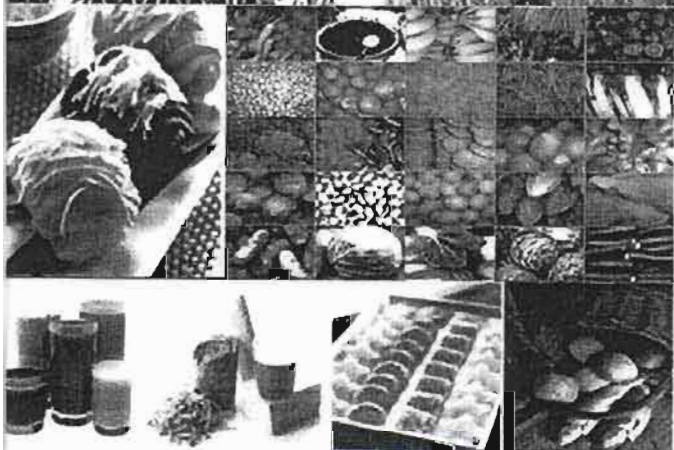
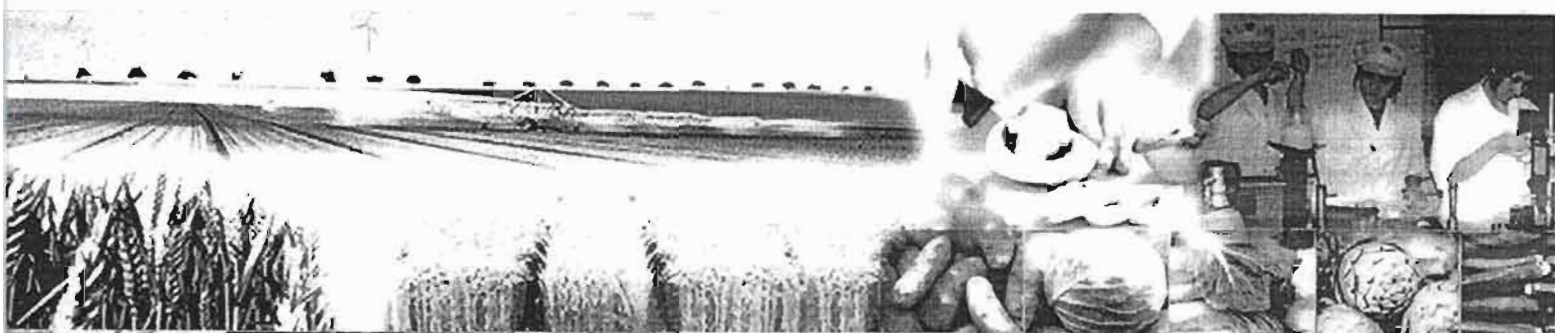


# PROCEEDING

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## RICE CAKE CHARACTERISTICS: EFFECT OF CORN FLOUR SUBSTITUTION AND NATRIUM CARBOXYMETHYL CELLULOSE

Anita Maya Sutedja\* And Chatarina Yayuk Trisnawati

Department of Food Technology, Agricultural Technology Faculty,  
Widya Mandala Catholic University Surabaya

\*tenerezzaus@yahoo.com

### ABSTRACT

*Cake is one of bakery products made from wheat flour. Wheat was an import commodity therefore, it need to find other Indonesia's local sources to substitute, such as rice. Rice formerly was one of potential local sources to be chosen. The decreasing of rice production in Indonesia forced rice to be imported. An alternative local sources which is available in a sufficient amounts is needed to substitute it. Corn is a primary Indonesian commodity besides rice with high production level. Its high carbohydrate contents made corn can be use to substitute rice flour in rice cake making. Rice flour and corn flour do not have gluten, therefore need other ingredient which can act as cake's body structure, such as Natrium Carboxymethyl Cellulose (Na-CMC). As both flours has different characteristics, so those affect the physicochemical and sensory characteristics of cake. The best substitute concentration of rice flour by corn flour combining with Na-CMC which make good cake's characteristics and acceptable by consumers. This research used Randomized Block Design with two factors: Na-CMC concentration (2% and 4 %) and substitution concentration of corn to rice flour (0%, 10%, 20% and 30%) with three replications. Data were analyzed by Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) at  $\alpha=5\%$  to evaluate the significant different between treatments. Addition of Na-CMC (2% and 4%) and corn substitution (0%, 10%, 20% and 30%) showed no significantly different on specific volume, compressibility, and the consumers' acceptability of pores uniformity. Significant different between treatments was showed on the consumers' acceptability of softness and taste. Substitution of 20% rice flour with corn flour and combine with 4% Na-CMC produce rice-corn cake that has good characteristic and consumers acceptability.*

**Keywords:** *cake, corn flour, rice flour, sodium carboxymethyl cellulose (Na-CMC)*

### INTRODUCTION

Cake is one of bakery products sell commonly and made from wheat flour. As wheat still import until today, therefore shows dependence through the wheat. Many local sources need which served in large amount need to be use in order to substitute the wheat flour, such as rice. Rice cake is cake made from the mixture of rice sugar, baking powder, eggs, chemical leavening agent, and fat (margarine or butter). A good nutrition

and support with its good characteristics made many people like it.

