Effects of Ascorbic Acid and/or Blanching on Quality of 'Kluai Khai' and 'Gros Michel' Banana Syrups

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บทคัดย่อ

วัตถุประสงค์ของการศึกษาครั้งนี้เพื่อศึกษาผลของการใช้กรดแอสคอร์บิกและการลวกต่อการยับยั้งการเกิดสีน้ำตาลในไซรัปกล้วยไข่และกล้วยหอมทอง การทดลองประกอบด้วย 4 ชุดการทดลองได้แก่ การใช้สารละลายกรดแอสคอร์บิกเข้มข้น 1% (1%AsA) การลวกที่อุณหภูมิ 80 °C เป็นเวลา 6 นาที (B) การลวกร่วมกับการใช้สารละลายกรดแอสคอร์บิกเข้มข้น 1% (1%AsA+B) และชุดควบคุม (control) ซึ่งพบว่า ปริมาณของไซรัปที่ได้ (yield) และค่าความสว่างของไซรัปในชุดทดลอง 1%AsA และ ชุดทดลอง 1%AsA+B มีค่าสูงกว่าไซรัปในชุดควบคุม ในไซรัปกล้วยไข่ ชุดการทดลอง 1%AsA+B มีปริมาณไซรัปที่ได้และค่าความสว่างของไซรัปสูงสุด ในขณะที่ไซรัปกล้วยหอม ไม่พบความแตกกันของทั้งสองค่าในทั้งสองชุดการทดลอง ค่าดัชนีสีน้ำตาลและค่าความเข้มของสีน้ำตาลของไซรัปกล้วยไข่มีค่าลดลง ในชุดการทดลอง B และ 1%AsA+B ในขณะที่ ไซรัปกล้วยไข่ในชุดการทดลอง 1%AsA มีความเป็นสีน้ำตาลเพิ่มขึ้น การใช้ 1%AsA และ 1%AsA+B สามารถลดความเป็นสีน้ำตาลในไซรัปกล้วยหอมทองได้ และพบว่า ค่าความใสของไซรัปกล้วยไข่ในชุดการทดลอง 1%AsA+B มีค่าสูงที่สุดและ ค่าความใสไซรัปกล้วยกล้วยหอมทองในชุดการทดลอง B มีค่าสูงที่สุด

คำสำคัญ: ไซรัปกล้วย ความเป็นสีน้ำตาล กรดแอสคอร์บิก การลวก

Abstract

The purpose of this study was to determine the use of ascorbic acid and blanching on browning inhibition of 'Kluai Khai' and 'Gros Michel' banana syrups. The experiment consisted of 4 treatments; adding 1% ascorbic acid (1% AsA), blanching (B) at 80ºC for 6 min, blanching incorporated with adding 1% AsA (1% AsA+B), and control. In both banana syrups the yield and lightness (*L**) of 1% AsA, B and 1% AsA+B treatments were higher than those of the controls. In 'Kluai Khai' banana syrup, 1% AsA+B treatment had the highest % yield and *L** whilst in 'Gros Michel' banana syrup, no significant differences of yield and *L** in 1% AsA, B and 1% AsA+B treatments were found. Browning index and browning intensity (OD_{420}/mL) of 'Kluai Khai' banana syrup were retarded by B and 1% AsA+B treatments whilst 1% AsA treatment induced browning in the syrup. 1% AsA, B and 1% AsA+B treatments retarded the browning in 'Gros Michel' banana syrup. The highest clarity of 'Kluai Khai' banana syrup was found in 1% AsA+B treatment and the highest clarity of 'Gros Michel' banana syrup was found in B treatment.

