

THE EFFECT OF CONCENTRATION OF KECOMBRANG FLOUR AND STORAGE DURATION ON PHYSICAL AND CHEMICAL PROPERTIES OF CUKO PEMPEK

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ABSTRACT

This study was intended to examine the effect of concentration of *kecombrang's* flower flour and storage duration on the physical and chemical properties of dark sauce, best-known as *cuko pempek*. A randomized block design was used and divided into two stages of implementation. In the first stage, the bioactive or phytochemical compounds contained in *cuko pempek* were generated, namely phenol and tannin. The average amount of phenol in *cuko pempek* is 157.762 ppm while the amount of tannin was 3.132 ppm. The organoleptic assessment was done based on the criteria of color, aroma, and taste of *cuko pempek* added with *kecombrang's* flower flour. In the second stage, the mean pH and total acid of *cuko pempek* with storage duration of 30-days was 4.14 and 0.67%, respectively. In overall, the organoleptic assessment on color was 3.27; aroma was 3.02 with criteria of like, and flavor was 2.88 with criteria of moderately like. The best treatment was gained by a concentration of 2.5% with storage duration until 30 days.

Keywords: Cuko pempek, kecombrang's flower flour

INTRODUCTION

Pempek is the traditional and best-known Palembang's dishes in which the consumption "must" be served with dark sauce called *cuko pempek*, to make this food complete and taste good. Palembang has been popular as *Pempek City* since the 16th century throughout the archipelago, Southeast Asian countries, and even many countries on various continents. According to Zusi (2010), consuming *pempek* is less tasty without *cuko pempek*.

Cuko pempek is a dark sauce served when consuming *pempek*. The factor that determines the taste of *pempek* is on the combination of sour, sweet, spicy, salty, and typical flavor of this sauce. Therefore, the ingredients of *cuko pempek* must be precisely complied with the composition. Muchsiri *et al.*, (2016) explicated this sauce is a companion sauce in consuming *pempek*, a typical Palembang culinary that tastes sour, sweet, and spicy with a distinctive and fiery flavor and aroma of spice, which is obtained from a mixture of sugar, chili, tamarind, vinegar, garlic, and salt with a particular composition. Alhanannasir (2011a, 2012b, and 2013c), asserted that the ingredients of *cuko pempek*, such as brown/palm sugar, cayenne pepper, tamarind, key lime, garlic, tong chai, and salt. It is indisputable that the delicacy of *pempek* is partly relied on the addition of *cuko pempek*.

Cuko pempek has been examined previously and yet there are some drawbacks in which this sauce easily forms sediment, easily damaged if storages in open space (room temperature) if the process does not involve preservative (both synthesis or natural). Therefore, safe, non-toxic, or non-carcinogenic preservatives are highly required. One of safe natural preservatives is *kecombrang* flowers since they contain bioactive components, such as alkaloids, polyphenols,

flavonoids, and essential oils. Naufalin, *et al.*, (2010) reported that the concentration of kecombrang's flower porridge (3% w/v) is capable to extend of storage duration of tofu into 3 days or 72 hours. Hence, this study aimed to investigate the effects of kecombrang flower flour on the physical and chemical properties as well as storage duration of *cuko pempek*.

RESEARCH METHODOLOGY

The Preparation of *Kecombrang's Flower Flour*

The preparation of *kecombrang's flower flour* was done through several steps based on Sudarmadji *et al.*, (2007), as follows:

- a. Fresh flowers were cleaned to remove dirt and rotten petals.
- b. They were washed and rinsed with running water to remove dirt inside of the petals thoroughly.
- c. Furthermore, the size reduction was done by cutting the flowers into small pieces before it was dried, which was intended to multiply the surface area and faster the drying process.
- d. The flowers were oven-dried at an initial temperature of 40°C for 2-hours and continued with a temperature of 60°C for 10-hours.
- e. The dried flowers were extracted by a blender.
- f. The flour was ready as a natural preservative.

