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The effect of blanching on texture and color of frozen young coconut meat

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Abstract

Brown color is one of the defects usually found in frozen young coconut. Appropriate treatment is consequently necessary to preserve the product quality. The aim of this study was to investigate the effect of blanching on enzymatic browning inhibition of frozen young coconut meat. The blanching temperature of young coconut meat prior freezing was varied at 85, 90 and 95 °C, each of which completed within 5, 10, 15, 20 and 25 min, respectively. The freezing temperature was -30 °C using air-blast freezer. The treated samples were evaluated for peroxidase activity, polyphenol oxidase activity, whiteness index, firmness and sensory acceptability. It was found that blanching temperatures of 90 °C accomplished within 5 min were sufficient to inactivate enzymatic browning activities while texture and color of the frozen young coconut meat were reasonably preserved after thawing.

Keywords: young coconut meat, browning reaction, blanching, freezing

1. Introduction

Young coconut meat (*Cocos nucifera L.*) is widely consumed because it is not only palatable but also rich source of nutrients. Preserving enables its market expansion to serve demand for convenience of consumption and further processing such as dessert, special dishes containing coconut meat. Freezing is the method effectively maintaining food quality. However, pretreatment prior freezing is required to prevent product deterioration, especially browning reaction leading to unpleasant color.

According to published researches, it has been reported the effective enzymatic browning inhibition in fruits and vegetables by blanching in order to inactivate polyphenol oxidase and peroxidase activities (Cano et al., 1997; Duangmal and Apenten, 1999; Waisundara et al., 2007; Munyaka et al., 2010; Sun et al., 2010). However, thermal treatment is subjected to loss of product

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textural characteristics. The purpose of this study was therefore to determine the suitable blanching temperature and time for preserving frozen young coconut meat quality.

2. Materials and Methods

2.1 Sample preparation

Coconut fruit harvested at approximately 190 days giving satisfied young meat was bought from supplier in Nakhon Pathom province. The coconut meat was around 2-3 mm thick with total soluble solids of its water of 6-7 °Brix. The coconut fruit was half-cut to remove water. Young coconut meat was then removed from coconut shell and cut into 5x5 in. pieces.

2.2 Blanching and freezing treatments

Young coconut meat pieces were divided into 15 groups for blanching at various temperatures (85, 90 and 95 °C) and times (5, 10, 15, 20 and 25 °C) prior subsequent freezing at -30 °C in air blast freezer until the sample temperature reached -18°C, monitored by thermocouple connected to the recorder. The frozen samples were then kept at -18 °C for further quality evaluation. Untreated fresh young coconut meat was served as a control. All treatments were triplicated.

2.3 Young coconut meat evaluation

2.3.1 Blanched sample evaluation

Blanched young coconut meat samples were analyzed for peroxidase activity following the method used by Chance (1995) and polyphenol oxidase activity following the method used by Wuyts et al. (2006). Color of a sample was measured for L*, a* and b* by Hunter Lab (Model Miniscan, Virginia, USA.) and calculated as whiteness index by the following equation:

$$\text{Whiteness Index} = 100-[(100-L^*)^2 + a^{*2} + b^{*2}]^{1/2} \quad \text{.....(1)}$$

2.3.2 Frozen sample evaluation

Frozen young coconut meat samples were thawed and analyzed for firmness, color and sensory acceptance. The firmness was evaluated after 2 weeks of storage as justified from noticeable change in product quality. It was determined by texture analyzer TA-XT 2I (Stable Micro

System, England) using spherical plunger diameter of 2 mm., testing speed of 1.0 mm/s, distance of 90%. Color was measured for L*, a* and b* and calculated as whiteness described previously. Sensory acceptance of frozen young coconut meat was evaluated by 30 panelists using 9-point hedonic scale.

2.4 Data analysis

Sample means were compared using Duncan's new multiple range test. Sensory data were analyzed following randomized complete block design of which panelists were treated as blocks. Statistical significance was determined at 95% confidence.

