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Physicochemical and Sensory Characteristics of Cuko Pempek with The Addition of Organic Acid

Friska Syaiful*, Tian Nabila Maharani, Merynda Indriyani Syafutri

Agricultural Technology Study Program, Faculty of Agriculture, Universitas Sriwijaya, Jl. Raya Palembang Pabumulih Km. 32 Indralaya Ogan Ilir, South Sumatra, Indonesia.

*Corresponding author (friskasyaiful@fp.unsri.ac.id)

Abstract

Cuko pempek is the accompanying sauce when consuming pempek. One of the ingredients used to make cuko is acid. This study aimed to see the effect of using several types of organic acids on the physicochemical and sensory characteristics of cuko. The analysis method used a Factorial Completely Randomized Design with two treatment factors, namely acid type (tamarind, kandis acid, key lime) and acid concentration (5% and 10%), Viscosity, pH, total acid, total soluble solids and hedonic test on taste and aroma were analyzed in this study. The results showed that the type of acid had a significant effect (α=0.05) on viscosity, pH, and total soluble solids. Meanwhile, acid concentration significantly influenced pH, total acid, and total solids. Sensory test showed that acid type and acid concentration significantly influenced the flavor and aroma of cuko pempek. Based on sensory analysis, panelists preferred cuko with low concentration of tamarind and kandis acid added, namely 5% acid.

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Introduction

Pempek is one of Palembang's specialties that is now known throughout Indonesia. Pempek is made from ground fish meat and tapioca as the main ingredients, added with water and spices (Wargadalem et al., 2023). The variations of pempek that exist today are caused by differences in additives, filling shapes, cooking methods, and serving methods (Surya et al., 2023). Pempek will be more delicious if eaten together with the sauce commonly called cuko pempek. Cuko pempek is a thick sauce that has a sweet and sour taste and is spicy with a slight aroma of spices (Muchsiri et al., 2016). The distinctive flavor of pempek vinegar is determined by the ingredients used, namely brown sugar, acetic acid (table vinegar), garlic, and cayenne pepper (Muchsiri & Alhanannasir, 2018). The addition of acetic acid in making cuko pempek aims to give a sour taste to the cuko. At certain concentrations, acetic acid can also function as a preservative (Yin et al., 2021). Acetic acid can inhibit the growth of mold and pathogenic bacteria in bakery and pickle products (Yuliana et al., 2014) (Yuliana et al., 2014). However, the use of synthetic food additives must comply with the minimum permissible limit, because it can have a negative effect (Bruna et al., 2018). Excessive use of acetic acid and citric acid can cause dental disorders (Dewi et al., 2020).

Some natural ingredients can also be used as a source of acid in making cuko pempek. Kecombrang flower powder as a substitute for acetic acid in cuko pempek significantly affects the properties (chemical and sensory) of cuko pempek (Muchsiri & Alhanannasir, 2018). The use of Yakult fermented milk as an acid source has also been done to produce probiotic cuko pempek (Muchsiri et al., 2018). Another study used lactic acid in making cuko pempek (Muchsiri et al., 2016).

Other sources of acid are tamarind, kandis acid, and key lime. These three types of acid are often used as seasonings in cooking, mixtures in herbal medicine, and confectionery products as well as various drinks, as a sour flavor and to improve aroma (Harjadi et al., 2022), (Zulfikar et al., 2023). The use of kandis tamarind as a chicken marination seasoning has a significant effect on the flavor and tenderness of chicken meat (Patliani & Purbasari, 2021; Patriani & Hesti Wahyuni, 2020). In addition, tamarind and kandis acid are also widely used in the pharmaceutical industry. Both the flowers, seeds, leaves, and fruits contain bioactive components that function as antimicrobial, anti-inflammatory, and antidiabetic (Tamarindus, 2022; Chimsah et al., 2020) (Putri et al., 2021). The dominant organic acid content

found in tamarind, kandis acid and key lime is citric acid (Bagabaldo et al., 2021) and tartaric acid (Ahmed et al., 2022).

Antimicrobial effects were also found in several types of organic acids. Tamarind pulp extract and kandis acid are known to have antioxidants and antimicrobial potential (Uddin et al., 2016; Nguyen et al., 2021). The addition of kandis acid in several types of products, such as juice and pickle, can maintain product stability and extend its shelf life (Gopakumar & M S, 2014). The aim of this study was to analyze the effect of natural acids on the physicochemical and sensory properties of cuko pempek.