The Preparation of *Cuko pempek*

The preparation of *cuko pempek* with the addition of *kecombrang flower flour* was made based on Zusi (2010), which is as follows:

- a. All ingredients are mixed into a blend.
- b. Dissolve 250g brown sugar in 500ml water.
- c. Sieve the sugar solution.
- d. Put cayenne pepper (50g) and other ingredients such as garlic (25g), dried shrimp/*ebi* (5g), salt (5g), and tong chai (2g).
- e. Heat the blend until boiling and all the ingredients mixed properly.
- f. Sieve the generated solution of ingredients.
- g. Lift up and cool down the blend.
- h. Add 25ml of key lime juice and *kecombrang flower flour* the previous blend is fairly cold.

The assessment on *cuko pempek* was performed with the addition of *kecombrang flower flour* with parameters including pH, total acid, taste, color, and aroma. In addition, the assessment of the viability and self life of *cuko pempek* during storage was also carried out. The treatment of *kecombrang flower flour* to *cuko pempek* was adding *kecombrang flower flour* on *cuko pempek* after the sauce was relatively cold.

- a. Served with *pempek*; organoleptic test of taste, color, and aroma,
- b. Stored for 30 days; observations during storage at room temperature at durations: 3 (T₁), 6 (T₂), 9 (T₃), 12 (T₄), 15 (T₅), 18 (T₆), 21 (T₇), 24 (T₈), 27 (T₉), and 30 (T₁₀).

In this study, the best treatment from the first stage of research with concentration (K) of 2-2.5% *kecombrang flower flour* (K₁ and K₂). Randomized block design with factorial treatment structure was done in three replications. The pH, total acid, and water organoleptic properties were analyzed using Microsoft Excels for Windows version 7 and SAS version 9.4 to obtain the analysis of variance (anova), and significant or very significant treatment was done and continued with Duncan's Multiple Range Test (DMRT) to determine the difference between treatments (Steel, *et al.*, 1993; Suparno, *et al.*, 2013; Mattjik, *et al.*, 2013).

RESULTS AND DISCUSSION

The Effect of Concentration of Kecombrang's Flower Flour and Duration Storage on the pH of Cuko Pempek

The results of the analysis of the diverse concentrations treatment of *kecombrang* flower flour to pH *cuko pempek* showed that the concentration treatment of *kecombrang*'s flower flour (K) for the storage durations of (T_0 , 3-days (T_3), 6-days (T_6), 9-days (T_9), 12-days (T_{12}), 15-days (T_{15}), 18-days (T_{18}), 21-days (T_{21}), 24-days (T_{24}), 27-days (T_{27}) and 30-days (T_{30}) had insignificant effect on the pH of *cuko pempek*.

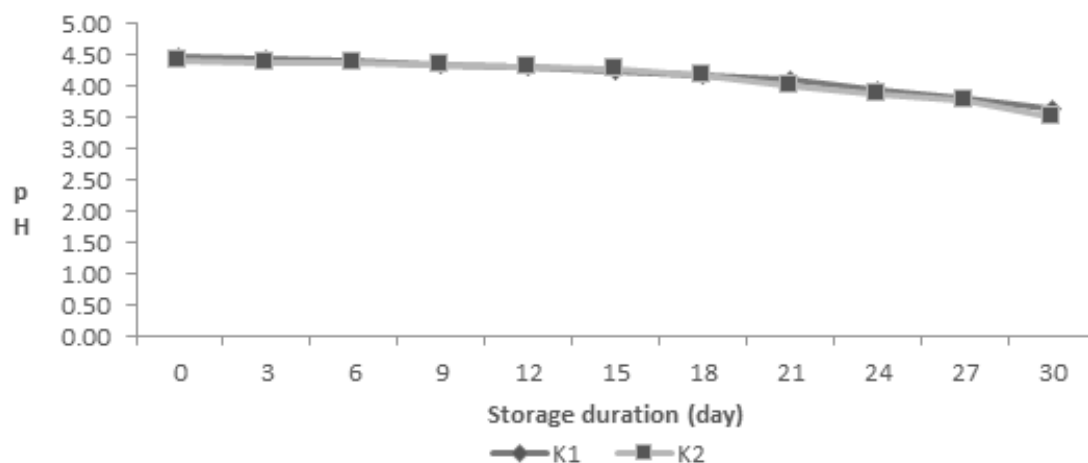


Fig 1. Average pH of *cuko pempek* during storage.

