SURUHAN (*Peperomia pellucida* L. Kunth) AND SENGGANI (*Melastoma malabathricum* L.) LEAVES AS NATURAL ANTIOXIDANT FOOD ADDITIVE

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Abstract: Food additives are components that affect the nature and/or shape of food. One of them is antioxidants added to food products that contain oil to prevent oxidation that causes damage to food ingredients characterized by rancid aroma. Suruhan (*Peperomia pellucida* (L.Kunth) and Senggani (*Melastoma malabathricum* L.) leaves are used as natural antioxidants to prevent such damage. This study aims to determine the class of compounds in both plant extracts, their antioxidant activity, and the effect of adding these extracts to bulk cooking oil. The extraction of Suruhan and Senggani leaves is carried out using a maceration with ethanol. In phytochemical tests, both Senggani and Suruhan leaf extracts showed positive results in containing flavonoids, tannins, phenolics, and saponins. Antioxidant activity test using the DPPH method (*2,2-diphenyl-1-picrylhydrazyl*) measured absorption at a maximum wavelength of 518 nm and compared with antioxidant synthesis TBHQ (*tert-butyl hydroquinone*). The results showed that Suruhan and Senggani leaves had moderate antioxidant activity with IC_{50} values of 131.5575 and 119.0362 ppm, respectively. The two extracts with the highest inhibitory value of 38.3657% were then applied to bulk cooking oil, which was heated at 60°C and 180°C and compared to the addition of TBHQ to bulk cooking oil. The results showed that the natural antioxidants of Suruhan and Senggani leaf extracts could inhibit damage to bulk cooking oil during the heating process by reducing the peroxide number and free fatty acid levels in bulk cooking oil.

Keywords: antioxidant; Senggani leaves; Suruhan leaves; DPPH; bulk cooking oil

Abstrak: Bahan tambahan pangan merupakan komponen yang ditambahkan untuk mempengaruhi sifat dan atau bentuk suatu bahan pangan. Salah satunya adalah antioksidan yang ditambahkan pada produk pangan yang mengadung minyak dengan tujuan mencegah oksidasi penyebab rusaknya bahan pangan yang ditandai dengan aroma tengik. Daun suruhan (*Peperomia pellucida* (L.) Kunth) dan senggani (*Melastoma malabathricum* L.) digunakan sebagai antioksidan alami dalam mencegah kerusakan tersebut. Penelitian ini bertujuan untuk mengetahui golongan senyawa yang terkandung dalam kedua ekstrak tanaman, aktivitas antioksidan dan pengaruh penambahan ekstrak tersebut pada minyak goreng curah. Ekstraksi daun suruhan dan senggani dilakukan

dengan metode maserasi menggunakan etanol. Pada uji fitokimia baik ekstrak daun senggani maupun suruhan menunjukan hasil positif mengandung flavonoid, tanin, fenolik, dan saponin. Dan hanya daun suruhan yang mengandung steroid. Uji aktivitas antioksidan menggunakan metode DPPH (*2,2-diphenyl-1-picrylhydrazil*) diukur serapan pada panjang gelombang maksimum 518 nm dan dibandingkan dengan antioksidan sintesis TBHQ (*tert-butyl hydroquinon*). Hasil penelitian menunjukan bahwa daun suruhan dan senggani memiliki aktivitas antioksidan yang sedang dengan nilai IC_{50} berturut-turut sebesar 131,5575 dan 119,0362 ppm. Kedua ekstrak dengan nilai inhibisi tertinggi yaitu 38,3657% selanjutnya diaplikasikan pada minyak goreng curah yang dilakukan pemanasan pada suhu 60˚C dan 180˚C serta dibandingkan dengan adanya penambahan TBHQ pada minyak goreng curah. Hasil penelitian menunjukan bahwa antioksidan alami ekstrak daun suruhan dan senggani dapat menghambat kerusakan pada minyak goreng curah selama proses pemanasan berlangsung dengan menurunkan bilangan peroksida dan kadar asam lemak bebas pada minyak goreng curah.
Kata kunci: antioksidan; daun senggani; daun suruhan; DPPH; minyak goreng curah.