Keywords: Banana syrup: Browning: Ascorbic acid: Blanching

Introduction

Banana fruit (*Musa sapientum* Linn.) is a tropical fruit and is commercially important. In Thailand, banana has been grown for commercial purposes for a long time, including cultivars such as 'Kluai Hom'(Gros Michel) banana, 'Kluai Khai' banana, 'Kluai Lebmhernang' banana, and 'Kluai Namwa' banana. With its high nutrients and pleasing flavor and aroma, the demand for banana fruit in both domestic market and export has never decreased. However, the loss of bananas in the market is still high due to the rapid ripening. Most overripe banana are rejected from the market as waste. Producing banana syrup from overripe bananas is one approach to reducing waste and adding value to the overripe bananas. However, a key problem of banana syrup is its undesirable visual appearance due to browning discoloration [1]. It is widely accepted that browning caused by enzymatic reaction is the main problem causing low visual appeal of banana products. Sudprasert [2] investigated the use of AsA and heat treatment controlling browning in dried banana pulp in which the use of 1%AsA incorporated with heat treatment at 80ºC for 10 min maintained a desirable appearance and retarded polyphenol oxidase in dried banana pulp. Jackson *et al*. [3] reported that blanching at 69ºC for 22 min retarded browning discoloration in fried banana pulp.

Thus, the purpose of this work was to determine the use of AsA at the concentration of 1% (w/w) and/or blanching on inhibiting browning discoloration in two kinds of banana syrup produced from two overripe commercial bananas, 'Kluai Khai' and 'Gros Michel' bananas.

Materials and Methods

Raw materials and normal process of banana syrup

Overripe 'Kluai Khai'(*Musa* (AA)) and 'Gros Michel' (*Musa* (AAA)) banana were purchased from a local market. The fruit was cleaned with tap water and then peeled. 300 g of banana pulp was cut (0.5 cm thickness) and then placed in a plastic box. The experiment consisted of 4 treatments; firstly, 100 g of sugar was mixed with the banana pulp (control); secondly, 1% AsA was mixed with 100g sugar before being mixed with the banana pulp (1% AsA); thirdly, the banana pulp was blanched at 80°C for 15 min and then mixed with 100g sugar (B); and fourthly, banana pulp was blanched at 80°C for 15 min and then mixed with the mixture of 1% AsA and sugar (1%AsA+B). All treatments were closed tightly and kept in a refrigerator (5°C) for a month. After that, the syrup was filtered using a cloth sheet and pasteurized at 75°C for 1 min before placing in a tightly-sealed bottle. The yield (%), lightness (*L**), clarity, browning index, and browning intensity of the finished product were determined.

Yield, clarity, browning intensity, and browning index measurements

The yield (%) of final syrup was calculated compared with the initial weight of banana pulp. Clarity and browning intensity were measured using a spectrophotometer. The percentage of transmittance at 650 nm was recorded as the clarity of syrup and the absorbance at 420 nm was measured as the browning intensity. Browning index (BI) of the syrup was estimated using a protocol described by Palou *et al*.[4].

Statistical analysis

The data are shown as the mean of three replications and S.D. Statistical analysis was carried out using ANOVA and the means compared by the least significant difference test (*LSD*) at significance level of 0.05.

Results and Discussion

The result in Fig. 1 shows the yield of both 'Kluai Khai' and 'Gros Michel' banana syrups. In both syrups 1% AsA, B, and 1%AsA+B treatments had yields higher than the control. In 'Kluai Khai' banana syrup, the highest yield was found in 1%AsA+B which was 60%. In 'Gros Michel' banana syrup, no significant differences in % yield of 1% AsA, B, and 1%AsA+B treatments were found which were in the range of 44-47%. The increased yield of both banana syrups might be associated with the degradation of banana pulp tissue caused by blanching. Gerrard and Robert [5] suggested that the high temperature from microwave application induced the volume of apple juice during extraction. Moreover, AsA might induce the juice leakage from banana pulp tissue during incubation. These could explain why the yields of 1%AsA, B, and 1%AsA+B treatments were higher than the control of both banana syrups.

