Conference Paper

Effect of Adding Snake Fruit Kernel Carboxy Methyl Cellulose (CMC) and Commercial CMC on Chemical, Physical and Organoleptic Properties of Snake Fruit Syrup

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Abstract

Syrup is one of well known beverage in Indonesia. Syrup can be made from "pondoh super" snake fruit to increase the shelf life of this fruit. Stabilizer and thickener are needed in making syrup to keep the stability of syrup in order to prevent precipitation during storage. Therefore, it is necessary to add stabilizer and thickener in syrup such as Carboxy Methyl Cellulose (CMC). This study aimed to determine the effects of CMC types which added in various concentrations on chemical, physical, and organoleptic properties of snake fruit syrup. In this study, the fresh snake fruit fleshes were blanched, soaked in 5% salt solution, crushed, and filtrated to get snake fruit extract. The extract was added with CMC then homogenated for 2 minutes. 65% of sugar were added to the extract then heated in 1000C for 25 minutes followed by adding 0.01% of citric acid. The chemical properties (moisture content, total sugar, reducing sugar, and pH), physical properties (viscosity, color, and total soluble solid), and organoleptic properties (color, aroma, viscosity, flavor, and overall) of snake fruit syrup were analyzed. Randomize Complete Block Design was used in this study with 2 independent variables. First is CMC types (commercial and snake fruit) and second is CMC concentrations (0.1%; 0.3%; and 0.5%). This study was statistically analyzed by SPSS 20 using one way and two ways ANOVA then continued by using Duncan Multiple Range Test and T-test with 5% significance level. The result showed that adding snake fruit kernel CMC increased the moisture content, total sugar, reducing sugar, total phenolic compound, the reddish of color (a*) and decreased the total soluble solid, lightness and viscosity of snake fruit syrup. The adding of snake fruit kernel CMC can make the snake fruit syrup more stable. The increasing concentration of snake fruit kernel CMC increase viscosity, total soluble solid, decrease moisture content and reducing sugar and did not influence pH, antioxidant activity and yellowish color (b*) of snake fruit syrup. Overall, snake fruit syrup added by snake fruit kernel CMC had the lower hedonic score than snake fruit syrup was added by commercial CMC. Snake fruit syrup with 0.3% commercial CMC had the highest hedonic score.

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INTRODUCTION

Snake fruit (Salacca edulis Reinw) is one of tropical fruit found in Indonesia, especially in Daerah Istimewa Yogyakarta. As a climacteric fruit, snake fruit has short shelf life and perishable. Therefore, it is necessary to make an innovation of snake fruit-based product in order to prolong the shelf life of snake fruit.

One of snake fruit-based product is syrup. This product has an easy way procedure and it doesn't need complex and difficult equipment to make, so it is possible to be applied in home industry. A lot of syrup products with various flavors have been sold in Indonesia, such as coco pandan, rose, vanilla, and etc. Otherwise, snake fruit syrup is rarely found in local market in Indonesia. Snake fruit syrup is one of syrup which has original flavor from snake fruit. The principle of making snake fruit syrup is separating snake fruit extract with the solid flesh and then added with sugar and stabilizer. The functions of stabilizer are as a thickening agent and keep the stability of syrup in order to prevent precipitation while storage.

There are a lot of stabilizers in market, one is Carboxy Methyl Cellulose (CMC). In this research, commercial CMC and snake fruit kernel CMC was used. Snake fruit kernel CMC has not been used as a stabilizer or thickening agent for syrup in Indonesia. Otherwise, commercial CMC has been used widely as a stabilizer or thickening agent for syrup in Indonesia. The differences between raw materials and methods for making commercial CMC and snake fruit kernel CMC will give different effects to snake fruit syrup. Snake fruit syrup with good characteristics and acceptability can be produced by calculating the concentration of CMC. Therefore, it is necessary to do the research for snake fruit syrup which added by commercial CMC and snake fruit kernel CMC in various concentrations. This study aimed to (i) determine the effects of CMC types (commercial and snake fruit kernel) on chemical, physical, and organoleptic properties of snake fruit syrup, (ii) determine the effects of CMC (commercial and snake fruit kernel) in various concentrations on chemical, physical, and organoleptic properties of snake fruit syrup.