Rice initially was potential to be chose as Indonesia can self-sufficient in rice production. It ground to make rice flour before using as the cake ingredient. As its production decrease and need to be import therefore it is important to find an indigenous sources as an alternative ingredient for making cake so can be substituted the rice flour.



Corn can be use as the alternative indigenous source to substitute regarding that corn was one of the main commodity of Indonesia besides rice with sufficient production. Its production was 7.457.656 ton on 2007 for java island (Communication and Information Department of Indonesia, 2007). It also support by its high carbohydrate, protein, and fibber content. As a potential local source to be used as rice flour substitute, corn should be made as ckomoditiom flour before utilize it. Corn flour was flour made from corn dry milling process (Inglett, 1970).

The use of rice flour and corn flour in cake affect the volume development of cake batter and the body of the cake because both of the flours do not have protein that can make gluten (non-gluten flours). Other ingredient needs to add to replace the function of gluten so can support the body formation of cake, such as Natrium Carboxymethyl Cellulose (Na-CMC). Na-CMC, a cellulose derivative, commonly uses as thickening agent, stabilizer, and retrogradation inhibition. Its ability to adsorb can increase viscosity of the cake so gas will trapped and not release easily and maintain its volume. This condition expects will influence the characteristics of the cake.

Utilizing of corn flour and Na-CMC in rice cake product will affect the characteristics of the cake. It is needful to have a research to evaluate effects of substituting rice flour by corn flour and the use of Na-CMC to the physicochemical characteristics of rice cake and determine the corn flour substituted concentration to rice flour which is combine with Na-CMC that produce rice cake with good physicochemical characteristics and acceptable by consumers.

## MATERIAL AND METHODS

### Materials

Material for making rice cake were rice flour (Rose Bran), waxy corn flour (mutiara variety), chicken egg, sugar (Gulaku), baking powder (Hercules), Na-CMC, margarine (BlueBand). Analytical reagents were Kjeldahl tablet, H<sub>2</sub>SO<sub>4</sub>, NaOH 10N, aquadest, HNO<sub>3</sub>, NaOH 0,1N, *phenolphtalain*, *methyl red*, HCl 0,1N, Zn powder, N-hexane.

### Cake Making

Cake was made by conventional-spoge method. Eggs (318%), sugar (100%), and Na-CMC (2% or 4%) were mix (10 minutes). Rice-corn flour proportion (100%) and baking powder (2,73%) were added and mixed until homogen then added melted margarine (100%) and mixed. The batter was baked at 175°C for 25 minutes.

### Physicochemical characteristics

Volume (V) and weight (W) of the cake was measured. Specific volume of cake was determined by divided its volume with weight (Lopez *et al*, 2004). Compresibility was determined as percentage of the probe (69.25 g) length enter the cake (a) after pressed and divided by its specific weight (Goesart *et al*, 2008 with modification). Proximate was according to AOAC, 1990.

### Methodology

This research was used Randomize Block Design with 2 factors, corn flour concentration (0%, 10%, 20%, and 30%) and Na-CMC concentration (2% and 4%). Each factors used 3 replications. Data analyzed by Analysis of Varians (ANOVA) and Duncans test at  $\alpha=5\%$ .

## RESULT AND DISCUSSION

### Specific Volume

Specific volume of the various rice-corn cakes were not significantly difference analyzed by ANOVA at  $\alpha = 5\%$  (Figure

1). Those showed that rice-corn proportion and Na-CMC combination did not affect to the rice-corn cake volume. This was contrary with application of wheat-plain composite flour that decrease the specific loaf volume (Mepba, Eboh and Nwaojigwa, 2007).

Volume of rice-corn cake was influence by gel formation of hydrocolloid (Na-

CMC) which added. 4% Na.CMC gave higher specific volume of the rice-corn cake than used 2%. Lazaridou *et al.* (2007) showed that hydrocolloid addition could improve the batter characteristics (higher viscosity and gas retention).

