

## Chemical Properties of Bogor Local Palm Sugar from Leuwiliang and South Bogor and Its Utilization on Physical and Preference Properties of *Cuko Pempek*

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### ABSTRACT

Bogor and West Java had enormous production of palm sugar as raw material for *cuko pempek*. The objective was to obtain palm sugar characteristics, and to study the effect of palm sugar types and water addition on the preference, viscosity, and total dissolved solids (TDS) of *cuko*. The preliminary research was to obtain chemical composition of palm sugar and spiciness preference for *cuko* with chili concentration of 1%, 3%, 5%, and 7%. The primary research used two factors of palm sugar types from Palembang, Leuwiliang, and South Bogor, and sugar to water ratio of 1:1, 1:2, and 1:3. Analysis in preliminary stage were water, ash, reducing sugar, and sucrose content as well as hedonic test. While, analysis in primary stage were total dissolved solid, viscosity, and preference analysis. The preliminary showed 5% chili was the most preferred spiciness, as well as the chemicals of Palembang palm sugar met the standard, while ash content of local palm sugar of Leuwiliang and South Bogor exceeds the SNI standard. Leuwiliang palm sugar has the highest ash and sucrose content, while Palembang palm sugar has the highest reducing sugar. The primary results showed that different palm sugar significantly affected the taste preference and the viscosity of *cuko*. Water addition could reduce the thickness and overall preferences, as well as the TDS and the viscosity of *cuko*. Also, Bogor local palm sugar could be used as raw material in *cuko pempek* as well as Palembang palm sugar, where the chosen in this study was South Bogor palm sugar with sugar and water ratio of 1:2.

**Keywords:** Bogor local palm sugar, *cuko pempek*, hedonic, total dissolved solids, viscosity

## INTRODUCTION

*Cuko pempek* is a complementary sauce served to eat *pempek*. *Pempek* is a traditional food from the southern part of Sumatra such as South Sumatra, Bangka Belitung, Lampung, and Bengkulu. *Pempek* is made from mashed fresh fish and tapioca as the main ingredients as well as salt, water, and seasonings as flavor enhancers (Karneta *et al.*, 2013; Aminullah *et al.*, 2020). Syukri *et al.* (2014) added that *cuko pempek* tastes like a mixture of sour and sweet with a distinctive pungent aroma and spicy taste at the appropriate level. This sour and spicy mixture then makes *cuko pempek* resistant to storage (Sari *et al.*, 2015). In addition to the distinctive spicy taste, sweetness is also essential, where the sweetness in *cuko* comes from palm sugar. Palm sugar has a blackish brown color and a distinctive palm sugar aroma which significantly affects both in preference and physical characteristics of the *cuko pempek*. Sularjo (2010) explained that sugar is a source of nutrition, a thickener, and a flavor enhancer through the browning reaction. According to Setiawan (2019), viscosity was strongly influenced by the total dissolved solids in a solution, where the higher the sugar content of the material was the higher total dissolved solids in the solution (Melisa & Mardesci, 2016).

In addition, some of the Palembang's *cuko pempek* uses palm sugar, which is produced in Lubuk Linggau City, South Sumatera Province. Based on statistical data from West Java plantations, palm sugar or brown sugar production in 2017 reached 38,425 tons with an average production of 4,806 Kg/Ha of a palm crops total area of 14,578 Ha (Dinas Perkebunan, 2017). The enormous amount of production was located in the Garut area of 16,180 tons with an average production of 8,967 Kg/Ha. In contrast, in Bogor itself, the amount of production was 259 tons, with an average production of 3,441 Kg/Ha (Dinas Perkebunan, 2017). This indicates that the production level which is quite large in West Java and Bogor can be an alternative in the use of local palm sugar without having to buy from the South Sumatra area.