MATERIALS AND METHODS

Materials

"Pondoh super" snake fruit used in this research were collected from snake fruit farmer in Desa Nglebeng, Margorejo, Tempel, Sleman, Yogyakarta. Other materials, such as commercial CMC, water, sugar, salt, and citric acid were purchased from local markets in Yogyakarta. Snake fruit kernel CMC was made from snake fruit kernel cellulose.

Processing of snake fruit syrup

The fresh snake fruit fleshes were blanched using water blanching method at 900C for 10 minutes followed by filtration and then soaked in 5% salt solution for 20 minutes followed by filtration. The soaked fleshes were added by water with ratio for water and fleshes were 2:1 and then crushed using blender for 2 minutes followed by filtration to get snake fruit extract. The extract was added with CMC (commercial and snake fruit seed) in various concentrations (0.1%; 0.3%; and 0.5%) then for 2 minutes.

Based on the weight of snake fruit extract, 65% of sugar were added to the extract then heated in 1000C for 25 minutes followed by adding 0.01% of citric acid 5 minutes before the end point. Snake fruit syrup processing was presented in Figure 2 on attachment.

Analysis of snake fruit syrup

The chemical properties (moisture content, total sugar, reducing sugar, and pH), physical properties (viscosity, color, and total soluble solid), and organoleptic properties (color, aroma, viscosity, flavor, and overall) of snake fruit syrup were analyzed. Moisture content, reducing sugar, and total sugar were determined by Anonim [2]. pH was measured with Crison pH meter 25 s/no 02203, total soluble solid was measured with hand refractometer Atago N2, viscosity was measured with viscometer DV-II+ Pro Brookfield, and color was measured with chroma meter Konica Minolta CR-400. Total phenolic compound was determined by Folin Ciocalteau method [10]. Antioxidant activity was determined by Radical Scavenging Activity method [4]. Sensory evaluation were determined by hedonic test [9].

Sensory evaluation of snake fruit syrup

Six different samples were presented to 20 untrained panelists in random order. Panelists were asked to evaluate color, aroma, viscosity, flavor, and overall acceptability. Between each samples, panelists were encouraged to rinse their mouth with water. The preference rating was scored on 7 points scale with 1 = like extremely and 7 = dislike extremely. Before served to the panelists, snake fruit syrups were dissolved to hot water first with ratio water and syrup was 6:1 (v/v).

Statistical analysis

Randomize Complete Block Design was used in this study with 2 independent variables. First is CMC types (commercial and snake fruit kernel) and second is CMC concentrations (0.1%; 0.3%; and 0.5%). This study was statistically analyzed by SPSS 20 using one way and two ways ANOVA then continued by using *Duncan Multiple Range Test* and T-test with 5% significance level.

RESULT

The Research was carried out to determine the effects of CMC types which added in various concentrations on chemical, physical, and organoleptic properties of snake fruit syrup.

Effects of CMC on chemical properties of snake fruit syrup

Chemical properties, such as moister content and total sugar was presented in Table 1, but reducing sugar, and pH of snake fruit syrup was presented in Table 2.

Effects of CMC on total phenolic compound and antioxidant activity of snake fruit syrup

Effects of CMC on total phenolic compound and antioxidant activity of snake fruit syrup was presented in Table 3.

Table 1: Moisture and total sugar content of snake fruit syrup.