Fig. 1 demonstrates the pH of *cuko pempek* for the concentration treatment of 2% (K_1) and 2.5% (K_2) has the lower propensity in line with the longer storage duration. Furthermore, the pH at treatment K_2 is lower than treatment K_1 , which is possibly due to the amount of flower flour is higher than in treatment K_2 . The amount or concentration of *kecombrang*'s flower flour causes the pH of treatment K_2 is relatively low than K_1 since the content of organic acids and fatty acids is higher than in treatment K_1 . Haraguchi *et al.*, (1998) claimed that *kecombrang* contains phenolic, flavonoids, essential oils, terpene, organic acids, fatty acids, fatty acid esters, and alkaloids.

Furthermore, storage duration also has a significant role in lowering the pH, this is possibly within the storage, in which there is decomposition of macromolecule compound into simpler compounds, such as organic acid compounds, which then contribute to the decrease in pH. Farbod *et al.*, (2013) asserted that on food products containing calcium (Ca) and protein, calcium will help decompose proteins to form calcium-phosphate and amino acids.

Influence of Concentration of Kecombrang Flower Flour and Storage Duration on the Taste of Cuko Pempek

The results of multiple range test showed the treatment of concentration of *kecombrang*'s flower flour on total acid (%). From the analysis, it can be determined that the treatment of concentration (K) of *kecombrang*'s flower flour was significantly different on total acid of *cuko pempek* for initial storage duration 0 (T_0), day-6 (T_6), day-9 (T_9), and day-30 (T_{30}); very significantly different on total acid of *cuko pempek* for storage duration day-3, and insignificantly different on storage duration day-12, day-18, day-21, day-24, and day-27.

Fig. 2 demonstrates total acid of *cuko pempek* with concentration of 2% (K_1) and 2.5% (K_2) is higher in line with the longer storage duration. Total acid of concentration K_2 is higher in compared with concentration K_1 .

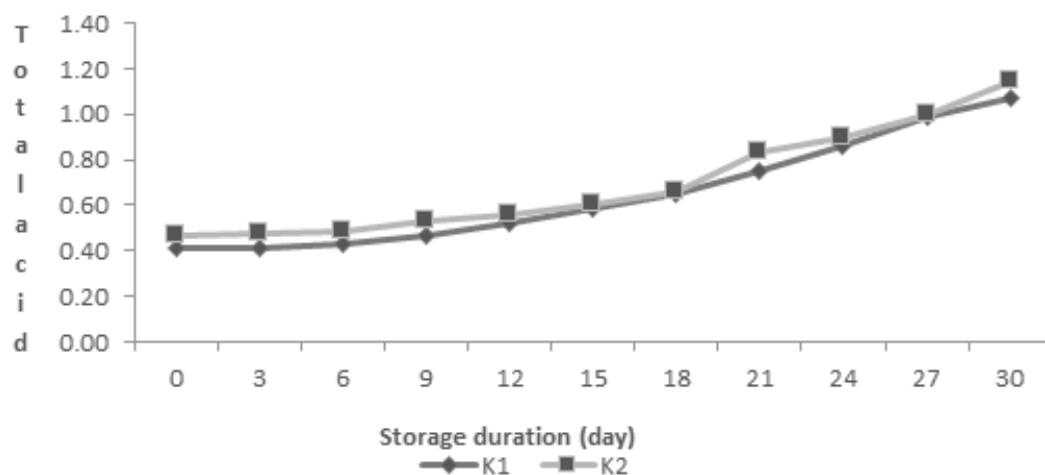


Fig. 2. Mean total acid of *cuko pempek* during the storage.

It is caused by the amount of *kecombrang's* flower flour in K_2 is higher, therefore, the acid is also higher. The increase of mean total acid is in line with the storage duration since the decomposition of macromolecule compound into simple compounds, such as organic acids, amino acids, and fatty acids as explained by Haraguchi *et al.*, (1998) in previous section.

Table 1 Results of the Duncan's multiple range test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-0 (T_0)

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K_1	0.406667	-	-	a
K_2	0.463333	2	0.03795	b

Description: Numbers followed with different letters are significantly different.

