

Conference Paper

The Effect of CMC Addition on the Characteristics of Sweet Potato (*Ipomoea Batatas* L. Cv Cilembu) Velva

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Abstract

Indonesia is the fourth largest sweet potato producing country in the world. However, the number of sweet potato utilization is still non optimal. One of the most popular sweet potato cultivars is Cilembu sweet potato. Velva is a frozen dessert which is made from mashed fruit (puree) with addition of water and sucrose. Fat content in velva is much lower than the ice cream, it is suitable to be consumed by vegetarian and those who are on low-fat diet. The *velva* making process may serve as an alternative of sweet potato utilization and will increase its economic value. One of the factors that affects the texture of velva is the type and amount of stabilizers used. This research aims to determine the optimal amount of *Carboxy Methyl Cellulose*(CMC) to yield Cilembu sweet potato velva with good characteristics and organoleptic properties of the panelists preferences. The method used is the experimental method with completely randomized design (CRD) consisted of 6 treatments of CMC addition (0.00%, 0.20%, 0.40%, 0.60%, 0.80%, and 1.00%) and replicated 4 times. The final results showed that the sweet potato velva with addition of 0.60% CMC was the best treatment. The velva has rate of melting 712.50 seconds, overrun 19.69%, and the amount of total soluble solids 27°brix. This velva has qualified the standard of rate of melting, according to Arbuckle and Marshall (1996) the ice cream's rate of melting in 20°C is 10-15 minutes.

Keywords: velva; sweet potato; CMC; characteristics.

1. Introduction

The *velva* making process aims to vary Cilembu sweet potato utilization. In Japan, Taiwan, Korea, China, and U.S., sweet potato are utilized to make instant noodle, baby food, bread, syrup, canned sweet potato, drink, jam, juice, concentrate [1].

One of the most popular sweet potato cultivars in Indonesia is the Cilembu sweet potato. Cilembu sweet potato is originally from Cilembu Village, Sumedang District, West Java. Cilembu sweet potato is well known because of its honey-like sweet taste after it is roasted. It has yellow flesh and rich in β -carotene [1]. The velva making

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process may serve as an alternative way of sweet potato diversification and it will aid in increasing the economic value of the crop.

Velva is a frozen dessert which is made from mashed fruit (puree) with addition of water and sucrose [2]. The fat content in velva is lower than that of ice cream. Velva does not contain any milk fat or milk solids. It is suitable to be consumed by vegetarian and those who are on low-fat diet. The fat that is contained in velva is originated from fruits [3].

The texture of velva is formed by puree, sugar, and stabilizer [4]. When these factors are not precisely mixed, a more coarse texture will be formed. Texture is one of the parameter that determines consumer acceptance. Stabilizer are used in velva making process mainly to obtain smooth texture [5].

The stabilizer used in this research was *Carboxy Methyl Cellulose* (CMC). CMC is easily dissolved in the mix and has a high water-holding capacity such that it is considered as a very good ice cream stabilizer [5]. The greater the concentration of CMC, the greater its stability and, on the contrary the lesser the concentration of CMC, the lesser its stability. However the thick texture can influence the sensory stimulation towards taste and odor attributes of a product because it can affect the olfactory reseptor stimulation and saliva [6].

This research objective was to determine the optimum amount of CMC that produce Cilembu sweet potato velva with good characteristics and organoleptic properties.

2. Materials and Method

2.1. Materials

Material used were Cilembu sweet potato (Figure 1) taken from Cilembu Village, Sumedang District, West Java, water, sugar, CMC, citric acid 0,1%, and ascorbic acid 0,1%. The equipments used were ice cream maker, blender, mixer, refrigerator, freezer, oven, analitical scale, plastic cup, graduated cylinder, plastic container, knife, spoon, timer, and gun infrared thermometer.

2.2. Methods

This research used experimental method with completely randomized design (CRD) consisted of 6 treatments on CMC addition (control, 0.20%, 0.40%, 0.60%, 0.80%, and 1.00%) and 4 replications. Figure 2 presents Cilembu sweet potato velva making process. It is referred to the research of Nugraha [7] about Japanese pumpkin velva with some modifications in raw material and material preparation.



Figure 1: Cilembu Sweet Potato.

TABLE 1: The effect CMC addition on Cilembu sweet potato velva overrun.