No	Type of CMC	CMC (%)	Moisture content (%)	Total sugar (%db)
1	Commercial CMC	0.1	55.00^{cd}	112.78^{bc}
		0.3	50.83^{b}	109.23^{ab}
		0.5	42.50^{a}	99.44^{a}
2	Snake fruit kernel CMC	0.1	58.34^{e}	124.06^{c}
		0.3	57.50^{de}	123.20^{c}
		0.5	54.16^{c}	115.87^{bc}

Column with same letter are not significantly different (p<0.05)

Table 2: Reducing sugar content and pH of snake fruit syrup.

No	Type of CMC	CMC(%)	Reducing sugar content (%db)	pH
1	Commercial CMC	0.1	2.09^{c}	4.74
		0.3	1.73^{b}	4.88
		0.5	1.46^{a}	4.97
2	Snake fruit kernel CMC	0.1	2.56^{d}	4.86
		0.3	2.53^{d}	4.94
		0.5	2.11^{c}	5.1

Column with same letter are not significantly different (p<0.05)

Effects of CMC on physical properties of snake fruit syrup

Effects of CMC on physical properties such as viscosity, color, and total soluble solid of snake fruit syrup was presented in Table 4 and Table 5.

Table 3: Total phenolic compound and antioxidant activity of snake fruit syrup.

No	Type of CMC	CMC (%)	Total phenolic com-pound (%db)	Anti-oxidant activity (%RSA)
1	Commercial CMC	0.1	0.15^{b}	34.35
		0.3	0.13^{b}	34.15
		0.5	0.10^{a}	37.2
2	Snake fruit kernel CMC	0.1	0.15^{b}	36.61
		0.3	0.15^{b}	38.84
		0.5	0.14^{b}	40.59

Column with same letter are not significantly different (p<0.05)

Table 4: Viscosity and total soluble solid of snake fruit syrup.

No	Type of CMC	CMC (%)	Visco-sity (cps)	Total solu-ble solid (%Brix)
1	Commercial CMC	0.1	196.25[d]	50.05[a]
		0.3	328.23[c]	53.13[e]
		0.5	896.17[f]	56.53[f]
2	Snake fruit kernel CMC	0.1	30.98[a]	50.90[b]
		0.3	58.02[b]	51.57[c]
		0.5	78.47[c]	52.33[d]
Column with same letter are not significantly different (p<0.05)				

Table 5: Color of snake fruit syrup.

No	Type of CMC	CMC (%)	Color		
			L*	a*	b*
1	Commercial CMC	0.1	54.05[b]	2.74[a]	9.45
		0.3	53.85[b]	2.87[ab]	8.86
		0.5	53.34[b]	2.87[ab]	8.32
2	Snake fruit kernel CMC	0.1	53.55[b]	3.13[c]	8.98
		0.3	52.46[a]	2.89[ab]	8.83
		0.5	51.87[a]	2.96[bc]	8.12
Column with same letter are not significantly different (p<0.05)					

Organoleptic properties

The quality of product can be determined from consumer acceptability or consumer's predilection. Consumer's predilection can be measured from organoleptic evaluation. The evaluation of a product not only measured from chemical aspect [17]. Organoleptic properties of snake fruit syrup was presented in Figure 1.

DISCUSSION

Moisture content

The result showed that snake fruit syrup added by commercial CMC had lower moisture content than snake fruit syrup added by snake fruit kernel CMC. Degree of substitution (DS) of commercial CMC was 0.84 [6] which higher than DS of snake fruit kernel CMC.

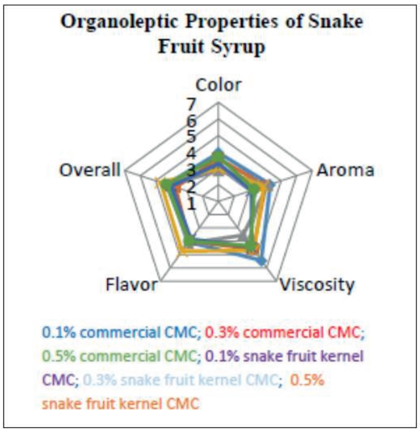

Figure 1: Organoleptic Properties of Snake Fruit Syrup.