Based on the DMRT as shown in Table 1, the storage duration of day-0 (T_0) for the treatment of K_1 (concentration 2%) is significantly different to treatment K_2 (concentration 2.5%). The highest total acid is gained by treatment K_2 , with mean of 0.46% in compared with treatment K_1 with mean of 0.41%.

Table 2. Results of the Duncan's Multiple Range Test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-3 (T_3)

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K_1	0.413333	-	-	a
K_2	0.473333	2	0.02484	b

Description: Numbers followed with different letters are significantly different.

The results of DMRT analysis as shown on Table 2 indicate the storage duration of 3-days (T_3) for treatment K_1 is significantly different with treatment K_2 . The higher total acid is obtained by treatment K_2 with mean of 0.471% in compared with treatment K_1 with mean of 0.41%.

Table 3. Results of the Duncan's multiple range test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-6 (T_6)

Concentration	Mean	Distance P	Critical Range	DMRT _{0.05}
K ₁	0.42667	-	-	a
K ₂	0.48667	2	0.04303	b

Description: Numbers followed with different letters are significantly different.

The results of DMRT analysis as demonstrated in Table 3 indicate that in storage duration on day-6 (T_6) of *cuko pempek*, treatment K₁ significantly different with treatment K₂. Total acid of treatment K₂ with mean of 0.49% is higher in compared with treatment K₁ with mean of 0.43%.

Table 4. Results of the Duncan's Multiple Range Test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-9 (T_9)

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K ₁	0.47000	-	-	a
K ₂	0.53333	2	0.05171	b

Description: Numbers followed with different letters are significantly different.

Based on DMRT analysis on Table 4, the storage duration of 9-days (T_9) of *cuko pempek* showed treatment K₁ is significantly different with treatment K₂. Total acid of treatment K₂ is also higher with mean of 0.53%, in compared with treatment K₁ with mean of 0.47%.

Table 5. Results of the Duncan's Multiple Range Test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-15 (T_{15})

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K ₁	0.5867	-	-	a
K ₂	0.6067	2	0	b

Description: Numbers followed with different letters are significantly different.

In accordance with DMRT analysis as presented in Table 5, on the day-15(T_{15}) of the storage of *cuko pempek*, treatment K₁ is significantly different with treatment K₂. The higher total acid is gained by treatment K₂ with mean of 0.61% in compared with treatment K₁ with mean of 0.59%.

Table 6. Results of the Duncan's Multiple Range Test (DMRT) on the effect of concentration on total acid of *cuko pempek* (%) on day-30 (T_{30})

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K ₁	1.06667	-	-	a
K ₂	1.14667	2	0.07452	b

Description: Numbers followed with different letters are significantly different.

Table 6 shows the results of DMRT analysis in which in the storage of *cuko pempek* on day-30(T_{30}), treatment K₁ is significantly different with treatment K₂. Total acid of treatment K₂ with mean of 1.15% is higher than those of treatment K₁ with mean of 1.07%.

The Effect of Concentration of Kecombrang's Flower Flour and Storage Duration on the Color of Cuko Pemppek

Result of analysis indicates the treatment of diverse concentrations of *kecombrang's* flower flour on the preference test of color of *cuko pemppek* is insignificantly different to the color of *cuko pemppek* for storage duration on 0 day (T_0), 6-days (T_6), 9-days (T_9) and 30-days (T_{30}).

The color of *cuko pemppek* is affected by total acid and pH. Based on the analysis, the lowest total acid of the sauce is 0.41% on K_1 and storage duration 0-day while the highest is 1.5% on K_2 and storage duration of 30-days. The lowest pH of *cuko pemppek* is 3.5 on K_2 with storage duration of 30-days, and the highest is 4.47 on K_1 with storage duration of 0-day. The mean total acid is 0.67% and the mean pH is 4.14. It confirms the findings reported by Pope and Gould (1973) and Ibrahim (2016), concerning with total acid and pH of juice, in which the treatment of acid compound and storage duration cause the increase of total acid and the decrease of pH.

The level of acid indicated by mean pH of 4.14 results the light color of *cuko pemppek*, which is attractive for consumers (panelists). It reaffirms the findings reported by Whetstone (1982) for food products with the addition of acid-compounds have a range of pH of 3-7.