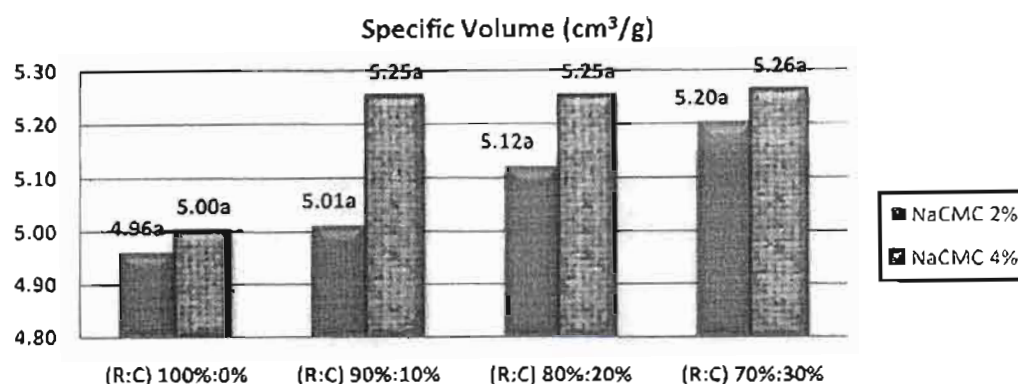


Figure 1. Specific volume of various rice-corn cake proportion and Na-CMC combination

**Compressibility**

Compressibility was cake ability to maintain its shape from pressure. It was influenced by moisture, protein, and carbohydrate content in batter. Low compressibility showed that the structure matrix of cake was firm, that is the matrix between Na-CMC, rice flour, and corn flour less firm therefore could be pressed easily. It was support by the research by

Pongjanta, *et al.* (2006) that used higher concentration of pumpkin in bread also increasing the hardness of the cake and Ahmad *et al.*, (2010) that analyzed cake texture supplemented with soy flour. Data showed no significantly difference between each treatments to the compressibility (Table 1). Overall, used 4% Na-CMC made the compressibility higher.

Table 1 Compressibility of various rice-corn cake proportion and Na-CMC combination

flour proportion	Na-CMC concentration	compressibility (mm/g/cm³)
(R:C) 100%:0%	2%	1,10 <sup>a</sup>
(R:C) 100%:0%	4%	1,10 <sup>a</sup>
(R:C) 90%:10%	2%	1,73 <sup>a</sup>
(R:C) 90%:10%	4%	1,80 <sup>a</sup>
(R:C) 80%:20%	2%	1,44 <sup>a</sup>
(R:C) 80%:20%	4%	1,00 <sup>a</sup>
(R:C) 70%:30%	2%	1,96 <sup>a</sup>
(R:C) 70%:30%	4%	1,82 <sup>a</sup>

Values with the different words shows significant difference at  $\alpha = 5\%$



with 2% Na.CMC (Figure 3). Na.CMC had an ability to absorb water and interact each other to form gel because of its double helix conformation (Gallagher, *et*

*al.*, 2004). This conformation made much water still retain during baking and made the moistness of cake better.

Table 2 Average Level of Consumers Preference for Softness, Pores Uniformity and Taste of Rice Cake

rice flour : corn flour	[Na-CMC]	softness	pores uniformity	taste
100%:0%	2%	5,54 <sup>bc</sup>	6,00 <sup>a</sup>	5,27 <sup>abc</sup>
100%:0%	4%	6,10 <sup>c</sup>	7,06 <sup>a</sup>	5,91 <sup>c</sup>
90%:10%	2%	5,25 <sup>abc</sup>	5,44 <sup>a</sup>	5,08 <sup>ab</sup>
90%:10%	4%	5,83 <sup>c</sup>	6,95 <sup>a</sup>	5,75 <sup>bc</sup>
80%:20%	2%	4,36 <sup>a</sup>	4,75 <sup>a</sup>	5,22 <sup>ab</sup>
80%:20%	4%	5,67 <sup>c</sup>	4,58 <sup>a</sup>	5,88 <sup>bc</sup>
70%:30%	2%	4,65 <sup>ab</sup>	3,82 <sup>a</sup>	4,57 <sup>a</sup>
70%:30%	4%	4,62 <sup>ab</sup>	4,22 <sup>a</sup>	5,23 <sup>abc</sup>