The DS of snake fruit kernel CMC was 0.76 [1]. explained that the higher DS will increase the viscosity of solution. This condition led the decreasing of moisture contents of solution.

Moisture content of snake fruit syrup was decreased by the increasing concentration of CMC added, not only commercial CMC but also snake fruit kernel CMC. Wicaksono and Zubaidah [15] found that the moisture content of soursop leaves jelly drink was decreased by the increasing concentration of stabilizer added. The higher concentration of stabilizer will increase the viscosity of solution. The higher viscosity leads the decreasing of moisture content. Tripamungkas[14] explained that the capability of CMC to trap water caused soluble solid and insoluble solids in solution will be pulled by the water trapped. The increasing concentration of CMC caused the more solids trapped by CMC. This condition led the decreasing of moisture content because of the greater proportion of total soluble solid in solution.

Total sugar and reducing sugar

Total sugar and reducing sugar of snake fruit syrup added by commercial CMC were lower than snake fruit syrup added by snake fruit kernel CMC. The purity of commercial CMC was 99.63% [6] which higher than snake fruit kernel CMC. The purity of snake fruit kernel CMC was 90.86% [1]. The lower purity of snake fruit kernel CMC enabled the existence of sugar in CMC which cause the higher total sugar and reducing sugar of snake fruit syrup added by snake fruit seed CMC.

The increasing concentration of commercial CMC caused the decreasing of total sugar and reducing sugar of snake fruit syrup. deMan [5] explained that the decreasing of moisture content caused the increasing of Maillard reaction rate. As a cellulose derivative, CMC could be degraded to monosaccharide, such as glucose (reducing sugar) then reacted with amino acid to form melanoidin (brown pigment) as the result of Maillard reaction. This condition led the decreasing of reducing sugar and total sugar of snake fruit syrup.

The increasing concentration of snake fruit kernel CMC didn't influence the total sugar of snake fruit syrup. No significant differences between moisture content of snake fruit syrups added by snake fruit kernel CMC did not increase Maillard reaction rate.

pH

Commercial CMC and snake fruit kernel CMC which added in various concentrations didn't influence the pH of snake fruit syrup. Both CMC were added slightly to snake fruit syrup (0.1%; 0.3%; and 0.5%). When CMC added in greater concentration, it might increase the pH of product. Manoi [7] showed that the pH of jambu mete (cashew) syrup was increased by the adding of 0.5%; 1%, and 1.5% CMC. CMC is hydrocolloid gum which contain carboxylic group that can be hydrolyzed. This condition could increase the pH of product.

Total phenolic compound

Snake fruit syrup added by snake fruit kernel CMC had the higher total phenolic compound than snake fruit syrup added by commercial CMC. The purity of commercial CMC was 99.63% [6] which higher than snake fruit kernel CMC. The purity of snake fruit kernel CMC was 90.86% [1]. The lower purity of snake fruit kernel CMC enabled the existence of phenolic compound in CMC which caused the higher total phenolic compound of snake fruit syrup added by snake fruit kernel CMC.

The addition of commercial CMC in the snake fruit syrup showed total phenolic decrease. It is due to the increasing the cocentration of commercial CMC caused the total soluble solid increased. The increasing proportion of total soluble solids resulting in dry weight of total phenolic snake fruit syrup had decrease.

Antioxidant activity

Commercial CMC and snake fruit kernel CMC which added in various concentrations didn't influence the antioxidant activity of snake fruit syrup. On the other hand, the adding of CMC influenced total phenolic compound of snake fruit syrup. This condition showed that antioxidant activity did not only reflect the quantity of phenolic compounds in the product but also the dimer and oligomer form of the phenolic compounds. Osakabe, et al [9] explained that (+)-chatecin compound had different antioxidant activity with its oligomer form.