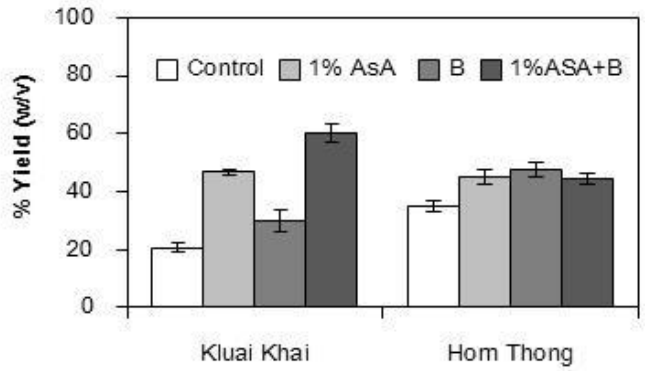

Figure 1 Yield (%) of 'Kluai Khai' and 'Gros Michel' banana syrups treated with 1% AsA, B, 1%AsA+B and the control. Each bar represents the mean ± S.D.(n=3).

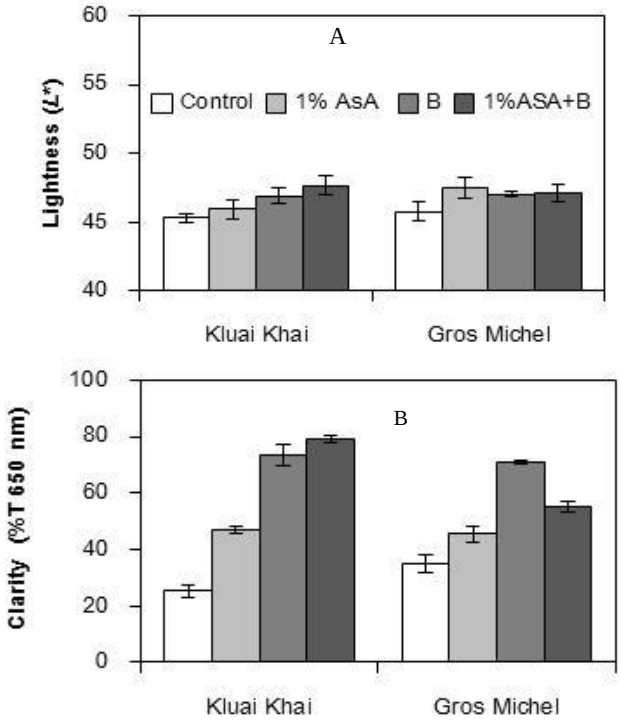

Figure 2 Lightness (*L**) (A) and clarity (B) of 'Kluai Khai' and 'Gros Michel' banana syrups treated with 1% AsA, B, 1%AsA+B, and the control. Each bar represents the mean ± S.D. (n=3).

As the results show in Figure 2, *L** and clarity of all treatments were higher than those of the control. *L** of 'Kluai Khai' banana syrup treated with 1% AsA+B was higher than others whilst no significant difference in that of 'Gros Michel' banana syrup treated with 1% AsA, B and 1%AsA+B was found. The clarity of 'Kluai Khai' banana syrup treated with 1% AsA+B was higher than others whilst the lowest one was the control. Similarly, the control treatment of 'Gros Michel' banana syrups had the lowest clarity but the highest one was found in B treatment. 1% AsA could improve clarity of both banana syrup rather than the control but blanching had more efficiency improving the syrup clarity more than 1% AsA. The clarity of banana syrups might be associated with starch and protein contents. The accumulation of protein and gelatinization of starch by blanching might relate to the increase in clarity of the banana syrups. Naknean *et al*. [6] reported that the turbidity of palm sugar syrup was positively related to protein content. Phaichamnan *et al*. [7] also reported that the clarity of banana syrups was associated with an increase in *L** value.

In 'Kluai Khai' banana syrup, B and 1% AsA+B retarded both browning index and browning intensity whilst 1% AsA induced both factors when compared to the control (Figure 3A). In 'Gros Michel' banana syrups, 1% AsA, B, and 1%AsA+B retarded both the browning index and browning intensity when compared to the control.