3. Results and Discussion

3.1 Freezing time determination

Temperature profile during freezing of young coconut meat at -30 °C in air blast freezer is presented in Fig. 1. It was found that the freezing process could be completed within 300 minutes to meet the equilibrium temperature. For this study, coconut meat temperature of -18 °C was justified for storage condition.

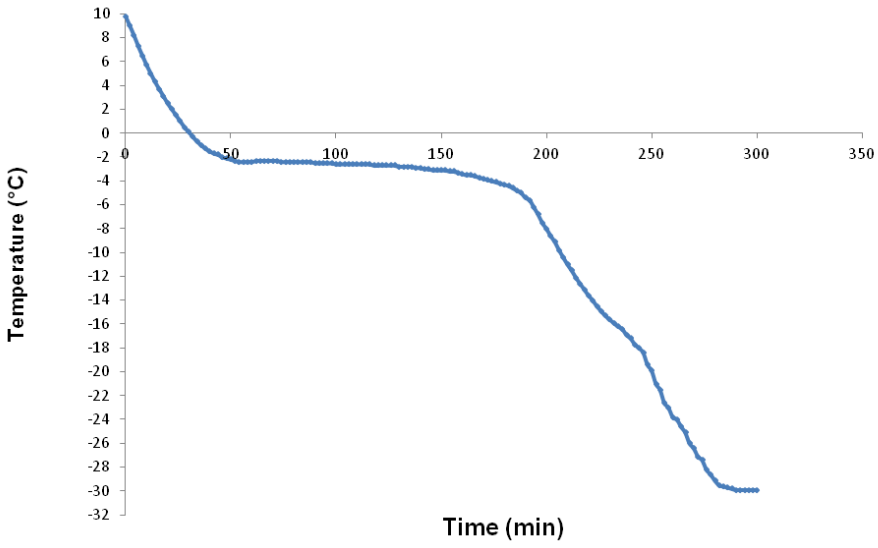

Figure 1. Freezing curve of frozen young coconut meat.

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3.1 Enzymatic browning activity

Peroxidase and Polyphenol oxidase (PPO) activities were the indicators of browning reaction. The results as shown in Fig. 2 and Fig. 3 indicate the noticeable reduction of PPO activity when increasing blanching temperature and time. It was found that the inactivation of PPO was completed at 90 and 90 °C within the experimental time range from 5-25 min. Nevertheless, peroxidase remained slightly active (approximately 10% as compared to that of control). The whiteness index of blanched samples, therefore, slightly decreased as compared to that of the control (Fig. 4). Thus, blanching temperatures of 90 and 95 °C within 5 min were selected for further investigation on changes in color and texture of frozen young coconut meat.