Viscosity

Snake fruit syrup added by commercial CMC had the higher viscosity than snake fruit syrup added by snake fruit kernel CMC. DS of commercial CMC was 0.84 (Lestari, et al., 2013) which higher than DS of snake fruit kernel CMC. The DS of snake fruit kernel CMC was 0.76 [1]. Adinugraha [1] states the higher value of the DS the viscocity is also higher. This is due to the higher substitution DS carboxymethyl group as nature groups water-like, so the CMC is easier to bind and trap water in system. The addition commercial CMC and snake fruit kernel CMC in fruit syrup showed significant increase in viscosity, it is because the capability of CMC to bind water.

The adding of commercial CMC and snake fruits seed CMC in various concentrations increased the viscosity of snake fruit syrup. Bochek, et al [3] explained that when Na-CMC was added to the water, Na+ released and reacted with H+ from water molecule to form HCMC which had capability to increase the viscosity. Winarno [16] also explained that by the adding of CMC, free water molecules were trapped in CMC molecules. So, the viscosity of solution was increase.

Color (L*/lightness)

The increasing concentration of commercial CMC didn't influence the lightness of snake fruit syrup. It might be caused by the base color of commercial CMC. The color of commercial CMC was white. Because of that, the lightness of snake fruit syrup would not change if CMC concentration was slightly added.

The increasing concentration of snake fruit kernel CMC decreased the lightness of snake fruit syrup. It might be caused by the base color of snake fruit seed CMC. The color of snake fruit seed CMC was brownish. It caused the darker appearance of snake fruit syrup by the increasing concentration of CMC added. The brownish color of snake fruit kernel CMC also caused the lightness of snake fruit syrup added by snake fruit seed CMC was lower than snake fruit syrup added by commercial CMC.

Color (a*/ reddish)

Snake fruit syrup added by snake fruit kernel CMC has the higher a* value than snake fruit syrup added by commercial CMC. The purity of commercial CMC is 99.63% (Lestari, et al., 2013) which higher than snake fruit kernel CMC. The purity of snake fruit kernel CMC was 90.86% [1]. Wicaksono and Zubaidah [15] explained that flavonoid was the largest phenolic compound group found in nature. Flavonoid was red, purple, and blue colorant which found in plants. By the lower purity of snake fruit kernel CMC, there were flavonoids or the other reddish color carrier compounds in snake fruit kernel CMC.

The increasing concentration of commercial CMC didn't influence the reddish color of snake fruit syrup. It might be caused by the high purity of commercial CMC; 99.63% (Lestari, et al., 2013). The high purity of CMC caused no flavonoids or just few flavonoids or the other reddish color carrier compounds found in CMC.

The reddish color of snake fruit syrup was significantly different by the adding of snake fruit kernel CMC. This condition was similar with the research from Nuryati [8] which explained that Na-CMC concentration literally influenced the reddish color of snake fruit syrup.

Color (b*/yellowish)

The adding of commercial CMC and snake fruit kernel CMC in various concentrations didn't influence the yellowish color or b* value of snake fruit syrup. Maillard reaction which happened in snake fruit syrup processing would form melanoidin (brown pigment). Melanoidin led the color of snake fruit syrup changed to brown. deMan [5] explained that Maillard reaction defined as reaction between amino acid and reducing sugar to form nitrogen polymer called melanoidin (brown pigment). This condition caused no significant difference on yellowish color of snake fruit syrups.

Total soluble solid

Snake fruit syrup added by commercial CMC had the higher total soluble solid than snake fruit syrup added by snake fruit kernel CMC. DS of commercial CMC was 0.84 (Lestari, et al., 2013) which higher than DS of snake fruit seed CMC. The DS of snake fruit kernel CMC was 0.76 [1]. This condition showed that commercial CMC had the higher capability to trap soluble solid which bought by water than snake fruit kernel CMC.