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Introduction

Cooking oil is one of the basic needs in Indonesia because cooking oil is used as a conductor in cooking and processing food. In addition, cooking oil also plays an important role in providing a crispy texture to food (Jounki and Khzaei, 2022; Wang et al, 2021). As a widely used commodity, consumers pay close attention to the quality factor of cooking oil (Latino et al, 2022; Nam et al, 2020). This quality is influenced by the fat content, smoke point, and how it is processed (Brinkmann, 2000). Therefore, understanding the types of cooking oil is important in choosing safe and healthy products (Wiege et al, 2020; Ma et al, 2021).

Choosing the right type of cooking oil can affect health, as each has a different fatty acid content. Oils that are high in unsaturated fat content are better for heart health compared to oils that are rich in saturated fat (Sacks, 2020). For example, olive oil and canola oil have high levels of unsaturated fats. Meanwhile, coconut oil and palm oil contain more saturated fat (Boateng et al, 2016). Understanding the content of fatty acids is important to maintain a balanced fat intake in the daily diet (Zhang et al, 2021; Bobinski and Bobinska, 2022).

In general, oil preservation uses synthetic antioxidants such as anisol hydroxyl butilated (BHA), hydroxy toluene butyl tertiary (BHT), and hydroxyl kinonene butilated tertiary (TBHQ). These antioxidants function to slow down the oxidation process that can cause rancid oil (Ribeiro et al, 2019). The use of synthetic antioxidants in cooking oil is also aimed at extending the shelf life of the product (Erickson et al, 2023; Wang et al, 2022). However, these substances are often a concern due to the potential for side effects if consumed in large amounts (Yeo et

al, 2020; Kornienko et al, 2019). Even so, its use is strictly regulated by the food control agency to ensure consumer safety.

The use of synthetic antioxidants is often also used for other food commodities, such as bakery products, snacks, and frozen foods. These products are susceptible to oxidative damage, especially those containing fat. With the presence of antioxidants, the quality and taste of food are maintained for longer. However, consumers need to remain vigilant against excessive intake of these ingredients. Choosing food products with low preservative content or natural ingredients can be a healthier choice.

The use of synthetic antioxidants, if consumed, will be harmful to the body as it can cause bladder tumors and stomach cancer. Research shows that the consumption of substances such as BHA and BHT in large doses risks triggering the growth of cancer cells in animals (Xu et al, 2021). Therefore, it is important to limit the consumption of foods that contain synthetic antioxidants. Food regulatory agencies set safe limits for the use of these substances, but consumers still need to be cautious. Choosing fresh food with minimal preservatives can be a wise step in maintaining health (Lichtenstein et al, 2021).

In the short term, the use of synthetic antioxidants can cause skin rashes, hives, headaches, and others. Allergic reactions to these substances often occur in individuals who are sensitive to certain chemicals (Liu and Mabury, 2020). The symptoms may be mild, but they can interfere with daily comfort. In addition, repeated short-term exposure can increase the risk of more serious reactions. Therefore, consumers should be aware of signs of sensitivity to foods containing synthetic antioxidants.

The use of synthetic antioxidants also, if consumed, will interfere with health in the long term. Long-term effects such as liver damage, hormonal disruptions, and decreased immune system function have been found in several animal studies (Wang et al, 2021). Although there is no strong evidence in humans, potential risks remain if consumed continuously for a long period of time. Therefore, it is important to consider safer alternatives. Reducing the consumption of processed foods and choosing natural foods is one way to avoid health disorders risk (Elizabeth et al, 2020; Popkin et al, 2021; Touvier, 2020).

Indonesian people have not widely utilized the use of natural antioxidants such as Suruhan leaves (*Peperomia pellucida* (L.) Kunth) and Senggani leaves (*Melastoma malabathricum* L.). Both of these plants have the potential to be a source of natural antioxidants that are safe to consume (Rahman et al, 2023; Zafar et al, 2023; Jideani et al, 2021). Research shows that extracts from these leaves are able to fight free radicals and slow down the oxidation process. The use of these natural antioxidants is not only safer, but also environmentally friendly. Further education is needed so that people switch to natural ingredients in maintaining food health.

This study aims to determine the antioxidant activity of the Suruhan *(Peperomia pellucida* (L.) Kunth) and Senggani (*Melstoma malabathricum* L.) leaf extract. This antioxidant activity has the potential to be a natural antioxidant in bulk cooking oil, so it can be used as a food additive parameter to improve the quality of bulk cooking oil. The addition of natural antioxidants to bulk cooking oil will be compared to bulk cooking oil without the addition of antioxidants and bulk cooking oil with the addition of synthetic antioxidant TBHQ (tertiary butylated hydroxyl quinone), the quality of which is known by determining the level of free fatty acids and peroxide numbers.