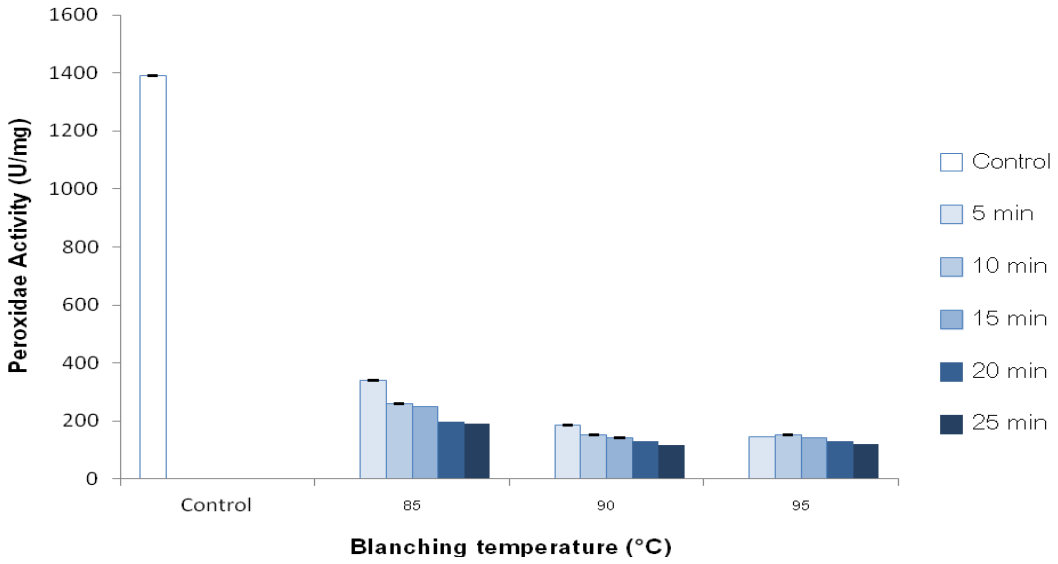

Figure 2. Peroxidase activity in young coconut meat, fresh (control) and frozen.

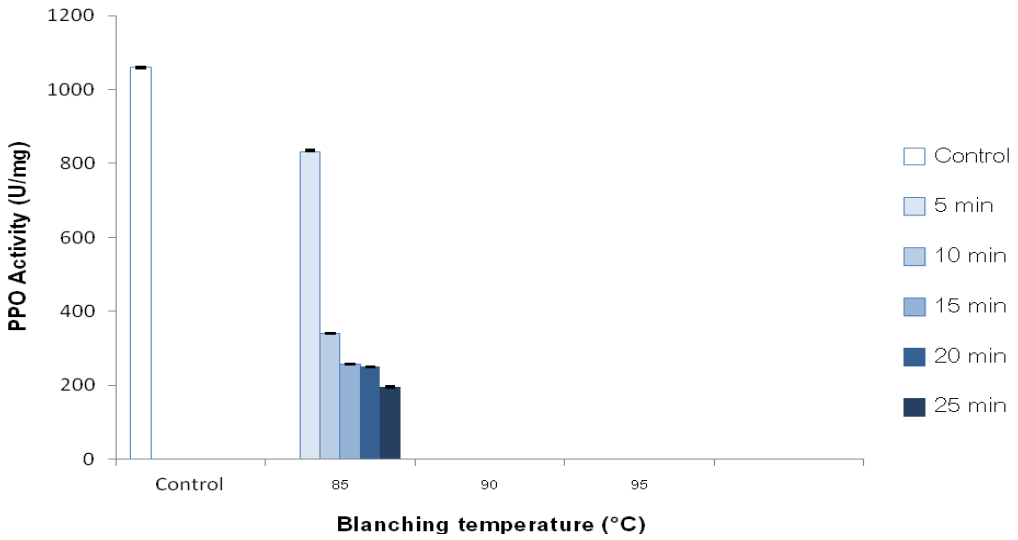

Figure 3. Polyphenol oxidase (PPO) activity in young coconut meat, fresh (control) and frozen.