There are several studies of *cuko pempek* in terms of acidity such as Muchsiri *et al.* (2016), Alhanannasir (2012, 2013), Gunawan *et al.* (2013), and Wahyono *et al.* (2013) which added several types of acids including lactic acid and acetic acid in the *cuko pempek* formula, while Nurman *et al.* (2013) using tamarind and citrus extract. In general, *cuko* in previous studies was made from palm sugar of Palembang, so there has been only few research using local palm sugar (non Palembang's palm sugar) and also their characteristics were not fully understood. So, this study will explore the use of Bogor local palm sugar on the physicochemical and sensory properties of *cuko pempek*. The use of local Bogor ingredients has also been carried out in *pempek* research by Aminullah *et al.* (2020, 2021) on *pempek* products made of taro flour and African catfish.

This research aims to study the effect of the use of palm sugar and the water addition on the viscosity and total dissolved solids as well as the preference of the panelists from *cuko pempek*. Preliminary research was also carried out to study the chemical composition of each palm sugar used and the concentration of cayenne pepper on spicy taste preference of *cuko*.

## MATERIALS AND METHODS

### Materials and Equipments

The main ingredients in making *cuko pempek* were palm sugar from Palembang of South Sumatera, and local areas in Bogor of West Java that Leuwiliang and South Bogor. The palm sugar was obtained from a local market both in Palembang, South Sumatera and in Leuwiliang, South Bogor. The supporting ingredients consisted of water, red cayenne pepper, tamarind, garlic, and salt. The materials used for the analysis process were distilled water, luff Schoorl solution, 30% KI, 25% H<sub>2</sub>SO<sub>4</sub>, 1% starch indicator, 0.1 N Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> solution, 25% HCl, phenolphthalein indicator (PP), and 40% NaOH from Sigma Aldrich.

The equipments used to make *cuko pempek* such as scale, cutting board, knife, spoon, blender, pan, basin, and filter. The equipment for analysis were questionnaires, hand refractometer type ATAGO, Ostwald viscometer type Pyrex, stopwatch, thermometer, analytical balance type And GR 200, erlenmeyer, 25 ml Mohr pipette, 25 ml volumetric pipette, desiccator, oven type WTC Binder, and furnace.

## Method

This study consisted of two stages: preliminary research to obtain the chemical composition of the palm sugar used and obtain the chili concentration with the spiciness level that the panelists preferred. While the primary research, namely the making of *cuko pempek* with two factors using a completely randomized design with two replications, included the type of palm sugar and the ratio of palm sugar and water.

## Preliminary Research

Palm sugar analysis was first carried out to obtain initial information on the chemical composition of palm sugar from Palembang, Leuwiliang, and South Bogor. In addition, this preliminary research also included research on the preference test on the spiciness level of *cuko pempek*. *Cuko pempek* in this research was made followed Sembiring (2019).

The chili concentration treatments used were 1%, 3%, 5%, and 7% of the weight of the sugar solution. The making of *cuko pempek* was begun with the preparation of all ingredients (palm sugar, water, cayenne pepper, garlic, salt, and tamarind), which were then weighed. Next, water and palm sugar were dissolved, then filtered to remove impurities in the sugar solution. Next, cayenne pepper according to the treatment, salt (1%), garlic (5%), and tamarind (0.5%) were mixed, until homogeneous in a saucepan and then cooked until boiling for 15 minutes. After cooking, cooled to 40 °C, which was then filtered so that the spice dregs can be wasted. The *cuko pempek* formulation can be seen in Table 1.

Table 1. *Cuko pempek* formulation with the addition of several concentrations of cayenne pepper (modification of Sembiring (2019))

Material	Chili Concentration			
	1%	3%	5%	7%
Water (mL)	400	400	400	400
Palm Sugar (g)	200	200	200	200
Cayenne pepper* (g)	6	18	30	42
Garlic* (g)	30	30	30	30
Salt* (g)	6	6	6	6
Tamarind* (g)	3	3	3	3

Remarks: \*The percentage of seasoning was calculated from the total sugar and water

## Primary Research

The primary research on the manufacture of *cuko pempek* used a 2-factor of completely randomized design (CRD), the use of different types of palm sugar, namely A1 (Palembang palm sugar), A2 (Leuwiliang palm sugar), and A3 (South Bogor palm sugar). While the B factor, the ratio of palm sugar to water, namely B1 (1:1), B2 (1:2), and B3 (1:3). The making of *cuko pempek* referred from Sembiring (2019), which was also used in the preliminary research. The *cuko pempek* formulation was presented in Table 2.