The Effect of Concentration of Kecombrang's Flower Flour and Storage Duration on the Aroma of Cuko Pemppek

The analysis shows the treatment of concentrations (K) of *kecombrang's* flower flour is very significantly different on the aroma of *cuko pemppek* for storage duration of day-30 (T_{30}). Treatment of concentration is insignificantly different on the aroma of *cuko pemppek* for storage duration of day-0 (T_0) and day-6 (T_6).

Table 7. Results of the Duncan's multiple range test (DMRT) on the effect of concentration on the aroma of *cuko pemppek* (%) on day-30 (T_{30})

Concentration	Mean	Distance	Critical Range	DMRT _{0.05}
K_1	2.1000	-	-	A
K_2	2.6500	2	0.2389	B

Description: Numbers followed with different letters are significantly different.

In accordance to DMRT analysis as presented in Table 7, the storage duration on day-30(T_{30}) generates the aroma of *cuko pemppek* on treatment K_1 is significantly different with treatment K_2 . The mean of preference level on the aroma of treatment K_2 is 2.65, which is higher in compared with the mean of treatment K_1 , which is 2.1 or classified as moderately like. Aroma is defined (Anonym, 1959) as the mixture of integrated experience that consists of sensation of taste, aroma, and concentration. In the context of *cuko pemppek*, it is the sensation of taste and aroma.

The Effect of Concentration of Kecombrang's Flower Flour and Storage Duration on the Taste of Cuko Pemppek

The result of the Multiple Range Test analysis showed that the concentration (K) of *kecombrang's* flower flour (K) has very significant effect on the taste of *cuko pemppek* for storage duration on day-30 (T_{30}). Meanwhile, the treatment of concentration on the taste of *cuko pemppek* is insignificantly different for storage duration on day-0 (T_0) and day-6 (T_6).

Table 8. Results of Duncan's Multiple Range Test (DMRT) on the effect of concentration on the taste of *cuko pempek* (%) on day-30 (T_{30})

Concentration	Average	Distance	Critical Range	DMRT _{0.05}
K ₁	1.75000	-	-	a
K ₂	2.55000	2	0.1921	b

Description: Numbers followed with different letters are significantly different.

Based on DMRT analysis in Table 8, in the storage duration of 30-days (T_{30}), the taste of *cuko pempek* in treatment K₁ is significantly different from treatment K₂. The mean of taste preferences on treatment K₂ (concentration 2.5% of *kecombrang's* flower flour) is 2.55, which is higher than the mean of treatment K1 treatment (concentration 2%) with the mean of 1.75, or classified as moderately like. Barrett *et al.*, (2010) claimed that flavor is the unified perceptual experience. There are five basic components of taste, namely sweet, salty, sour, bitter and savory (*umami*). In *cuko pempek*, sour is typical flavor, hence consumers (panelists) prefer K₂.

CONCLUSION

Based on the findings of the study on the concentration of *kecombrang's* flower flour on *cuko pempek*, it can be concluded as follows:

1. The treatment of the concentration of *kecombrang's* flower flour is insignificantly different on the level of pH and the color of *cuko pempek*.
2. The treatment of the concentration of *kecombrang's* flower flour is significantly different on total acid of *cuko pempek* for the initial storage period of day-0 (T_0), day-6 (T_6), day-9 (T_9), and day-30 (T_{30}); had a very significant effect on total acid of *cuko pempek* for storage duration of day-3 (T_3), but insignificant on other storage durations.
3. The treatment of concentration of *kecombrang's* flower flour is very significantly different on the aroma and taste of *cuko pempek* for 30 days (T_{30}) of storage duration, but insignificantly different on other storage durations.
4. Mean pH and total acid of *cuko pempek* for 30-days of storage duration are 4.14 and 0.67%, respectively.
5. Mean of organoleptic assessment by panelists on the color is 3.27; aroma is 3.02 or classified as like, and taste is 2.88 or classified moderately like.
6. The most optimal treatment in using *kecombrang's* flower flour in *cuko pempek* is the concentration of 2.5% and to serve it before 30 days.

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