PROCEEDING

INTERNATIONAL CONFERENCE

6th SAADC 2017

Conference on Sustainable Animal Agriculture for Developing Countries

"WISDOM OF USING LOCAL RESOURCES FOR DEVELOPMENT OF SUSTAINABLE ANIMAL PRODUCTION IN DEVELOPING COUNTRIES"

The Singhasari Resort, Batu City, Indonesia, October 16-19, 2017

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Faculty of Animal Husbandry
Brawijaya University Indonesia

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PREFACE

It is my privilege to thanks to all of authors for your enthusiasm in participating and contributing papers at this 6th International Conference on Sustainable Animal Agriculture for Developing Countries (The 6th SAADC-2017) that had been successfully held on 16-19 October 2017 in The Singhasari Resort, Batu City, Indonesia with the theme of *"Wisdom of Using Local Resources for Development of Sustainable Animal Production in Developing Countries"*

The primary objective of the 6th SAADC-2017 was to provide a scientific forum for animal scientists and producers, and administrators of livestock related agencies, particularly from the developing countries, to share their experiences, discuss issues and suggest recommendations to develop further a more sustainable livestock production.

This proceeding contains selected papers that were presented in the conference based on the quality and relevancy to the confencence. The papers are reflecting responsiveness of animal scientist from various countries in promoting sustainability of animal agriculture for the prosperity of the never ending generations. These proceeding hopefully will certainly enrich the body of knowledge and understanding about various aspects related to sustainable animal agriculture.

Our special thanks are also for the SAADC President for his confidence to our Universitas Brawijaya to organize this prestigious conference. Also, congratulation that SAADC is now listed in the International Congress and Conference Association (ICCA) based on its quality and consistent activities.

We also wish to thank all partners and sponsors for their support to the success of the conference. To colleague members of the organizing committee, please accept my deep appreciation for your hard working in ensuring the success of the conference.

Yours Sincerely,

Prof. Ifar Subagiyo
Chief Editor

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ORAL PRESENTATION

Animal Production

Animal Product Technology

The use of coconut (*Cocos nucifera L*) flesh and water to improve the physicochemical properties of palm sugar syrup

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Abstract

Palm sap is a sweet and colorless liquid obtained by tapping the stem of the male flowers of sugar palm (*Arenga pinnata*). Palm sap can be used as one of the sources in the manufacture of liquid brown sugar to replace cane sugar. Adding coconut water and flesh can improve the physical and chemical properties of palm sugar syrup. The purpose of this research is to find out the effects of the addition of coconut water and flesh to the physical and chemical properties of palm sugar syrup. The experiment is conducted using a Randomized Block Design (RBD), consisting of two factors. The first factor is the addition of coconut water with 3 levels (0%, 10%, and 20%) and the second factor is the addition of coconut flesh with 2 levels (0% and 1%); each treatment is replicated three times. Observation variables include total dissolved solids (°Brix), color intensity, and viscosity. The best treatment is obtained from the addition of 20% coconut water without coconut flesh with 75°Brix, pH 6.6, 1.26 viscosity (10^3cPs), lightness level (L^*) 30.5, redness level (a^*) 23.5, yellowness level (b^*) 22.0. Sugar content identification shows that the levels of sucrose, glucose, and fructose are 69.84%, 29.45%, and 30.76%, respectively. It is concluded that the addition of fresh coconut water can improve the physicochemical properties of palm sugar syrup.

Keywords: palm sugar syrup, physicochemical, sugar content, viscosity

Introduction

Palm sap is a sweet and colorless liquid obtained from tapping the stem of male flowers of sugar palm (*Arenga pinnata*). Palm sap is obtained from sugar palm trees which contain 10% - 12% total sugar content, especially the sucrose (Faridatul et al., 2014). Palm sap produced in average reaches 10 - 15 liter per day with the highest production of 20.83 liter per tree per day for 10-20 year-old sugar palms, whereas 21-30 year-old palms only yield 7.95 liter per tree per day (Abdullah et al., 2014). Palm sap has been used as a sweetener in many Asian countries in the form of palm sugar following a heating process (Ho et al., 2007). Furthermore, the sap can be processed into a coconut soft drink (*legen*), fermented beverage (*tuak*), vinegar, and as a single cell protein medium (Diniyah, 2008). Palm sap can be used as a source in the manufacture of liquid brown sugar to replace sugar cane and to meet the national needs for sugar. The potential of brown sugar as a replacement of cane sugar is not only as a sweetener, but also due to its unique flavor and aroma, as well as its high nutritional content. Brown sugar has low glycemic index; it dissolves and melts almost the same as sugar, very natural, unrefined, and has a superior taste. Compared to cane sugar, brown sugar is high in calcium, phosphorus, and iron content, as well as contains thiamine and riboflavin (Abdullah et al., 2014).

Solid palm sugar has short shelf life; therefore, it is more effective if solid palm sugar is replaced by a syrup form so as to shorten cooking time, increase ease of storage (durability), increase hygiene, as well as to increase the sale value of palm sugar. Palm sugar syrup is expected to be able to compete with maple syrup, a foreign product with brix level of 66.9°Brix (Vermont minimum standard), in addition to surpass the physicochemical properties of maple syrup. Palm sugar syrup is a syrup which results from the boiling down of palm sap with sugar content of ± 75°Brix and at the temperature of 45°C. At that concentration, invert sugar will not crystallize. The quality of palm sugar syrup is strongly influenced by the degree of the purity of the sap, the duration of the boiling process, and the final temperature of the production process (Diniyah, 2008).