## Chemical Analysis of Palm Sugar

Water content, ash content, reducing sugar, and sucrose content of palm sugar were analyzed in preliminary research (Association of Official Analytical Chemist, 2005). These analysis were carried out at the Chemistry Laboratory, UPT Sartika, Faculty of Halal Food Science, Universitas Djuanda, Bogor.

Table 2. Formula for making *cuko pempek* (200 g palm sugar)

Treatment code	Material (g)					
	Palm sugar	Water	Cayenne pepper	Garlic	Salt	Tamarind
A1B1	200	200	a%*400	20	4	2
A1B2	200	400	a%*600	30	6	3
A1B3	200	600	a%*800	40	8	4
A2B1	200	200	a%*400	20	4	2
A2B2	200	400	a%*600	30	6	3
A2B3	200	600	a%*800	40	8	4
A3B1	200	200	a%*400	20	4	2
A3B2	200	400	a%*600	30	6	3
A3B3	200	600	a%*800	40	8	4

Remarks: a% is taken from the concentration of the selected chili then multiplied by the total sugar and water

### Total Dissolved Solids (TDS) Analysis of *Cuko Pempek* (Muchtadi et al., 2010)

A total of 1 ml of *cuko* sample was taken and placed into a measuring cup, then 9 ml of distilled water was added, stirred well, and transferred to a beaker glass. On the prism of the hand refractometer, 2-3 drops of the solution were dripped, then the number between the light and dark points was read on the refractometer scale. To calculate the total dissolved solids value of the sample using equation as equation (1)

$$Total\ dissolved\ solids\ (^{\circ}Brix) = refractometer\ scale \times dilution\ factor \quad (1)$$

### Viscosity Analysis of *Cuko Pempek*

The Ostwald viscometer was used to measure the viscosity of *cuko pempek*. Time, when *cuko* at 26°C was inserted into it, was recorded using a stopwatch. Water was used as a comparison in this measurement with a temperature of 26°C. Next, 5 ml of the sample was put into a viscometer with known specific gravity for *cuko* and water. The formula for calculating viscosity was followed by equation (2).

$$\eta_1 = \left( \frac{d_1 \times t_1}{d_2 \times t_2} \right) \times \eta_2 \quad (2)$$

where  $\eta_1$ = viscosity of *cuko* (cP);  $\eta_2$ = viscosity of water (cP);  $d_1$ = density of *cuko* (g/cm<sup>3</sup>);  $d_2$ = density of water (g/cm<sup>3</sup>);  $t_1$ = flow time of *cuko* (s); and  $t_2$ = flow time of water (s).

### Preferences Analysis of *Cuko Pempek* (Setyaningsih et al., 2010)

The sensory test was carried out using a line scale preference test (0-10 cm, where 0 was dislike and 10 was like) with 30 semi-trained panelists who like about *cuko pempek*. The preference test of the spiciness level was observed in the preliminary study, while in the primary research, it included taste, aroma, thickness, and overall parameters.

### Data Analysis

Data analysis in this study using the SPSS 16.0 program via analysis of variance (ANOVA) to determine whether the treatment used had a significant effect or not. If the p-value <0.05, then Duncan's test was continued at a 95% confidence interval.

## RESULTS AND DISCUSSION

### Chemical Composition of Palm Sugar

The chemical characteristics of palm sugar can determine the preference of sensory *cuko* produced. Chemical composition analysis includes water content, ash content, reducing sugar content, and sucrose content, where the analysis results of palm sugar used in this study can be seen in Table 3.