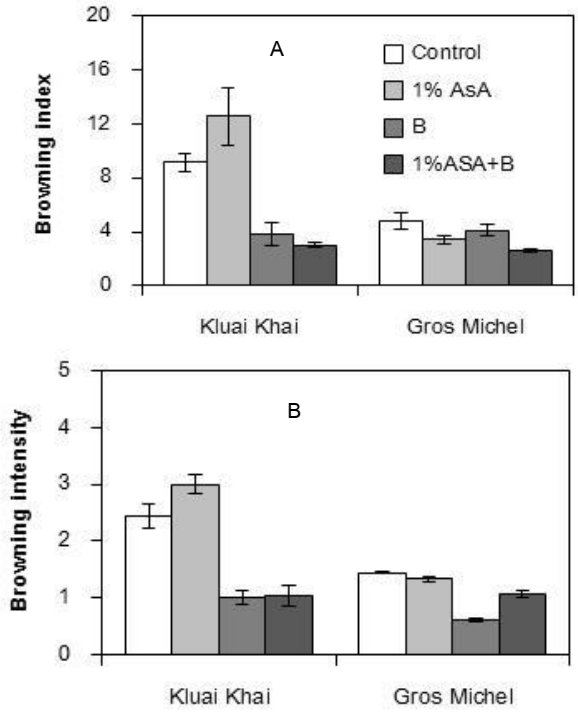

Figure 3 Browning index (A)and browning intensity(B)of 'Kluai Khai'and 'Gros Michel'banana syrups treated with 1% AsA, B, 1%AsA+B and the control.Each bar represents the mean ± standard deviation (n=3).

The lowest browning index was detected in 1%AsA+B and the lowest browning intensity was detected in B. These show that blanching could retard browning of both banana syrups. It is widely recognized that browning reaction in banana fruit is an enzymatic reaction. This reaction is inhibited by heat treatment. Jackson *et al*. [3] suggested that blanching inhibited browning in fried banana fruit. Sudprasert [2] suggested that the combination of blanching at 80°C and 1% AsA could inhibit browning in dried banana fruit. However, the induced browning of 1%AsA treated 'Kluai Khai' banana syrup might be described by the work of Bradshaws *et* al. [8] in which AsA induced browning by reacting with catechin in the produce. However, the catechin content in both bananas must be investigated in further work.

Conclusion

In conclusion, 1%AsA+B is an effective treatment improving yield and clarity and retarding browning in 'Kluai Khai' banana syrup and the effective treatment for improving visual quality involving clarity and retarding browning of 'Gros Michel' banana syrup is blanching.

References

[1] Chaiyo, M. 2003. **Qualitative comparison of banana syrup from refined sugar and nonrefined sugar**. M.S. dissertation, Faculty of Science, Srinakharinwirot University.

[2] Sudprasert, S. 2003. **Control of browning in dried banana *Musa sapientum* L. Products**. M.S. dissertation.Faculty of Science, Chulalongkorn University.

[3] Jackson, J. C.; Bourne M. C.;Barnard,J. 1996. "Optimization of blanching for crispness of banana chips using response surface methodology"**. J. of Food Science**, 61: 165-166.

[4] Palou, E.;López-MaloA.;Barbosa-Cánovas,G. V.;Welti-Chanes,J.; Swanson,B. G. 1990. "Polyphenoloxidase activity and color of blanched and high hydrostatic pressure treated banana puree"**. J. of Food Science**, 64: 42-45.

[5] Gerard, K. A.; Roberts, J. S. 2004. "Microwave heating of apple mash to improve juice yield and quality". **LWT- Food Science and Technology**, 37: 551–557.

[6] Naknean, P.;Meenune,M.; Roudaut,G. 2009. "Changes in physical and chemical properties during the production of palm sugar syrup by open pan and vacuum evaporator". **Asian J. Food Agro-Industry**, 2:448-456.

[7] Phaichamnan, M.;Posri,W.;Meenune,M. 2010. "Quality profile of palm sugar concentration produced in Songkhla province, Thailand". **International Food Research J.**, 17: 425-432.

[8] Bradshaw, M. P.; Prenzler, P.D.; Scollary, G.R. 2011. "Ascorbic acid-induced browning of (+)-catechin in a model wine system". **J. of Agricultural and Food Chemistry**, 49: 934-939.