Methodology

Material

The materials to be used in this study are Suruhan leaves (*Peperomia pellucida* (L.) Kunth) and Senggani (*Melastoma malabathricum* L.) obtained from Karawang, West Java, and determined by the Biology Department, Faculty of Science and Technology, UIN Sunan Gunung Djati, ethanol, Whatmann filter paper (no. 42), DPPH (pa, Sigma Aldrich), acetic acid 0.1 M (pa, Merck), aquades, potassium iodide (pa, Merck), $Na_2S_2O_3$ (pa, Merck), chloroform (pa, Merck), amylum (pa, Merck), bulk cooking oil, $FeCl_3$ (pa, Merck), HCl (pa, Merck), NaOH (pa, Merck), methanol (pa, Merck), and phenolftalein indicator (pa, Merck).

Instrumentation

UV-Vis spectrophotometer (Thermo Scientific).

Procedure

Simplisia preparation

Simplisia was made by taking 500 grams of each Suruhan and Senggani leaf. Then, the leaves were washed, chopped, and dried using the dry method of aeration. After that, they were mashed and sifted.

Extraction

Sample extraction using the maceration method was used for the extraction of samples. As much as 100 grams of Suruhan and Senggani simplisia is macerated with 500 mL of ethanol solvent. Maceration was carried out for seven days, and the solvent was changed every 24 hours. Then, another 250 mL of ethanol solvent was added on the second to the seventh day. Stirring was carried out every three times a day. The maceration results were filtered, then the filtrate was concentrated using a rotary evaporator vacuum and water bath at 40 °C until a thick extract was obtained.

Phytochemical tests

Phytochemical tests performed include phenolic tests, flavonoids, tannins, saponins, and steroids. The phenolic test was performed by reacting a 1% $FeCl_3$

solution with the sample. A positive result is indicated by a color change to dark black. The flavonoid test was performed by adding Mg powder and HCl, which reduce the benzipyrone nucleus in the flavonoid structure, resulting in a red or orange color change. The steroid test was performed by adding chloroform, acetic anhydride, and concentrated sulfuric acid to the sample. If a color change occurs and a blue-green ring forms, the sample contains steroids. The saponin test was performed by identifying the formation of foam after the addition of distilled water and HCl, followed by shaking. The saponin test can also be performed using the Lieberman-Burchard method (3 drops of acetic anhydride and 1 drop of concentrated H_2SO_4), which is a characteristic test for unsaturated sterols (steroids) and terpeneoids. The Lieberman-Burchard method produces a brown-purple color indicating triterpenes, and a blue-green color indicating steroid saponins.

Determination of maximum wavelength

DPPH 50 ppm solution was pipetted as much as 3.5 mL, added with 0.5 methanol, homogenized, and left at room temperature in a dark place for 30 minutes. Furthermore, the absorbance was measured with a UV-Vis spectrophotometer at a 400-800 nm wavelength with a blank, namely methanol.

Control measurement

The test was carried out by piping 3.5 mL of DPPH, adding 0.5 mL of methanol p.a, homogenizing, and leaving it at room temperature in a dark place for 30 minutes. Its absorbance is measured at the maximum wavelength.

Measurement of antioxidant activity

The test was carried out by pickpocketing 0.5 mL of sample solution of various concentrations (10 ppm, 30 ppm, 50 ppm, 70 ppm, and 90 ppm.). Then, each was added with 3.5 mL of DPPH. The mixture was then homogenized and left at room temperature in a dark place for 30 minutes. The absorbance was measured at the maximum wavelength. The same method was used to measure antioxidant activity in comparison (TBHQ synthetic antioxidants). The percentage of antioxidant activity is calculated using the following formula:

$$\% \text{ inhibitions} = \times 100\% \frac{\text{A control} - \text{A sample}}{\text{A control}} \quad \text{.....(1)}$$

In determining the IC_{50} value (*Inhibitory Concentration* 50%), the extract or antioxidant comparison (TBHQ) sample concentration and the percent inhibition are plotted; the x-axis was the concentration, and the y-axis was the percent inhibition. Then, the linear equation (y = ax + b) obtained was used to determine the value of IC_{50} by expressing the value of y as 50 and x as the value of IC_{50}.