Table 3. Chemical composition of palm sugar

Component	SNI*	Palembang palm sugar	Leuwiliang palm sugar	South Bogor palm sugar
Water content (%)	Max. 10	5.7	9.6	10.1
Ash content (%)	Max. 2	1.2	8.5	2.6
Reducing sugar (%)	Max. 10	7.0	4.2	5.1
Sucrose Level (%)	Max. 77	72.2	76.3	72.5

\*Badan Standardisasi Nasional (1995)

Table 3 shows that the water content of palm sugar ranged from 5.7 to 10.1. This water content is in accordance with SNI (Badan Standardisasi Nasional, 1995). Although, South Bogor palm sugar has a slightly higher than SNI, that 10.1%. Susi (2013) reported that all samples of palm sugar in small agroindustry were higher than SNI that were caused by high water content of raw materials. Besides, water content in palm sugar is influenced by the evaporation process, namely the concentration of solutes in solution, solubility, temperature-sensitive substance, foaming, pressure, and temperature.

In addition, Table 3 shows the ash content of Palembang palm sugar below 2%, where the content is in accordance with SNI (Badan Standardisasi Nasional, 1995), which is a maximum of 2%. Leuwiliang and South Bogor palm sugar have ash content of more than 2%. This high ash content of palm sugar has been reported by Zuliana *et al.* (2016) that the use of lime preservatives could increase the ash content of ant palm sugar by about 7%. Generally, the preservatives used in the preservation of sap, namely sodium metabisulfite and lime. NaCl content in sodium metabisulfite and the mineral content of calcium (Ca (OH)<sub>2</sub>) in lime would cause high ash content of brown sugar. Iskandar *et al.* (2015) reported that palm sugar has minerals potassium (3.07%), phosphorus (0.61%), magnesium (0.21%), calcium (0.28%), and sodium (0.06%).

Reducing sugar affects the sweetness of palm sugar produced because glucose and fructose have a low level of sweetness. Table 3 shows that Palembang palm sugar, Leuwiliang palm sugar, and South Bogor palm sugar have a reducing sugar content of less than 10%, which tends to be low and is in accordance with SNI (Badan Standardisasi Nasional, 1995). One of the reducing sugar content in palm sugar is influenced by processing sap into sugar. This study supports the results of Nursafuan *et al.* (2016), which stated that the higher evaporation temperature treatment would produce higher invert sugar or reduce sugar.

Table 3 also shows the sucrose content of Palembang palm sugar, Leuwiliang palm sugar, and South Bogor palm sugar are according to the value set by SNI (Badan Standardisasi Nasional, 1995). The processing of sap into sugar due to hydrolysis and browning reactions causes a decrease in sucrose levels in palm sugar. The cooking process of sap with high temperatures and a long time significantly affects these two reactions. In addition, Table 3 shows that palm sugar with higher reducing sugar content has a lower sucrose level. Pontoh (2013) explained that there was a negative relationship between the sucrose level and reducing sugar, where the higher the reducing sugar, the lower the sucrose content in palm sugar.

### Spiciness Preference of *Cuko Pemppek*

The spicy taste of *cuko pemppek* is an essential factor because it has been attached as a dominant taste and can increase taste but at the appropriate level (Syukri *et al.*, 2014). The

results of the preference level on the spiciness of *cuko pempek* using a 0-10 cm (0 is dislike and 10 is like) line scale can be seen in Table 4.

Tabel 4. The spiciness preference on *cuko pempek*

Chili Concentration Treatment	Preference value
1%	6.3 <sup>b</sup>
3%	6.6 <sup>ab</sup>
5%	7.3 <sup>a</sup>
7%	6.6 <sup>ab</sup>

\*The same superscript letters show no significant difference at the 5% level

The statistical analysis results in Table 4 show that the 5% chili concentration was significantly different from the 1% chili concentration but not significantly different from the 3% chili concentration and 7% chili concentration. However, the average preference for the 5% spiciness level is higher than the 3% and 7% concentrations. This indicates a tendency that the addition of 5% cayenne pepper concentration in the making of *cuko pempek* is the most preferred concentration. In addition, Table 3 shows that too much chili concentration (more than 5%) can cause a too hot taste but tends to reduce the panelists' preference for the *cuko pempek* produced. According to Iman *et al.* (2016) and Farliansyah *et al.* (2013) that the addition of chili to the *cuko* solution generally ranged from 5-6%. The spiciness level with a 5% chili concentration then became the selected percentage in making *cuko* in the primary research stage.