Treatment (%)	Overrun (%)
A (0,00)	5,31 a
B (0,20)	12,50 b
C (0,40)	14,69 c
D (0,60)	19,69 d
E (0,80)	24,38 e
F (1,00)	29,69 f

3. Results and Discussions

3.1. Overrun

Statistical analysis showed that CMC addition in any rate influenced Cilembu sweet potato velva overrun significantly as shown on Table 1.

Based on Table 1 it can be concluded that the higher CMC addition the longer the overrun of velva. Sherbets, sorbets, and ices has lower overrun than ice cream, ranging from 24-45% [5]. The formation of small and uniform ice crystal and enough air is whipped into a mixture during freezing are great importance in order that the final product is perceived smooth. The amount of CMC addition in velva making process limits the ice crystals growth and helped air whipping process so that the overrun can be increased, and the desired physical characteristics can be produced.

CMC has a high water-holding capacity, hence it binds the water molecules and increases viscosity. This increased viscosity enhances stabilization of air cells and

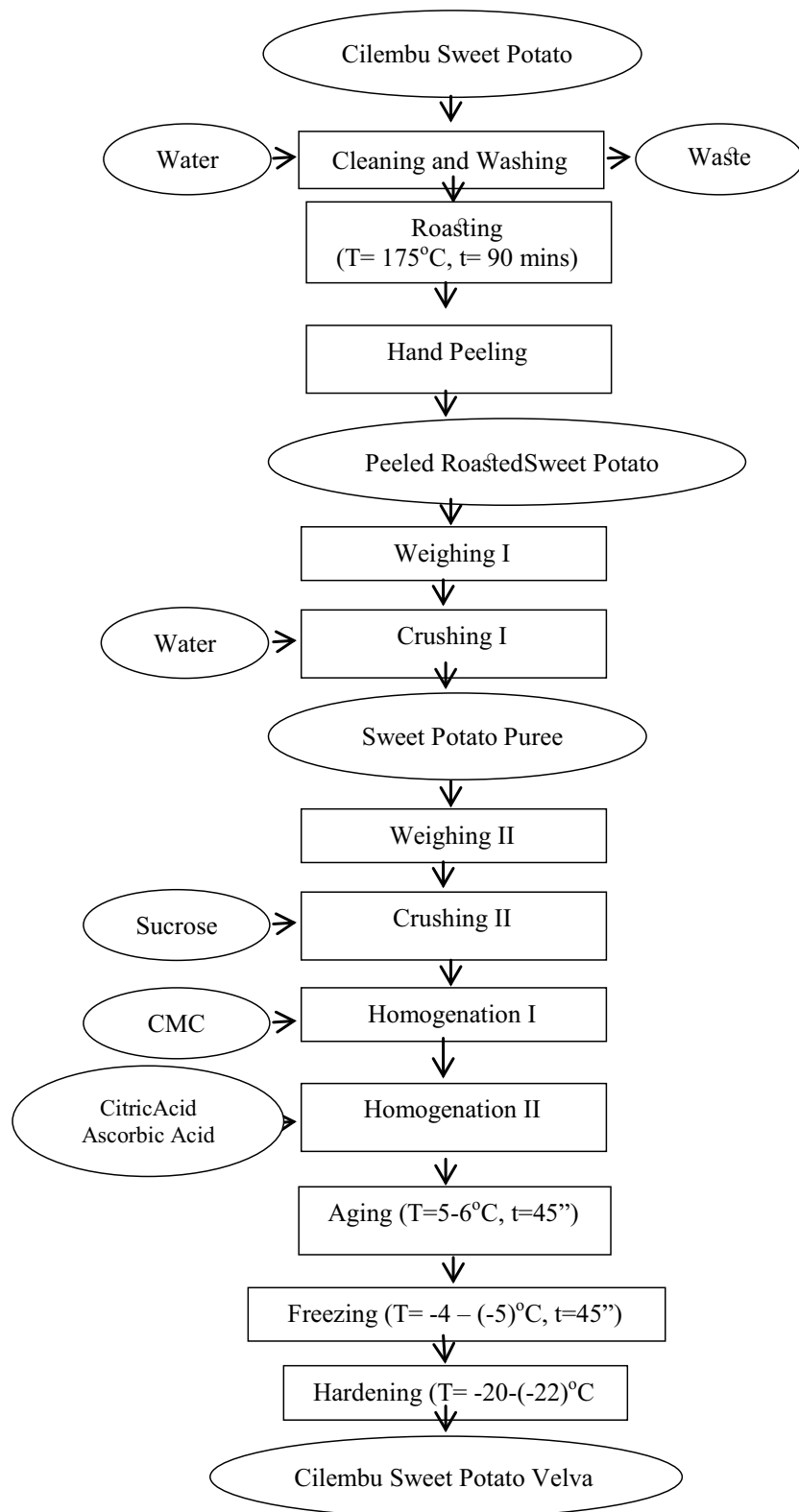


Figure 2: Process Diagram of Sweet Potato Velva.