Antioxidant testing on bulk cooking oil

One hundred mL of bulk cooking oil was put into a beaker and heated to a temperature of 60° C using a hotplate to begin the test. Next, put Senggani leaf

extract with the highest antioxidant power while stirring. The temperature was maintained for 15 minutes. Then, the beaker was removed from the hotplate and cooled at room temperature. The same was done in the bulk cooking oil control solution without administering senggani leaf extract and synthetic antioxidant comparison (TBHQ) heating at 180°C (Brinkmann, 2000).

Free fatty acid analysis

Prepare bulk cooking oil (5 grams) in Erlenmeyer 250 mL, then add 25 mL of 96% ethanol, heat it using a water bath for 10 minutes, and cool. After that, add two drops of phenolphthalein indicator, titrated with 0.1 N NaOH solution (which has been standardized) until a fixed pink color was formed (Wiege et al, 2020). The same was done on blank and cooking oil solutions with TBHQ synthesis antioxidants. Free fatty acid levels can be determined with the following formula:

$$\%FFA = \frac{mL\ NaOH \times N\ NaOH \times BM}{g \times 1000} \times 100 \quad \text{...} (2)$$

Analysis of the number of peroxides

Peroxide number analysis was performed based on the AOCS Cd8-53 method. Bulk cooking oil was prepared as much as 2.5 grams, each put into Erlenmeyer 250 mL, and the solvent CH_3COOH-$CHCl_3$ was added as much as 15 mL (3: 2). A saturated KI solution of 0.5 mL was added to the solution. Allow it to stand for 1 minute while occasionally shaking it. Next, 15 mL of aquades was added to the solution and titrated with 0.05 N Na2S2O3 until the yellow color almost disappears. A starch solution (1%) was added as much as 0.5 mL as an indicator and titrated again until the blue color disappears. The same was done for the titration of blanks and oils with TBHQ synthesis antioxidants (Higea,2016). The peroxide number can be calculated using the following formula:

$$\text{Number of peroxides} = \frac{Volume\ titrasi\ (mL) \times N\ Na2S2O3\ (meq/mL)}{massa\ sampel\ (gram)} \times 1000\ \frac{gram}{Kg} \ldots (3)$$

Organoleptic test

The purpose of the organoleptic test was to observe color, aroma, taste, and texture. Organoleptic testing was carried out by frying crackers using bulk cooking oil without the addition of senggani leaves (sample 1) and with the addition of senggani leaves (sample 2). Then, the crackers from the frying pan were used to conduct organoleptic testing on 15 panelists.

Results and Discussion

Suruhan and Senggani Leaf Sample Extraction

In this study, the two leaf samples were first dried by the wind-dry method to prevent microbes' growth so that they could be stored longer and the active compounds were not damaged. The dried leaves of suruhan and senggani are smoothed to increase the surface area to make the extraction process more optimal.

The extraction method used is the maceration method. This method is more straightforward because it simply immerses the sample using the solvent at room temperature for several days until the resulting filtrate is close to colorless, meaning that the solvent has attracted the active compound from the cell.

(a) ***(b)***

Figure 1. Suruhan (*Peperomia pellucida* (L.) Kunth) (a) and Senggani (*Melastoma malabathricum* L.) (b)

Maceration extraction is done for seven extractions to maximize the active compounds extracted. The suruhan and senggani leaf extracts were thick green extracts of 12.1969 and 14.333%, respectively.

Phytochemical Test

Phytochemical tests are carried out to determine what secondary metabolite compounds are found in the leaves of suruhan and senggani. The phytochemical test results of suruhan and senggani leaves (**Table 1**) showed positive results against secondary metabolite compounds of phenolic groups, flavonoids, tannins, and saponins, while steroids only appeared on Suruhan leaves.

Table 1. Phytochemical test results of suruhan and senggani leaves

Test	Positive results according to the literature	Senggani Leaves	Suruhan Leaves
Fenolik	A black solution is formed	+	+
Flavonoid	A red-orange solution is formed	+	+
Tanin	A blackish-green solution is formed	+	+
Saponin	Formed stable foam	+	+
Steroid	A blue solution is formed	-	+

Antioxidant Activity Test

Antioxidant activity on suruhan and senggani leaves is tested using the DPPH method. This test uses a UV-Vis spectrophotometer by making a 500 ppm sample stock solution and then making it into various concentration variations, such as 10, 30, 50, 70, and 90 ppm. The solution is then pipetted as much as 0.5 mL and added with DPPH 50 ppm as much as 3.5 mL. Then, it is homogenized and left in a dark place for 30 minutes so that the sample can react optimally with DPPH. The literature suggests that DPPH takes about 15-30 minutes to react perfectly. Preparing DPPH solution and reacting DPPH with samples are carried out in a dark

place to minimize damage because DPPH is quickly damaged when exposed to light.