### Total Dissolved Solids (TDS) and Viscosity of *Cuko Pempek*

Generally, *cuko pempek* from Palembang has a viscous and thick texture, where these properties relate to the TDS and viscosity of the solution. The total dissolved solids (TDS) content and viscosity of *cuko pempek* can be seen in Table 5.

The statistical analysis results showed that the type of palm sugar used does not significantly affect the TDS of *cuko pempek*. However, on average, it shows that the TDS of Leuwiliang palm sugar is higher than that of South Bogor palm sugar and Palembang palm sugar. This is related to the slightly higher sucrose content in Leuwiliang palm sugar (76.3%) as shown in Table 3. The amount of sugar present influences the increasing value of total dissolved solids in the solution due to sucrose, where the sucrose sugar dissolved in a solution has a high amount of dissolved solids (Zuhra *et al.*, 2018). In addition, the addition of more water reduces the TDS of *cuko pempek*. *Cuko* from Palembang palm sugar tend to has a lower TDS than the others. This can be seen from the water content of Palembang palm sugar, which has the lower water content than Leuwiliang and South Bogor palm sugar. Water in foodstuffs has properties and roles as a solvent for organic and inorganic compounds, dispersing other materials, suspending medium materials, chemicals making up foodstuffs, reagents in foodstuffs, determining the texture, appearance, and resistance of materials. In addition, Kuspratomo *et al.* (2012) reported that the more water that comes out, the more dissolved solids would be. Yunita & Rahmawati (2015) reported that TDS could also be affected by ash content, where high ash content could increase the TDS of the solution. Based on Table 5, it can be seen that *cuko pempek* from Leuwiliang palm sugar has a higher TDS score than Palembang and South Bogor palm sugar. This is supported by the ash content in Leuwiliang palm sugar which is higher than other palm sugars.

Table 5 also shows that the use of Leuwiliang palm sugar has the highest viscosity value of *cuko*. The sucrose content in palm sugar determines the viscosity of *cuko* because, according to Andragogi *et al.* (2018) and Kartika & Nisa (2015), sucrose has strong hygroscopic properties so that it could bind water. The high viscosity is also due to the total dissolved solids in Leuwiliang palm sugar, resulting in high viscosity. Setiawan (2019) explained that this

viscosity was strongly affected by the TDS in a solution, the higher the TDS led to the higher the viscosity. In addition, the addition of water caused a decrease in the viscosity of *cuko pempek*. This is because the viscosity of the solution is inversely proportional to the solvent concentration (water), where the more water, the lower the viscosity of the solution. This result is supported by Fitriyah *et al.* (2013), who reported a decrease in the viscosity of fish paste along with the addition of water.

Tabel 5. Total dissolved solids content and viscosity of *cuko pempek*

Treatment	Total dissolved solids (°Brix)	Viscosity (cP)
Effect of the type of palm sugar		
A1	30.0 <sup>x</sup>	2.8 <sup>y</sup>
A2	32.5 <sup>x</sup>	3.0 <sup>x</sup>
A3	30.7 <sup>x</sup>	2.6 <sup>y</sup>
Effect of sugar and water ratio		
B1	40.5 <sup>p</sup>	4.7 <sup>p</sup>
B2	28.0 <sup>q</sup>	2.0 <sup>q</sup>
B3	24.7 <sup>q</sup>	1.7 <sup>r</sup>
Interaction of types of palm sugar and the ratio of sugar and water		
A1B1	45.0 <sup>a</sup>	4.8 <sup>a</sup>
A2B1	37.0 <sup>b</sup>	4.7 <sup>a</sup>
A3B1	39.5 <sup>ab</sup>	4.5 <sup>a</sup>
A1B2	25.0 <sup>cde</sup>	2.1 <sup>b</sup>
A2B2	30.5 <sup>c</sup>	2.1 <sup>b</sup>
A3B2	28.5 <sup>cd</sup>	1.9 <sup>b</sup>
A1B3	20.0 <sup>e</sup>	1.5 <sup>c</sup>
A2B3	30.0 <sup>cd</sup>	2.1 <sup>b</sup>
A3B3	24.0 <sup>de</sup>	1.5 <sup>c</sup>