Materials and Methods

Materials

The materials used for making cuko pempek in this study are tamarind, kandis acid, key lime, brown sugar, cayenne pepper, and garlic obtained from traditional markets in Palembang city. While the materials for analysis are 0.1 N NaOH solution, phenolphthalein indicator, buffer solutions 4, and 7 and distilled water.

The tools used in this research were analytical scales, dropper pipettes, aluminium foil, Erlenmeyer, beaker glass, vortexes, Viscometer NDJ-8S, pH meter Eutech Instruments, and Hand Refractometer Atago Japan.

Experimental Design

This research was conducted at the Chemistry, Processing and Sensory Laboratory of Agricultural Products, Agricultural Product Technology Study Program, Faculty of Agriculture, Universitas Sriwijaya. The research used a Randomized Group Factorial Design with two factors, namely the type of acid (factor A) and acid concentration (factor B), Factor A consisted of tamarind, kandis acid, and key lime, whereas acid concentration consisted of 5% and 10%. Each treatment was repeated 3 times. The parameters observed in this study were viscosity, pH, total acid, total soluble solids and sensory (taste and aroma) of cuko pempek.

Preparation of Cuko Pempek

250 g palm sugar was pulverized. 500 mL of water was heated to boiling then palm sugar was added and cooked for 2 minutes. The palm sugar solution was filtered to separate impurities from the palm sugar. Cayenne pepper (50 g), garlic (25 g), salt (5 g) that have been mashed are included in the palm sugar solution. The mixture of palm sugar solution and ingredients is heated again for 5 minutes, stirring gently until all ingredients are mixed to form cuko pempek. The cuko pempek is filtered and cooled to 50°C. Then, acid is added (according to the treatment). The pickling ingredients were included in the cuko pempek according to the treatment (Muchsiri et al., 2020).

Determination of Viscosity

Before the measurement was taken, the spindle is determined. Measurements were taken randomly to determine the appropriate spindle for the sample solution. If the results of large-scale readings, above 100, a small spindle diameter is selected, and if the scale measurement results are less than 10, a large diameter spindle is selected (Delgadillo et al., 2017).

Determination of pH

The pH-meter electrode was calibrated using acidic buffer solution (pH 4) and neutral buffer (pH 7), then cleaned using distilled water. Samples were taken as much as 10 mL and then placed into a glass beaker. The electrode is dipped into the sample, and the electrode is left until a stable reading is obtained (Patil et al., 2020).

Determination of Total Acid

Samples as much as 10 mL, put in a 100 mL measuring flask, and added aquadest to the line mark. The solution was filtered, and 10 mL of phosphate was taken. Added 1% phenol pthalein (pp) indicator as much as 3 drops. Subsequently titrated with 0.1 N NaOH solution until a constant pink color is seen. Total acid is calculated using the following formula (AOAC, 1995).

$$Total\ acid\ (\%) = \frac{N \times V \times B \times Fp}{W}$$

Where:
N (NaOH, Normality)
V (NaOH volume)
B (citric acid molecular weight)
Fp (dilution factor)
W (sample weight)

Determination of Total Dissolved Solids

The sample was filtered and taken with a dropper pipette. It was then dripped onto the refractometer lens. The Brix value (%) indicates the value of total dissolved solids (sugar content) in the sample (Condro & Stefanie, 2022).

Hedonic Analysis

Hedonic analysis was conducted by 25 semi-trained panelists on the flavor and aroma parameters of pempek vinegar. The scoring scale used was 1 = strongly dislike; 2 = dislike; 3 = like; and 4 = strongly like.

Table 1. The effect of type of acid on viscosity, pH value, and total soluble solids of cuko pempek.

Type of acid	Viscosity (mPa.s)	pH value	TSS (°Brix)
Tamarind	2.24±0.08 [b]	3.64±0.27 [c]	34.10±0.76 [a]
Kandis acid	2.11±0.06 [a]	3.30±0.20 [a]	35.58±0.66 [c]
Key lime	2.12±0.04 [a]	3.61±0.18 [b]	34.95±0.55 [b]

*Different lowercase superscript indicates a significant difference ($p<0.05$) within the same column.

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Table 2. The effect of acid concentration on total acid, pH value, and total soluble solids of cuko pempek.

Acid concentration	Total acid (%)	pH value	TSS (°Brix)
5%	28.39±0.11 [a]	3.32±0.18 [a]	34.03±0.83 [a]
10%	35.44±0.13 [b]	3.72±0.16 [b]	35.70±0.59 [b]

*Different lowercase superscript indicates a significant difference ($p<0.05$) within the same column.