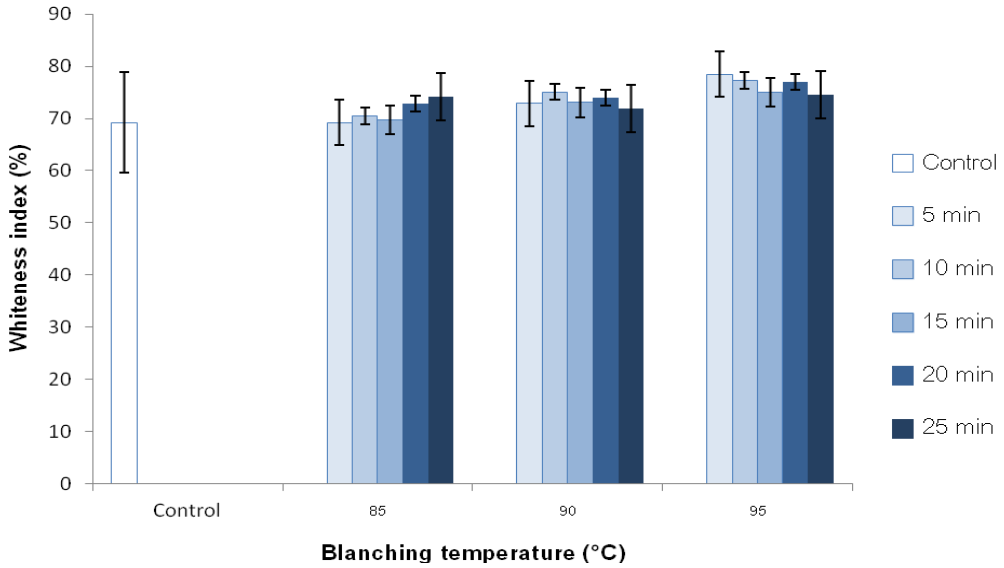

Figure 4. Color of blanched young coconut meat measured as whiteness index.

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3.3 Changes in texture and color of frozen young coconut meat

Firmness of frozen young coconut meat after thawing significantly decreased after 2 weeks of storage at -18 °C ($p<0.05$) when compared with that of control. Loss of firmness in frozen food is caused by ice crystal damaging cell membrane resulting in leakage of water, and consequently lowering cell turgor (Sterling, 2006).

Table 1. Firmness of frozen young coconut meat after 2 weeks of storage at -18 °C.

Blanching temperature (°C)	Firmness (N)
Control (Fresh)	3.92±1.09[a]
90°C, 5 min	3.04±1.05[b]
95°C, 5 min	3.12±1.18[b]

The whiteness index of frozen young coconut meat decreased with ageing during 2 weeks of storage. The whiteness reduction of sample blanched at 95 °C for 5 min was the slowest followed by that blanced at 95 °C for 5 min and that of control, respectively, as shown in Fig. 5. The browning reaction in blanched sample remained as indicated by incompleted inactivation of peroxidase mention earlier (Fig. 1).

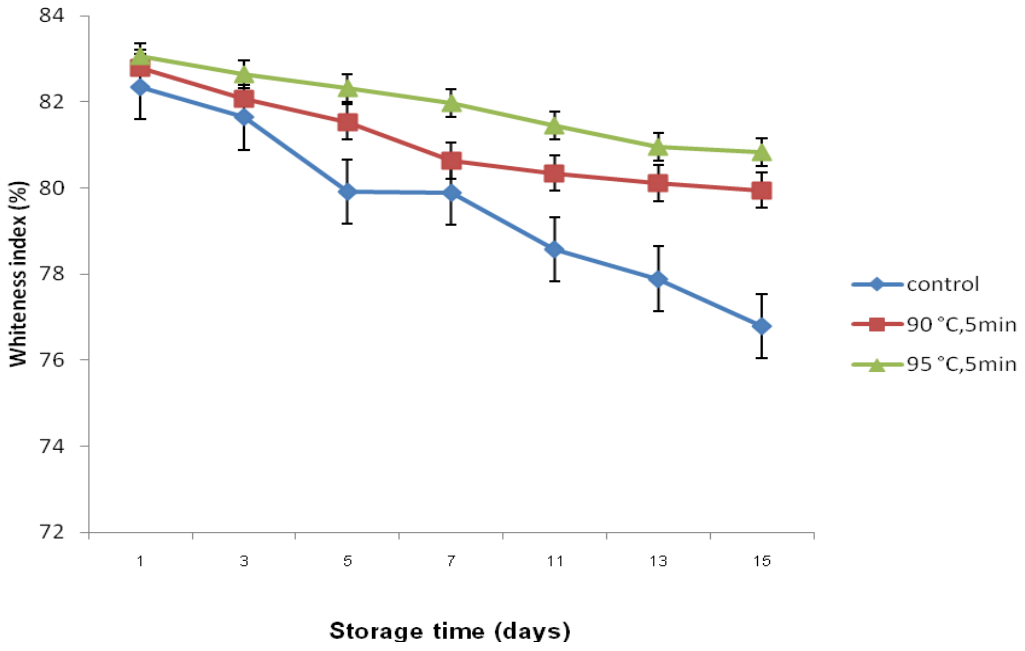

Figure 5. Changes in whiteness index of frozen young coconut meat during storage at -18 °C