Remarks:

A1= Palembang palm sugar

A2 = Leuwiliang palm sugar

A3 = South Bogor palm sugar

B1 = palm sugar: water ratio 1: 1

B2 = palm sugar: water ratio 1: 2

B3 = palm sugar: water ratio 1: 3

The same superscript letters in one coloumn show no significant difference at the 5% level

### The Preference Level of *Cuko Pempek*

The hedonic test aims to determine the individual response in acceptance or preference from consumers for the product being tested (Setyaningsih *et al.*, 2010). The results of testing preferences for aroma, taste, thickness and overall, of *cuko pempek* can be seen in Table 6.

Table 6 shows that different palm sugar has no significant effect on the aroma, thickness, and overall parameters. Panelists considered that *cuko* from South Bogor palm sugar has a distinctive aroma of palm sugar which is not too sharp and tends to be almost the same as *cuko* from Palembang palm sugar. The pungent aroma of *cuko pempek* is created from the garlic and cayenne pepper used compared to the aroma of palm sugar itself. Moulia *et al.* (2018) explained that the allicin compound in garlic, which contains much sulfur, was responsible for garlic's taste, aroma, and pharmacological properties. In addition, Handoko *et al.* (2017) also

explained that the content of capsaicinoid and several volatile compounds in chili causes a distinctive pungent aroma of chili besides causing a spicy taste.

Table 6. The preference level of *cuko pempek* on aroma, taste, thickness, and overall parameters

Treatment	Aroma	Taste	Thickness	Overall
Effect of the type of palm sugar				
A1	6,9 <sup>x</sup>	6,0 <sup>y</sup>	6,3 <sup>x</sup>	6,4 <sup>x</sup>
A2	6,9 <sup>x</sup>	6,0 <sup>y</sup>	6,4 <sup>x</sup>	6,2 <sup>x</sup>
A3	7,0 <sup>x</sup>	6,8 <sup>x</sup>	6,6 <sup>x</sup>	6,8 <sup>x</sup>
Effect of sugar and water ratio				
B1	6,7 <sup>p</sup>	6,2 <sup>p</sup>	7,1 <sup>p</sup>	6,7 <sup>p</sup>
B2	7,1 <sup>p</sup>	6,5 <sup>p</sup>	6,5 <sup>p</sup>	6,7 <sup>p</sup>
B3	7,0 <sup>p</sup>	6,0 <sup>p</sup>	5,7 <sup>q</sup>	6,0 <sup>q</sup>
Interaction of types of palm sugar and the ratio of sugar and water				
A1B1	6,5 <sup>a</sup>	6,1 <sup>a</sup>	7,3 <sup>a</sup>	6,9 <sup>ab</sup>
A2B1	6,6 <sup>a</sup>	5,8 <sup>a</sup>	6,6 <sup>abc</sup>	5,9 <sup>b</sup>
A3B1	6,8 <sup>a</sup>	6,8 <sup>a</sup>	7,4 <sup>a</sup>	7,3 <sup>a</sup>
A1B2	6,8 <sup>a</sup>	6,3 <sup>a</sup>	5,9 <sup>bc</sup>	6,4 <sup>ab</sup>
A2B2	7,2 <sup>a</sup>	6,2 <sup>a</sup>	6,7 <sup>abc</sup>	6,5 <sup>ab</sup>
A3B2	7,4 <sup>a</sup>	7,1 <sup>a</sup>	6,9 <sup>ab</sup>	7,0 <sup>ab</sup>
A1B3	7,3 <sup>a</sup>	5,8 <sup>a</sup>	5,7 <sup>bc</sup>	5,8 <sup>b</sup>
A2B3	6,8 <sup>a</sup>	5,9 <sup>a</sup>	5,9 <sup>bc</sup>	6,2 <sup>ab</sup>
A3B3	6,7 <sup>a</sup>	6,4 <sup>a</sup>	5,5 <sup>c</sup>	6,1 <sup>ab</sup>

