in regard to color, appearance and texture compared with control. Overall results demonstrate that adding carrot and ripe papaya peel is possible to increase safety of Chinese sausage. However, to avoid the negative effect on color and texture, the amount of peels need to control at suitable levels.

Key Words – Chinese sausage, residual nitrite, carrot peel, ripe papaya peel.

I. INTRODUCTION

Nitrite is a key ingredient of cured meat products which provides unique color as well as protects against oxidation rancidity and pathogenic microorganism especially, *Clostridium botulinum* [1]. However, residual nitrite in cured meat products can be reacted with the secondary amines leading to the formation of *N*-Nitrosamines, which are toxic, mutagenic and carcinogenic compounds [2].

Polyphenol are well known for their antioxidant and antimicrobial activities. It has been reported that various polyphenol compounds could reduce nitrite to nitric oxide leading to the reduction of residual nitrite in cured meat products during storage. Formation of *N*-Nitrosamine in meat product is influenced by various factors such as meat type, biogenic amine, pH, temperature and nitrite content. Lowering residual nitrite concentrations in meat products was able to reduce nitrosamine formation and products are considered to be more safe. [3]

Both carrot and ripe papaya peels are the byproduct from food industry. After the processing, the peels are not currently used with any commercial objectives and being discarded as a waste and turning into a source of pollution. Both carrot peel and ripe papaya peel are rich source of natural polyphenolic compound, such as beta-carotene and vitamin B_1, B_2 (in carrot peel) and catechin, chlorogrnic acid and phloricin (in ripe papaya peel) [4].

The objective of this study was to investigate the effects of addition of carrot peel and ripe papaya peel on residual nitrite, color characteristics and quality of Chinese sausage during storage.

II. MATERIALS AND METHODS

Preparation of carrot and ripe papaya peels

Carrot and ripe papaya peels were milled, blanched in boiled water at 95 °C for 5 min and dried at 60 °C, 6 hr. After that dried peels were ground and kept in vacuum bag.

Preparation of Chinese sausage

Chinese sausage samples were made by mixed 1 kg lean tissue and 200g pork back together, and then ground through a 10 mm plate. Mixture was mixed with 2.5 and 5.0% carrot peel and ripe papaya peel and other ingredients (20 g salt, 150 g sugar, 1 g spice powder, 0.25 g sodium nitrite), after that it was stuffed into casings. Control sample was the sample without the addition of any peel. The sausages were dried at 70°C for 24 h. Samples were vacuum-packed in polyethylene bags and kept at room temperature (25 ˚C) for 7 days and

determined for the qualities and residual nitrite at 3 and 7 days of storage.

Residual nitrite content

Residual nitrite contents in Chinese sausage were determined according to AOAC method no. 973.31 (AOAC, 1995) [5].

Color measurement

The samples were removed casing and measured the color by Hunter lab calorimeter to yield *L** (lightness), *a** (redness) and *b** (yellowness) values of sample. A standard plate with X= 79.63, Y= 84.36 and Z= 89.00 was used as reference.

Sensory evaluation

Hedonic scaling test was conducted by 40 untrained panelists according to Utrilla *et al.* [6] with slight modification. Panelists consisted of students and staffs at Kasetsart University. The sensory evaluation was performed using a five-point hedonic scale with label ranging from "like very much (score 5) to "dislike very much (score 0)" were used to assess the degree of liking of the color, appearance and overall acceptability.

III. RESULTS AND DISCUSSION

Residual nitrite

As show in Figure 1, residual nitrite in Chinese sausages with the addition of both carrot peel and ripe papaya peel at concentrations of 2.5% and 5% was significantly decreased compared to control ($p \leq 0.05$). With all treatments, addition of 5% ripe papaya peels showed the highest reduction of residual nitrite during 3 and 7 days of storage. A similar trend was also reported by Wang *et al.* (2015) for cured sausages added plant polyphenols (green tea polyphenol or grape seed extract) significantly decreased residual nitrite during storage [7]. Vauda-Martos *et al.* [8] reported that the nitrite depletion is dependent on many factors, including raw meat type, meat pH, processing, storage temperature and the presence of reductants [2].