Methodology

The purpose of this research is to find out the effects of the addition of coconut water and flesh to the physical and chemical properties of palm sugar syrup. The research is conducted using Randomized Block Design (RBD) with two factors. The first factor is the addition of coconut water with three levels (0%, 10%, and 20%) and the second factor is the addition of coconut flesh with two levels (0% and 1%); each treatment is replicated three times. Observation variables include total dissolved solids (°Brix), pH, color intensity, viscosity, and sugar analysis.

Results and Discussion

Degrees Brix is a unit used to measure the total dissolved solids of a solution counted as sucrose. The results of the study show that the mean value of the brix degree of palm sugar syrup ranges between 72.7 - 75.0°Brix. The mean values of the palm sugar syrup brix degree in each coconut water and flesh addition treatment are shown in Table 1. The brix degree of palm sugar syrup tends to increase with the increase of coconut water added. This is due to the sugar and amino acids content in coconut water which contributes to the acceleration of Maillard reaction. The reaction occurs during the interaction between sucrose and amino acids at a high temperature (Amin et al., 2010).

The pH or acidity level is used to express the degree of acidity or basicity of a solution. The mean value of the palm sugar syrup pH ranges between 6.5 – 7.1. The mean values of palm sugar syrup pH in each coconut water and flesh addition treatment are shown in Table 1. The more coconut water added, the lower the pH value of palm sugar syrup. The addition of coconut water allegedly plays a role in the decrease of the pH value because coconut water has low acidity, ranging between 4.2 – 5.6 (Tenda, 1992; Runtunuwu et al., 2011). The pH and sugar content values employed in this study are of 5.1 and 4°Brix. Viscosity or thickness is a measure of the extent of movement resistance given by a liquid. The results show that the mean value of the viscosity of palm sugar syrup ranges between 0.84 – 1.26 (10^3centipoise). The mean values of the viscosity of palm sugar syrup in the additions of coconut water and flesh are shown in Table 1.

Table 1. Mean values of the Brix degrees, pH, viscosity (10^3cPs) of palm sugar syrup in the treatments of coconut water and flesh addition

Coconut Water (%)	Coconut Flesh (%)	ºBrix1	pH1	Viscosity[1] (10^3*centipoise*)
0	0	72,7a ± 0,58	7,1b ± 0,38	0,84 ± 0,18
	1	72,8a ± 1,44	7,1b ± 0,15	1,02 ± 0,24
10	0	74,3a ± 1,04	6,9b ± 0,23	1,19 ± 0,75
	1	73,8a ± 1,26	6,7a ± 0,45	1,12 ± 0,37
20	0	75,0b ± 1,00	6,6a ± 0,40	1,26 ± 0,20
	1	74,2a ± 1,61	6,5a ± 0,29	1,01 ± 0,39

Means followed by different letters show significant differences ($p < 0.05$). Means of 3 replicates

The treatment of adding 20 % coconut water without adding coconut flesh with sugar content of 75.0°Brix reveals highest mean viscosity value of 2.05 (10^{3}°cPs), where as the lowest mean value is obtained from the treatment without the addition of coconut water and flesh at 0.84 (103cPs). Pato and Fitriani (2009) suggested that the higher the temperature the lower the viscosity of a liquid; conversely, the lower the temperature the higher the viscosity of a liquid.

The measure of the color of palm sugar syrup is conducted with a color reader, in which the parameters read are the L^*, a^*, and b^*. The mean value of the lightness level (L^*) of palm sugar syrup ranges between 26.7 – 31.2, which means that the color of palm sugar syrup tends to be dark (cloudy) since it is below the 50 value which is the mid value between dark and bright (cloudy or clear). The mean value of the redness level (a^*) of palm sugar syrup ranges between 20.8 – 25.0. The mean value of the yellowness level (b^*) of palm sugar syrup ranges between 17.7 – 22.7.

Table 2. Mean values of the color intensity lightness level (L^*), redness level(a^*), and yellowness level(b^*) of palm sugar syrup

Coconut Water (%)	Coconut Flesh (%)	Lightness Level[1] (L*)	Redness Level[1] (a*)	Yellowness Level[1] (b*)
0	0	26,7 ± 6,16	20,8 ± 1,07	20,5 ± 5,55
	1	29,7 ± 1,89	23,8 ± 2,26	21,0 ± 3,54
10	0	29,4 ± 4,82	25,0 ± 3,20	20,1 ± 8,06
	1	31,2 ± 5,65	22,4 ± 3,40	22,7 ± 9,46
20	0	30,5 ± 3,89	23,5 ± 4,51	22,0 ± 6,48
	1	27,6 ± 4,41	21,8 ± 6,50	17,7 ± 8,00

Means followed by different letters show significant differences ($p < 0.05$). Means of 3 replicates

Conclusion

The best treatment is obtained from the addition of 20% coconut water without coconut flesh with 75°Brix, pH 6.6, viscosity 1.26 (10^{3}cPs), lightness level (L*) 30.5, redness level (a*) 23.5, yellowness level (b*) 22.0; panel preference level to taste is 4.67, to color 5.27, to aroma 4.77, and to thickness 5.11. The results of sugar content identification reveal that the levels of sucrose, glucose, and fructose are 69.84%, 29.45%, and 30.76% respectively. It is concluded that the addition of fresh coconut water can improve some physicochemical properties of palm sugar syrup.

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