allows air cells to be broken down to smaller size [8]. The uniformity of crystal ice increases the probability that air can be easily whipped into the mixture and increasing

TABLE 2: The effect of CMC addition on potato velva melting rate.

Treatment (%)	Melting Rate (Second)
A (0,00)	290,00 a
B (0,20)	471,00 b
C (0,40)	608,00 c
D (0,60)	712,50 d
E (0,80)	854,75 e
F (1,00)	1036,25 f

the overrun. Dynamic freezing changes the incorporation of air. The overrun may occur based on the type of freezer used to make ice cream.

3.2. Melting Rate

Statistical analysis shown that the CMC addition in any rate influenced Cilembu sweet potato velva melting rate significantly as shown on Table 2.

Based on Table 2, the higher the amount of CMC addition, the faster the velva melting rate. The resistance to melting and the smoothness of texture increases due to the increase in viscosity [5]. As a stabilizer, CMC has an ability to increase viscosity. Referring to Table 1 and 2, it was shown that the higher the overrun, the higher the melting rate. Ice cream with desirable melting quality begins to shown definite melting within 10-15 minutes or 600-900 seconds of having been dipped and placed at room temperature [8]. The melting rate of velva with CMC addition by 0,40% (608,00), 0,60% (712,50), and 0,80% (854,75) have met the standard.

3.3. Total Soluble Solid

Statistical analysis has shown that the addition of CMC at any rate affected velva total soluble solid significantly as shown on Table 3. Based on the table, the higher the CMC addition the higher the velva total soluble solid. Total soluble solid indicates the content of dissolved materials in the solution. The total soluble solids increases as CMC binds water in the product, therefore increase the viscosity. Cilembu sweet potato contains high number of total soluble solid. After the addition of 15% sucrose the total soluble solid increases from 13°brix to 24°brix.

3.4. Color Intensity

Statistical analysis shown that the CMC addition in any rate did not affect velva color intensity significantly as shown in Table 4. Human eyes are subjective. Eye fatigue, age,

TABLE 3: The effect of CMC addition on potato velva total soluble solid.

Treatment (%)	Total Soluble Solid (°brix)
A (0,00)	24,00 a
B (0,20)	24,88 b
C (0,40)	25,88 c
D (0,60)	27,00 d
E (0,80)	27,50 e
F (1,00)	28,00 f

TABLE 4: The effect of CMC addition on L*, a*, b* value.

Treatment (%)	L*	a*	b*	HUE	Chromatics Color
A (0)	45,79a	0,11a	24,71a	89,72°	Yellow Red (YR)
B (0,2)	45,48a	0,30a	25,14a	88,87°	Yellow Red (YR)
C (0,4)	45,62a	0,64a	26,29a	87,26°	Yellow Red (YR)
D (0,6)	46,22a	0,29a	26,28a	88,57°	Yellow Red (YR)
E (0,8)	46,23a	-0,22a	25,59a	88,59°	Yellow Red (YR)
F (1,0)	46,31a	-0,16a	25,47a	88,49°	Yellow Red (YR)

and other physiological factors can influence the color perception. Human eyes define the Cilembu sweet potato velva color as yellow. However from Table 4, the average HUE value of Cilembu sweet potato velva is 88,58°. HUE value ranging on 54°-90° is classified as yellow red (YR) [9]. The yellow red color is caused by caroten pigment contained in the potato.

3.5. Sensory Evaluation Test

Result of sensory analysis by hedonic test is given in Table 5. Based on the table, it can be concluded that the CMC addition did not result in any significant effect on the color of velva. Panelist mostly likes yellow color of velva. The yellow color of velva was affected by many things like its carotenoid content of Cilembu sweet potato. On the other hand, CMC was a clear solution which does not cause discoloration of food ingredients.

TABLE 5: Influence of CMC concentration on color preference.