Before testing the antioxidant activity, the maximum wavelength is determined by measuring the absorbance of a 50 ppm DPPH solution at a wavelength of 400-800 nm. This measurement creates a curve between the wavelength as the x-axis and the absorbance as the y-axis. The maximum wavelength can be seen from the highest peak on the graph (**Figure 2**) at a wavelength of 518 nm.

DPPH is a free radical with unpaired electrons on its nitrogen atom, so it has a purple complementary color. The addition of antioxidants aims to donate hydrogen atoms so that DPPH radicals can be stabilized, characterized by the fading of purple color to yellow. Adding 10 and 30 ppm and 50, 70, and 90 ppm of TBHQ concentrations has changed the color to light purple and yellow, respectively. In contrast, it requires 90 ppm of senggani leaf extract to make the DPPH solution change color to light purple.

After measuring absorbance in controls and samples using a UV-Vis spectrophotometer, the absorbance results were used to determine the percentage of antioxidant inhibition in inhibiting DPPH radical activity. The percentage of antioxidant inhibition or activity shows the number of hydrogen atoms donated by antioxidant compounds to the DPPH radical so that it is reduced to DPPH.

Table 2. Antioxidant activity test result data

Concentration (ppm)	Concentrationse Inhibisi (%)		
	Senggani leaves	Suruhan Leaves	TBHQ
10	7.7981	22.7222	14.6186
30	13.4091	26.1621	43.5494
50	23.0527	33.5148	72.2295
70	31.1805	37.4898	93.6865
90	38.3657	38.8992	96.8397

Table 2 illustrates that the higher the concentration of antioxidants added, the higher the percentage value of inhibition. The results showed that TBHQ synthetic antioxidants had a higher percentage of inhibition than the two samples. The result of each concentration's inhibition percentage is then made as a curve of the relationship between concentration as the x-axis and the percentage of inhibition as the y-axis.

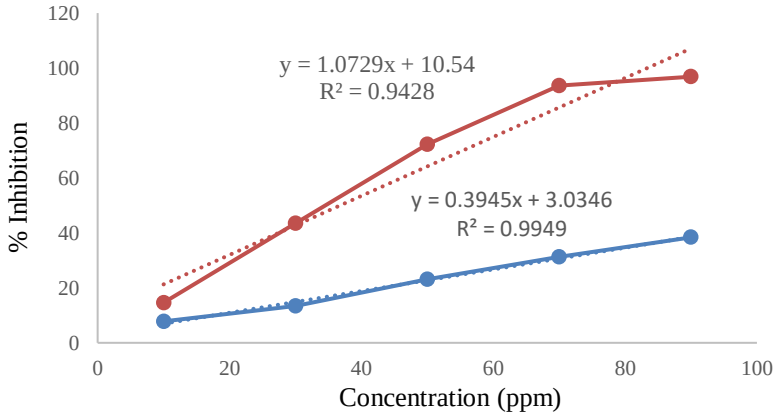

Figure 1. Graph of antioxidant activity of senggani leaves (Blue Line) and TBHQ (Red Line)

From the graph (see **Figure 3**), it can be seen that the value of IC_{50} is obtained from the linear regression equation y = ax + b, where the value of x is the value of IC_{50} and y is the value of 50. The regression analysis can be trusted if the R2 value is close to 1 so that it can be used for further analysis. Ramayani et al. (2013) explained that the classification of antioxidants is divided into 5, namely IC_{50} with a value < 50 ppm very strong antioxidant, the IC_{50} with a value of 50-100 ppm strong antioxidant, IC_{50} value of 100-150 ppm medium antioxidant, IC_{50} value of 150-200 ppm weak antioxidant, and IC_{50} value of >200 ppm is a very weak antioxidant (Wiege et al, 2020).