The adding of commercial CMC and snake fruit kernel CMC in various concentrations increased the total soluble solid of snake fruit syrup. This condition was similar to research from Siskawardani, et al [11] that the increasing concentration of Na-CMC caused the increasing of total soluble solid in sugar cane extract acid-drink. Tripamungkas [14] also explained that the higher concentration of CMC caused the higher total soluble solid in mungbean extract.

Color

The result showed that panelist's predilection to the color of snake fruit syrup was like moderately to neutral. The color of snake fruit syrup added by 0.5% commercial CMC had the highest hedonic score. This syrup had the lowest lightness than other syrups as the result from objective measurement using chromameter. Because of that, snake fruit syrup added by 0.5% commercial CMC had better appearance than other snake fruit syrups after dissolved in water.

Aroma

Panelist's predilection to the aroma of snake fruit syrup was slightly neutral. Snake fruit syrup added by 0.3% snake fruit seed CMC had the highest hedonic score. It showed that 0.3% snake fruit kernel CMC could deliver a better aroma of snake fruit syrup.

Tamaroh [12] explained that CMC was hydrocolloid which could be used as aroma-binding agent. On the other hand, as smelly substance, CMC didn't influence the aroma of snake fruit syrup. From Figure 1, snake fruit syrups added by snake fruit kernel CMC had the higher hedonic score than snake fruit syrups added by commercial CMC. This condition showed that snake fruit seed CMC could deliver better aroma to snake fruit syrup than commercial CMC.

Viscosity

Panelist's predilection to the viscosity of snake fruit syrup was like slightly to dislike moderately. Snake fruit syrup added by 0.5% commercial CMC had the highest hedonic score.

This condition showed that panelists liked the viscosity of this syrup. From objective measurement using viscometer, snake fruit syrup added by 0.5% commercial CMC has the highest viscosity. After dissolved with water, the viscosity of this syrup was apparently still viscous than other syrups.

Flavor

Figure 1 showed that panelist's predilection to the flavor of snake fruit syrup was like slightly to dislike slightly. In this case, CMC had functions as thickening agent and sweet flavor stabilizing-agent. Sweet flavor of a product could be defended using CMC [13]. Snake fruit syrup added by 0.3% snake fruit kernel CMC had the highest hedonic score. This condition showed that snake fruit kernel CMC was better to stabilize the flavor of snake fruit syrup than commercial CMC.

Overall

The result showed that panelists predilection to the overall attributes was neutral to dislike slightly. Snake fruit syrups added by commercial CMC had the higher hedonic score than snake fruit syrups added by snake fruit kernel CMC. Snake fruit syrup added by 0.3% commercial CMC had the highest hedonic score than other snake fruit syrups.

CONCLUSION

Viscosity, Lightness (L*), and total soluble solid of snake fruit syrup added by commercial CMC were higher than snake fruit syrup added by snake fruit kernel CMC. Moisture content, total sugar, reducing sugar, total phenolic compound, and reddish color (a*) of snake fruit syrup added by commercial CMC were lower than snake fruit syrup added by snake fruit kernel CMC. The adding of snake fruit kernel CMC and commercial CMC didn't influence pH, antioxidant activity, and yellowish color (b*) of snake fruit syrup. Overall, snake fruit syrup added by commercial CMC had the higher hedonic score than snake fruit syrup added by snake fruit kernel CMC.

The increasing concentration of commercial CMC and snake fruit kernel CMC increased viscosity and total soluble solid, decreased moisture content and reducing sugar, and didn't influence pH, antioxidant activity, and yellowish color (b*) of snake fruit syrup. The increasing concentration of commercial CMC decreased total phenolic compound and didn't influence color (L* and a*) of snake fruit syrup. The increasing concentration of snake fruit kernel CMC decreased color (L* and a*) and didn't influence total sugar and total phenolic compound of snake fruit syrup. Overall, snake fruit syrup added by 0.3% commercial CMC had the highest hedonic score.

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