Treatment (%)	Color Score
A (0,00)	3,93 a
B (0,20)	4,33a
C (0,40)	4,58a
D (0,60)	4,62a
E (0,80)	4,52a
F (1,00)	4,30a

TABLE 6: The effect of CMC addition on flavor.

Treatment (%)	Flavor Score
A (0,00)	4,07 a
B (0,20)	4,23a
C (0,40)	4,45a
D (0,60)	4,48a
E (0,80)	4,28a
F (1,00)	3,97a

TABLE 7: The effect of CMC addition on taste.

Treatment (%)	Taste Score
A (0,00)	4,12 a
B (0,20)	4,37a
C (0,40)	4,57a
D (0,60)	4,63a
E (0,80)	4,35a
F (1,00)	4,18a

For the flavor, as shown in Table 6, the CMC addition did not give any significant effect. The panelists like specific flavor of the velva because the CMC does not contain volatile compound which cause a change in flavor of velva.

Results in Table 7 shows that the CMC addition did not give any significant effect on the taste of Cilembu sweet potato velva. The taste of the velva was affected by many things such as the sweetness of roasted Cilembu sweet potato and the addition of vinegar and sucrose. In contrast, CMC has no taste and aroma.

Statistical analysis results on Table 8 shows that the CMC addition gave a significant effect on texture of Cilembu sweet potato velva. The panelists "like slightly" the texture of the velva with CMC addition of 0,00% and this increased until CMC addition reached 0,60%, but then decreased slowly. The highest score was at CMC addition of 0,60% because the panelists like soft texture of velva with small ice crystals. Conversely, the lowest score was at CMC addition of 0,00% (control), because it has big crystals ice which melt very fast. Texture of velva was affected by many things, such as velva *overrun*, total soluble point velva, and the freezing process.

3.6. Overall acceptability of Organoleptic Test

Result of analysis on overall organoleptic acceptability (color, flavor, taste, and texture) is given in Table 9. It can be concluded that the CMC addition have a significantly different effect on Cilembu sweet potato velva. The highest score of overall acceptability of Cilembu sweet potato velva was at treatment D (0,60%) and the lowest one

TABLE 8: The effect of CMC addition on texture.

Treatment (%)	Texture Score
A (0,00)	2,72 a
B (0,20)	3,62 b
C (0,40)	4,58 de
D (0,60)	4,78 e
E (0,80)	4,30 cd
F (1,00)	3,88 bc

TABLE 9: The effect of CMC addition on overall organoleptic acceptability.

Treatment (%)	Overall Acceptability Score
A (0,00)	2,97 a
B (0,20)	3,97 b
C (0,40)	4,23bc
D (0,60)	4,80d
E (0,80)	4,53cd
F (1,00)	4,20bc

at treatment A (control). The panellist "like" velva which has soft texture, small ice crystals, natural taste and the color of Cilembu sweet potato.

Velva with the best treatment (0,60% CMC addition) were later evaluated for β -carotene, fat, and crude fiber content. Cilembu sweet potato velva have many nutritional content, such as β -carotene, fat and crude fiber which are beneficial for health and diet. Results of analysis is shown in Table 10. It shows that the velva has low fat, high β -carotene and crude fiber.

4. Conclusion

Based on the aforementioned findings, it can be concluded that the higher the addition of CMC, the higher the overrun, melting rate, and total soluble solid of the velva. Furthermore, the addition of CMC also increase the sensory score of texture and overall acceptability gradually until 0,60% of CMC and then decrease the score slowly. On the other hand, the CMC addition does not give any significant effect on color intensity,

TABLE 10: Additional Analysis of the Best Treatment.

NO	Treatment	Result
1	β -karoten(ppm)	52,66
2	Fat Content(% v/v)	0,15
3	Crude Fiber(% b/b)	0,57

sensory score of color, sensory score of flavor, and sensory score of taste. Nevertheless, Cilembu sweet potato velva with 0,60% of CMC gave the best characteristics. It has overrun of 19,69%, melting rate of 712,50 sec, total soluble solid of 27°brix, sensory score of color of 4,62 (like), the sensory score of flavor of 4,48 (like), the sensory score of taste of 4,63 (like), the sensory score of texture by 4,78 (like), and the sensory score of overall acceptability by 4,80 (like). The Cilembu sweet potato velva with 0,60% CMC contains β -carotene of 52,66 ppm, fat content of 0,15%, and crude fiber content of 0,57%.

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