3.4 Sensory evaluation

Frozen young coconut samples kept for 2 weeks at -18 °C were thawed and tasted by 30 panelists. Liking scores of samples are presented in Table 2. It was found that frozen sample blanched at 95 °C for 5 min gave the liking scores for color, odor, appearance, taste and overall not significantly different from control (fresh young coconut meat) ($p>0.05$). The sample blanced at 90 °C for 5 min gave liking scores of all characteristics but tatse significantly lower than those of control and samples blanched at 95 °C for 5 min ($p<0.05$).

Table 2. Sensory scores of young coconut meat after 2 weeks of storage at -18 °C.

Blanching Temperature (°C)	Average liking score				
	Color	Odor	Appearance	Taste	Overall
Control	7.17±1.26^{a}	7.03±1.58^{a}	6.80±1.47^{a}	7.07±1.41^{a}	7.10±1.32^{a}
90°C, 5 min	6.87±1.28^{b}	6.83±1.56^{b}	6.53±1.57^{b}	6.83±1.51^{a}	6.80±1.35^{b}
95°C, 5 min	7.00±1.29^{a}	7.07±1.14^{a}	6.83±1.39^{a}	6.93±0.98^{a}	7.07±0.91^{a}

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4. Conclusion

According to this study, blanching temperatures of 90 and 95 °C for 5 min were sufficient for inactivate PPO but peroxidase for inhibiting enzymatic browning reaction in frozen young coconut meat. After freezing, losses in color, texture and sensory attributes were observed. Decreasing whiteness reduction rate during storage of frozen young coconut meat was noted when blanched prior freezing. The experimental results suggested the suitable blanching process justified for preserving the frozen young coconut meat at temperature of 95 °C for 5 min.

References

Cano, M. P., Begoña de Ancos, M., Lobo, G., and Santos, M. 1997. Improvement of frozen banana (Musa cavendishii, cv. Enana) colour by blanching: relationship between browning, phenols and polyphenol oxidase and peroxidase activities. Zeitschrift für Lebensmittel-Untersuchung und –Forschung. 204(1): 60-65.

Chance, B. and Maehly, A. W. 1995. Assay of catalase and peroxidase. Journal of Methods Enzymol. 2: 764-775.

Duangmal, K., and Apenten, R. K. O. 1999. A comparative study of polyphenoloxidases from taro (*Colocasia esculenta*) and potato (*Solanum tuberosum var Romana*). Journal of Food Chemistry. 64(3): 351–359.

Munyaka, A.W., Oey, I., Van Loey, A., and Hendrickx, M., 2010. Application of Thermal Inactivation of Enzymes During Vitamin C Analysis to Study the Influence of Acidicfication, Crushing and Blanching on Vitamin C Stability in Broccoli (*Brassica oleracea L var. italica*), Journal of Food Chemistry. 120: 591-598.

Sterling, C. 2006. Effect of low temperature on structure and firmness of apple tissue. Journal of Food Science. 33(6): 577-580.

Sun, J. Y., You, E. G., Long, X. and Wang, J. 2010. Biochemical properties and potential endogenous substrates of polyphenoloxidase from chufa (*Eleocharis tuberosa*) corms. Food Chemistry. 118: 799-803.

Waisundara, Y.V., Perera, C. O. and Barlow, P.J. 2007. Effect of different pre-treatments of fresh coconut kernels on some of the quality attributes of the coconut milk extracted. Journal of Food Chemistry. 101: 771-777.

Wuyts, N., Waele, D.D. and Swennen, R. 2006. Extraction and partial characterization of polyphenol oxidase from banana (Musa acuminata Grande naine) roots. Journal of Plant Physiol. 44: 308-314.