Statistical Analysis

The data obtained were processed statistically using analysis of variance (ANSIRA). Treatments that have a significant effect will be tested further with the Honest Real Differences (BNJ) test at the 5% level.

Results and Discussion

Viscosity

The average viscosity of cuko pempek with the addition of tamarind, kandis acid, and key lime ranged from 2.08 - 2.29 mPas. Further test results showed that the type of acid added had a significant effect on the viscosity of cuko pempek.

In this study, the viscosity of cuko added with tamarind was higher and significantly different from other types of organic acids (Table 1). This is because tamarind extract contains water-soluble particles such as reducing sugars and organic acids (Altuhami et al., n.d.) and mineral salts (Adamu Ishaku et al., 2016) that can increase the viscosity of cuko pempek.

The viscosity value of cuko pempek in this study was lower than the viscosity of fish sauce, which ranged from 10.81 -14.80 mPas (Witono et al., 2014). This is because in the manufacture of fish sauce, thickeners are added, such as red sugar (30%) and caramel (10%).

pH value

The pH value of cuko pempek in this study ranged from 3.12 to 3.88. Cuko with kandis acid addition had the lowest pH value and was significantly different from the other acid types (Table 1). This is because kandis acid has more acid content than tamarind and key lime. The dominant type of acid in kandis acid is Hydroxy citric acid (HCA). The results of preliminary analysis also show that kandis acid has a lower pH value of 2.05, then lime with a pH value of 2.54, and tamarind 2.78.

Total acid

The total acid value in kandis acid (33.62%) is higher than tamarind and key lime (31.06%). This result is in line with the pH value of cuko pempek, where the lower the pH value means the more organic acids in the cuko. However, further test results showed that the total acid in the three types of acid was not significantly different. The difference was more determined by the concentration of acid added to the cuko (Table 2). The dominant acids in kandis acid are HCA (7.95%), HCA-Lactone (3.27%), and citric acid (0.13%) (Bheemaiah & Kushalappa, 2019).

The types of dominant acids found in tamarind, kandis acid, and key lime are different. Tamarind contains greater amounts of tartaric acid, compared to citric acid, ascorbic acid, and malic acid (Ahmed et al., 2022). While the dominant acids of kandis acid are hydro citric acid (HCA), HCA-Lactone, and citric acid (Bheemaiah & Kushalappa, 2019). Kalamansi orange are rich in ascorbic acid and citric acid.

Total Soluble Solid

The total soluble solids value of cuko with kandis acid addition was higher and significantly different from tamarind and key lime (Table 1). The addition of kandis acid to cuko pempek causes a strong acidic atmosphere in the cuko, which allows the hydrolysis of carbohydrates (starch) into simple sugars, so that it can be measured as total soluble solids.

Hedonic analysis

Testing was conducted to assess the acceptability and preference of a product by measuring the sensory attributes of taste and aroma. Panelists will provide feedback on their personal likes and dislikes of the product. The hedonic test scores on the aroma of cuko pempek ranged from 2.12 (not good)-3.08 (good). Meanwhile, the scores for flavor were 1.80 (dislike) - 3.08 (like) (Table 3).

Panelists gave a favorable rating on the sensory taste of cuko added with 5% key lime, which was not significantly different from 10% key lime, and 10% tamarind. Almost the same assessment for sensory aroma, where panelists preferred the aroma of cuko added with kandis acid and tamarind. This is because tamarind and kandis acid are good sources of acid and are often added to foods and beverages to give a refreshing impression and sour aroma.

Table 3. Score of taste and flavour of cuko pempek.

Treatment	Taste	Aroma
Tamarind (5%)	2.60^{bc}	3.08^{b}
Tamarind (10%)	2.20^{ab}	2.88^{b}
Kandis acid (5%)	3.08^{c}	2.96^{b}
Kandis acid (10%)	2.76^{c}	3.00^{b}
Key lime (5%)	2.16^{ab}	2.72^{b}
Key lime (10%)	1.80^{a}	2.12^{a}

*Different lowercase superscript indicates a significant difference ($p<0.05$) within the same column.

Conclusion

Based on the result, the addition of tamarind, kandis acid, and key lime affects the viscosity, pH, total acid and total soluble solids of cuko pempek. panelists preferred the taste and aroma of cuko pempek, additional with tamarind and kandis acid. Further research needs to be done to see the effect of the addition of these natural acids on the shelf life of cuko pempek.

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