Values with the different words shows significant difference at  $\alpha = 5\%$

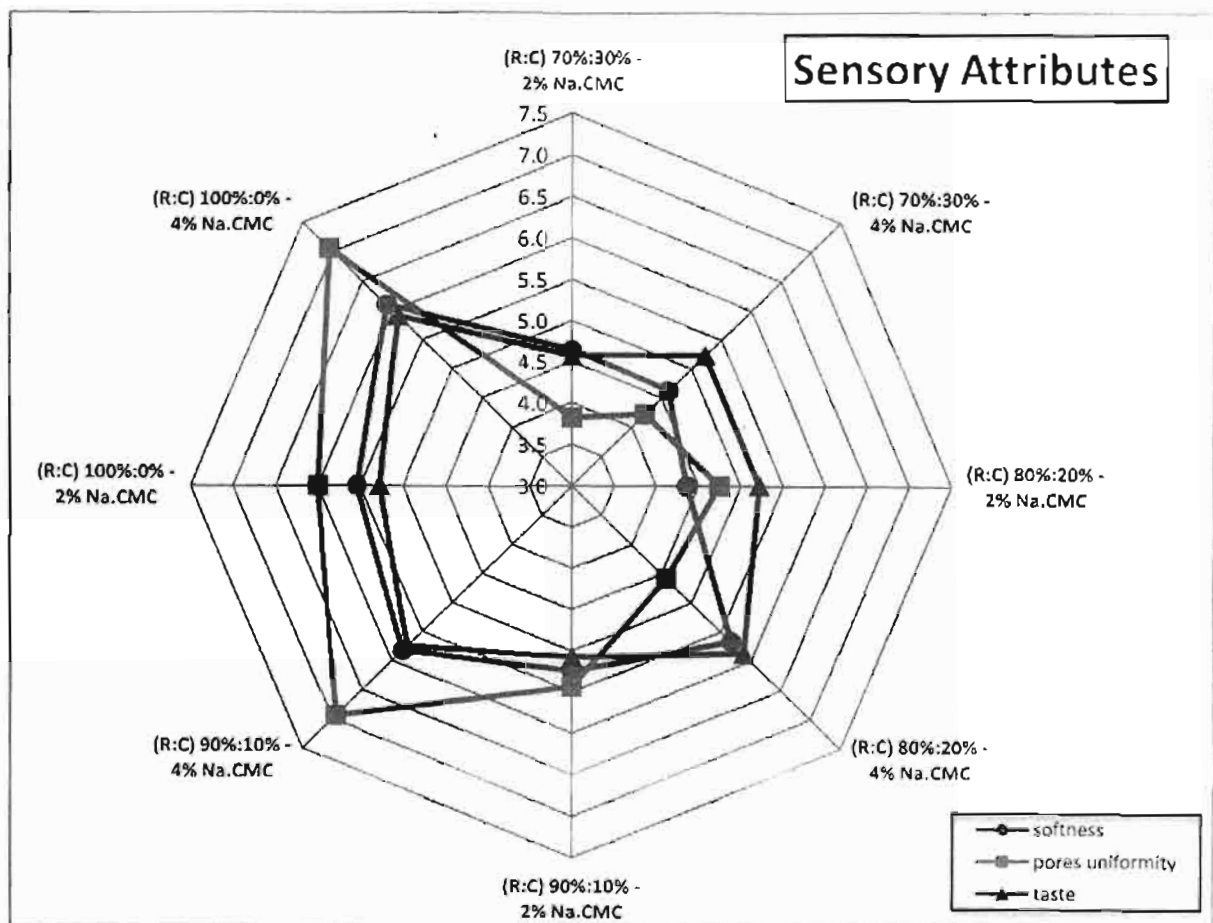


Figure 3 Sensory Attributes of Rice-Corn Cake

Rice flour and corn flour proportion and Na.CMC affect the rice-corn cake characteristics. 10% corn flour in the flour proportion and 4% Na.CMC gave the high preferable of softness and taste from consumers. Otherwise, 20% corn flour in the flour proportion and 4% Na.CMC showed not significant different

to the 10% corn flour, therefore this formulation can be used to made rice-corn cakewhich still made an acceptable rice-corn cake. This was also supported by the high specific volume than control. Proximate composition for thirs formulation of rice-corn cake was shown as Tabel 3.

Table 3. Proximate Composition of Rice-Corn Cake Hasil Analisa Proksimat Rice Cake

Composition	Content (%)
Water	38,25
Ash	2,50
Protein	10,33
Fat	12,89
Carbohydrate (by different)	36,03

**CONCLUSION**

Substitute rice flour with corn flour until 30% and combine with Na-CMC (2% and 4%) have not significant difference to the physicochemical characteristics (volume, specific volume, and compressibility) and the consumer preference level for pores uniformity, but influence the consumer preference level for softness and taste of rice cake. This shows that corn potential to be use as ingredient for cake by combining with rice flour. The use of 20% corn flour in rice-corn flour proportion with 4% Na.CMC gave the best characteristics of cake regarding it can affect the softness and taste of the cake.

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