

EFFECT OF *CAESALPINIA SAPPAN* L. EXTRACT ON PHYSICO-CHEMICAL TRAITS OF COOKED PORK SAUSAGE DURING COLD STORAGE

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I. INTRODUCTION

Cooked pork sausages are a widely consumed meat product in many countries. However, chemical composition and processing procedures, such as mincing and cooking, may initiate the oxidation of meat products due to interaction of free acids and oxygen in the presence of heat and metalloproteins [1]. Traditionally, nitrite/nitrate is a well-known preservative using in meat products. Nitrite imparts the red color on curing, inhibits microbial contamination, and exhibits antioxidant properties in meat products [2]. However, increased public concern over the safety of synthetic additives challenges the meat industry to find alternatives from natural sources. *Caesalpinia sappan* L. has been used as traditional Oriental medicines because of its biological activities and phytochemical contents [3]. Therefore, the aim of this study was to investigate the effects of the *C. sappan* L. extract on the quality properties of cooked pork sausages during cold storage.

II. MATERIALS AND METHODS

For each treatment, 2.3 kg of sausages was prepared, and the sausage manufacture was carried out with three replications. The basic recipe consisted of 67.5% pork lean meat, 18% pork backfat, 12.3% iced water, 1.5% salt, 0.2% sodium tripolyphosphate and 0.5% sugar. Five different types of pork sausages were considered: 1) without sodium nitrite or *C. sappan* L. extract (control), 2) added with 0.007% sodium nitrite (T1), 3) added with 0.004% sodium nitrite + 0.05% *C. sappan* L. extract (T2), and 4) added with 0.1% *C. sappan* L. extract (T3). Then sausages were cooked at 90°C for 1 h to an internal temperature of 75.5°C (CHS-76, Alto-Shaam Inc., FL, USA). After cooking, sausages were allowed to cool at 4°C for 2 h, and then packaged using oxygen-permeable bags (polyethylene, Thai Griptech Co. Ltd., Bangkok, Thailand), and stored at 4°C for 30 days. All data were presented as mean \pm standard deviations from three replications. The data were analyzed using the SAS[®] program. Analysis of variance (ANOVA) was performed, and Duncan's multiple range tests ($P < 0.05$) were used to determine the differences among the means.

III. RESULTS AND DISCUSSION

In this study, the cooked pork sausage with T2 and T3 showed slightly lower hardness values than those of control sample ($P < 0.05$). Deterioration of the particular texture traits, especially hardness values of storage meat products were closely linked to the oxidation of meat proteins [4]. Sodium nitrite concentration changed the textural attributes of hardness [5]. Redness (a^*) values for all treated samples were increased after 30 days of storage. Especially, a^* values of T1 and T2 treated samples on day 30 was dramatically higher ($P < 0.05$) than those of other treatments ($P < 0.05$). Some researchers reported that lipid oxidation influenced to decrease the redness [6]. TBARS values of cooked pork sausage were increased significantly as the storage was increased. All samples showed lower TBARS values, as compared to those of control after 30 days ($P < 0.05$). The TBARS values of the *C. sappan* L. extract treatments showed a similar profile as that of cooked pork sausages containing nitrite. All treatment samples had higher DPPH values for 30 days ($P < 0.05$). The cooked pork sausage with T2 showed higher DPPH radical scavenging activity than those of control and T1 ($P < 0.05$). Furthermore, T3 treated sample showed the highest DPPH values, as compared with those of other treatments. This implies that the level of antioxidant activity depends on the amount of *C. sappan* L. extract. *C. sappan* L. has guided to the isolation of several compounds that can show antioxidative characteristics [3].

Table 1. Changes in hardness, redness, TBARS and DPPH radical scavenging activity in added *C. sappan* L. extract of cooked pork sausage during cold storage

Treatments ¹⁾		Storage periods (days)		
		1	15	30
Hardness (N)	C	7.54±0.71 ^A	7.35±0.75 ^A	7.22±0.75 ^A
	T1	6.94±0.91 ^{AB}	6.79±0.75 ^{AB}	6.86±1.01 ^{AB}
	T2	6.58±0.65 ^B	6.50±0.50 ^B	6.55±0.51 ^B
	T3	6.69±0.59 ^B	6.59±0.58 ^B	6.70±0.51 ^B
Redness (a)	C	0.44±0.33 ^{Bb}	0.31±0.30 ^{Bb}	3.43±2.39 ^{Ba}
	T1	3.90±0.72 ^{Ab}	2.97±0.88 ^{Ac}	5.31±1.94 ^{Aa}
	T2	3.75±0.39 ^{Ab}	3.02±0.69 ^{Ac}	5.10±1.82 ^{Aa}
	T3	0.66±0.20 ^{Bb}	0.36±0.22 ^{Bb}	2.02±1.12 ^{Ca}
TBARS (mg MDA/kg)	C	0.75±0.17 ^{Ab}	1.23±0.14 ^{Aa}	1.20±0.21 ^{Aa}
	T1	0.35±0.04 ^C	0.53±0.29 ^B	0.54±0.13 ^B
	T2	0.37±0.03 ^{Cb}	0.49±0.21 ^{Ba}	0.52±0.11 ^{Ba}
	T3	0.48±0.06 ^{Bb}	0.49±0.16 ^{Bb}	0.64±0.16 ^{Ba}
DPPH (%)	C	48.00±4.29 ^{Ba}	39.55±8.26 ^{Cb}	35.03±8.70 ^{Dc}
	T1	41.08±5.05 ^C	41.37±10.67 ^C	40.96±8.11 ^C
	T2	50.48±3.25 ^B	47.40±13.08 ^B	48.82±2.92 ^B
	T3	53.43±3.67 ^A	56.43±3.61 ^A	57.42±8.40 ^A

^{A-D}Means with different superscript small letters in a row within at storage time differ significantly (P<0.05). ^{a-d}Means with different superscript capital letters in a column within each treatments differ significantly (P<0.05).

IV. CONCLUSION

Cooked pork sausages, prepared with *C. sappan* L. extract, showed lower hardness and lipid oxidation, and higher DPPH radical scavenging activity, as compared with those of control. Therefore, the addition of *C. sappan* L. extract in meat products could be an alternative to the usage of synthetic ingredient as a natural antioxidant.

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REFERENCES

1. Gray, J. I., Gomma, E. A. & Buckley, D. J. (1996). Oxidative quality and shelf life of meats. *Meat Science* 43: S111-S126.
2. Honikel, K. O. (2008). The use and control of nitrate and nitrite for processing of meat products. *Meat Science* 78: 68-76.
3. Ma, G. X., Zhu, Y. D., Sun, Z. H., Yuan, J. Q., Xie, Y., Zhang, X. P., et al. (2014). Three new cassane diterpenes from the seeds of *Caesalpinia sappan*. *Phytochemistry Letters* 8: 141-144.
4. Estévez, M., Ventanas, S. & Cava, R. (2005). Protein oxidation in frankfurters with increasing levels of added rosemary essential oil effect on color and texture deterioration. *Journal of Food Science* 70(7): c427-c432.
5. Dong, Q., Tu, K., Guo, L., Yang, J. L., Wang, H. I. & Chen, Y. Y. (2007). The effect of sodium nitrite on the textural properties of cooked sausage during cold storage. *Journal of Texture Studies* 38: 537-554.
6. Fernández-López, J., Fernández-Ginés, J. M., Aleson-Carbonell, L., Sendra, E., Sayas-Barberá, E. & Pérez-Alvarez, J. A. (2004). Application of functional citrus by-products to meat products. *Trends in Food Science and Technology* 15(3-4): 176-185.