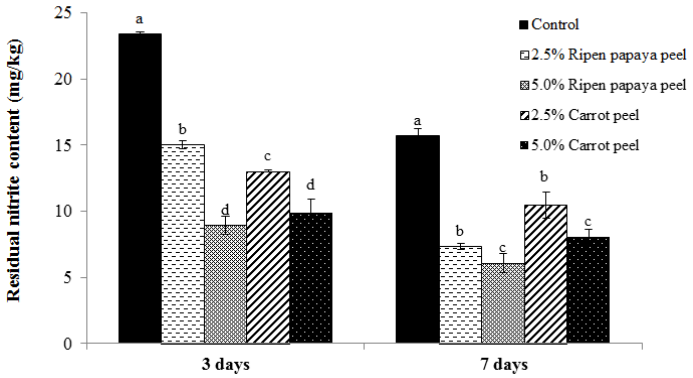

Figure 1. The residual nitrite contents of Chinese sausages with and without the addition of carrot and ripe mango peels (2.5 and 5.0%) during 3 and 7 days of storage

[a-d] Different letters within treatment differ significantly ($p \leq 0.05$).

Color

Appearances of control and Chinese sausages added with carrot and ripe papaya peels are shown in Figure 2. Chinese sausages added with carrot and ripe papaya peels had darker color compared with the control, especially in 5.0% carrot peel added sample.

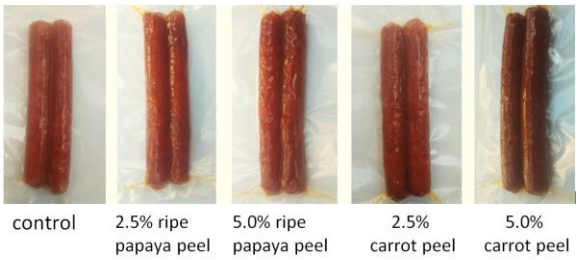

Figure 2. Appearance of control Chinese sausages and Chinese sausages added with carrot and ripe papaya peels (2.5 and 5.0%)

The color values of Chinese sausage added with carrot and ripen papaya peels (2.5 and 5.0%) during storage are shown in Figure 3. The result showed that the lightness and yellowness values of all samples were not significantly different. Redness values of Chinese sausage with the

addition of carrot and ripe papaya peels both 2.5% and 5% were significantly increased ($p \leq 0.05$) compared with control. These are mainly due to the effect of natural orange-red color of carrot peel and ripe papaya peel. Lightness and yellowness of sample in each sample treatment did not change much during storage. However, the redness values in all samples tended to decrease during storage because the cured pigment color, denatured globin nitroso-hemochrome was exposed to light and oxygen, and it became brown as the pigment is oxidized from the ferrous to the ferric form [9].

Sensory quality

Results of the sensory evaluation of Chinese sausage samples are given in Table 2. The acceptance scores in regard to color, appearance and texture of control sample was the highest. Addition carrot and ripe papaya peel at levels 2.5% and 5% caused the significant reduction in acceptance scores of color, appearance and texture ($p \leq 0.05$). The lower color and appearance scores of these samples compared with control samples could be due to their natural orange-red color of carrot and ripe papaya peels. The texture acceptance scores of Chinese sausages with added carrot and ripe papaya peels was also lower than the control. There were some comments from panelists stated that the Chinese sausage samples added with 5% carrot peel were too dense and tough. Our results are agreed with García *et al.* (2002) [10] reported that addition of dietary fiber, such as wheat fiber and oat fiber, to dry-fermented sausages led to increase the hardness which significantly affected the acceptance score.