Remarks:

A1= Palembang palm sugar

A2 = Leuwiliang palm sugar

A3 = South Bogor palm sugar

B1 = palm sugar: water ratio 1: 1

B2 = palm sugar: water ratio 1: 2

B3 = palm sugar: water ratio 1: 3

The same superscript letters in one coloumn show no significant difference at the 5% level

The use of different palm sugar does not have a statistically significant effect on preference for thickness parameters. This is strengthened that sucrose content and reducing sugar is not much difference between the three types of palm sugar used in the range of 72-76% and 4.2-7.0%, respectively. In addition, this result is also strengthened by the viscosity test using a viscometer which shows results that tend not to be significantly different from the three palm sugars used (2.6-3.0 cP).

However, Table 6 shows that the taste of *cuko pempek* using South Bogor palm sugar is preferable to palm sugar from Palembang and Leuwiliang palm sugar. Although the panelists considered that the *cuko* from Palembang palm sugar had a slightly bitter aftertaste. This result is strongly suspected due to the reducing sugar content of palm sugar, which is medium (5.1%) compared to Palembang (7.0%) and Leuwiliang (4.2%) palm sugar. The sucrose content is equivalent to Palembang palm sugar to create the *cuko* character more fitting than the other two palm sugars. This is also consistent with the descriptive results of the panelists

who state that *cuko pempek* using South Bogor palm sugar has the exemplary *cuko* character, which is not too sweet.

In addition to the factor of the type of palm sugar used, Table 6 also shows that the more water added tends to decrease the panelists' preference for the thickness and overall parameters of *cuko pempek*. However, there is no significant difference in the aroma and taste parameters. The results of this study are supported by Nurhasanah *et al.* (2017), who stated that chili sauce with low viscosity (too runny) makes the product less preferred by consumers. Table 6 also shows an interaction between types of palm sugar and the ratio of sugar to water on the thickness and overall parameters of *cuko pempek*. Based on the parameters tested, it is found that *cuko pempek* from South Bogor palm sugar with sugar and water ratio of 1:2 is the chosen *cuko pempek* in this study. The preference level of aroma, taste, thickness, and overall parameters are 7.4, 7.1, 6.9, and 7.0 (scale 0-10), respectively, with TDS values and viscosity of 28.5 °Brix and 1.9 cP.

## CONCLUSION

The results showed that the spiciness level that the panelists preferred was the chili concentration of 5%. In addition, the chemical composition of Palembang palm sugar was in accordance with SNI requirements, while ash content of Leuwiliang and South Bogor palm sugar were exceed the standard. Leuwiliang palm sugar has the highest ash and sucrose content, while Palembang palm sugar has the highest reducing sugar than the others. The primary results showed that the use of different palm sugar did not significantly affect the preference level of the panelists on aroma, thickness, overall parameters, and total dissolved solids of *cuko pempek*. However, different types of palm sugar significantly affected the taste and the viscosity of *cuko pempek*. The addition of water did not significantly affect the preference level on aroma and taste parameters. However, it tended to decrease the preference level of the panelists on thickness and overall parameters of *cuko pempek*. In addition, the more water led to the lower the viscosity and the total dissolved solids of *cuko pempek*. Based on the parameters tested, it was found that *cuko pempek* from South Bogor palm sugar with sugar and water ratio of 1:2 was the chosen *cuko pempek* in this study. Also, Bogor local palm sugar could be used as raw material in *cuko* of *pempek* product as well as Palembang palm sugar.

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