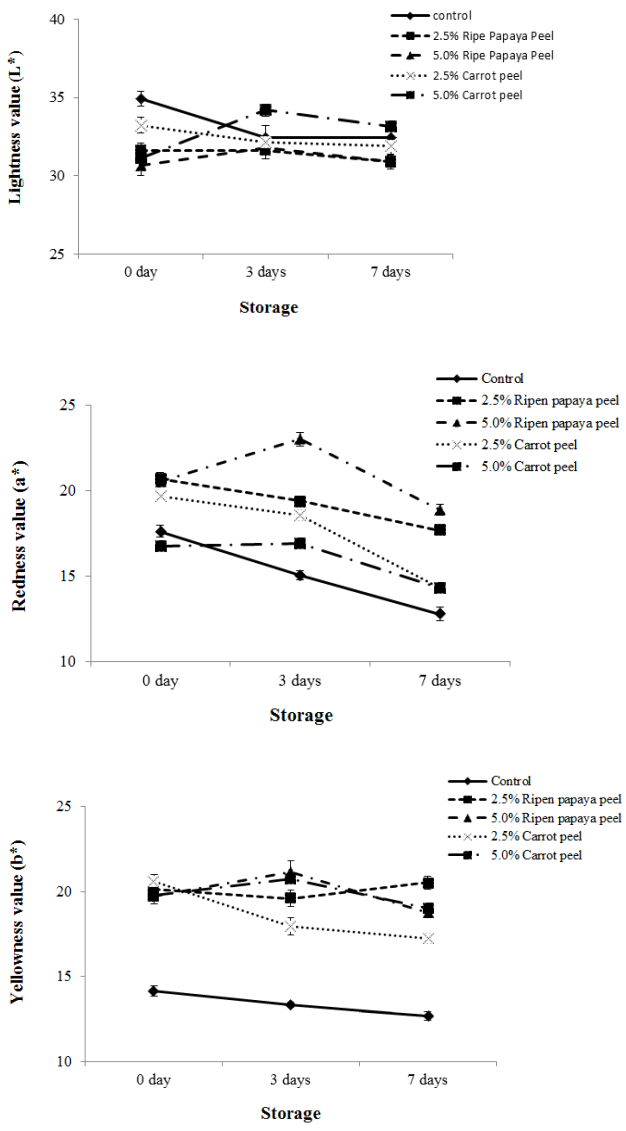

Figure 3. Hunter color values of Chinese Sausage added with carrot and ripe papaya peels (2.5 and 5.0%) during storage

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Table 2 Five-point Hedonic scale (n=40) of color, appearance and overall acceptance of Chinese Sausage added with carrot and ripe papaya peels (2.5 and 5.0%) during storage

Treatment	Sensory parameter			
	Level	Color	Appearance	Texture
Control	-	4.35 ± 0.86 [a]	4.15 ± 0.97 [a]	4.25 ± 0.87 [a]
Ripe papaya peel	2.5	2.2 ± 1.07 [cd]	2.08 ± 0.94 [cd]	2.23 ± 0.97 [cd]
Ripe papaya peel	5.0	2.43 ± 1.06 [c]	2.96 ± 1.06 [c]	2.53 ± 1.06 [c]
Carrot peel	2.5	3.20 ± 1.94 [b]	3.20 ± 0.88 [b]	3.13 ± 0.96 [b]
Carrot peel	5.0	1.88 ± 0.82 [d]	1.65 ± 0.86 [d]	1.73 ± 0.85 [d]

The data is expressed as mean ±standard deviation
a-d: Different letters within a same row differ significantly ($p \leq 0.05$). Scale: 0=disliked very much and 5=like very much

IV. CONCLUSION

The present study showed that addition of carrot and ripen papaya peel are possible means to reduce residual nitrite in Chinese sausage during storage. Therefore, the products are considered to be more safe in regard to the carcinogenic nitrosamine formation. However, these peels were affect the color and quality of Chinese sausage when added at the high amount. Therefore, adding peels at optimum levels are very important to provide high acceptable products.

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