From the results of the study, IC_{50} values of the suruhan leaf extract obtained were 131.5575, and the senggani leafe extract was 119.0362 ppm, which means that both samples of suruhan and senggani leaves have moderate antioxidant activity. The IC_{50} TBHQ value is 36.7788 ppm, which means TBHQ has very strong antioxidant activity. The IC_{50} value shows that TBHQ synthesis antioxidants are better than natural antioxidants in reducing DPPH radicals. This result is because the industry primarily makes TBHQ an antioxidant. At the same time, the leaves of suruhan and senggani contain other compounds that are not antioxidants, causing the antioxidants to be lower than TBHQ.

Table 3. IC_{50} value data on antioxidant activity

Sample	IC_{50} (ppm)
Suruhan Leaves	131.5575
Senggani leaves	119.0362
TBHQ	36.7788

Application to Bulk Cooking Oil

Extracts of suruhan and senggani leaves are applied to bulk cooking oil. The choice of bulk cooking oil is based on the number of people still using it compared

to packaged cooking oil because it is cheaper. However, oxidation and hydrolysis processes make this bulk cooking oil more easily damaged.

From the results of the antioxidant activity test, the sample with the highest antioxidant activity is that with a concentration of 90 ppm. In this study, a sample of 9 mg was added to 100 mL of bulk cooking oil, and the same was done in the TBHQ comparison. In the preparation stage, samples (oils and antioxidants) were heated at 60°C and 180°C for 15 minutes. The heating temperature of 60°C is an *accelerated stability test* as a simulation of cooking oil storage, and the heating temperature of 180°C is a simulation of the frying process in general (Ayucitra et al 2013). In addition, the bulk cooking oil was heated without adding antioxidants at 60 ° C and 180 ° C for 15 minutes as a control. The prepared bulk cooking oil was tested for quality with free fatty acid test parameters and peroxide number.

Determination of Free Fatty Acids

Determination of free fatty acid levels is used in determining oil quality because the higher the free fatty acids, the lower the oil quality. The determination of free fatty acids is carried out by the principle of alkalimetry. The principle is based on the neutralization reaction due to a reaction between hydrogen ions derived from free fatty acid compounds in oil and hydroxide ions derived from bases used as titrants. In this study, NaOH was used as a titrant.

Alcohol was used to dissolve the fat or oil in the sample to react with NaOH through heating, so the reaction occurred faster. The alcohol used was neutral as acidic or non-neutral alcohol will react with NaOH, generating titrate-free fatty acids in oil and titrate acids in alcohol. Therefore, such a reaction will produce inaccurate data, which should be avoided.

The measurement of free fatty acid (FFA) levels in bulk cooking oil without heating and the addition of antioxidants (initial oil) is 0.3071%. From the data obtained, it can be seen in **Table 4** that all samples that go through the heating process have free fatty acid levels that are not in accordance with the Indonesian National Standard (SNI), exceeding 0.3%. However, adding antioxidants to bulk cooking oil reduces free fatty acid levels even though the value still exceeds the SNI limit. According to the literature, further peroxide degradation from rancidity processes can form other volatile compounds such as aldehydes, ketones, and free fatty acids. Therefore, the presence of antioxidants can further suppress the degradation of peroxide, thereby reducing the formation of free fatty acids in bulk cooking oil (Feiner, 2016).

Table 4. Data from free fatty acid analysis

Bulk cooking oil treatment	FFA (%)		Condition SNI 2019
	Warming 60˚C	Warming 180˚C	
Oil without antioxidants	0.5650	0.6604	
Oil + TBHQ	0.3905	0.4847	Max.0.3 %

Bulk cooking oil treatment	FFA (%)		Condition SNI 2019
	Warming 60˚C	Warming 180˚C	
Oil + Senggani leaves	0.4366	0.5005	
Oil+ Suruhan Leaves	0.4800	0.5987	

Designation of the Number of Peroxide

The number of peroxides is a parameter for determining the quality of oil. The number of peroxides indicates the abundance of peroxide compounds with milli-equivalent units in every 1000 grams or 1 kg of oil or fat (Zhang et al, 2021). The SNI 2019 stipulates that the maximum peroxide number in cooking oil is 10 Meq / Kg. The amount of peroxide in cooking oil can be determined based on iodometry, which is a redox reaction between potassium idodia as a reducing agent and peroxide compounds contained in bulk cooking oil as an oxidizer, and the reaction occurs in an acidic atmosphere to release iodine (I_2). The released iodine will then be titrated with sodium thiosulfate ($Na_2S_2O_3$). Sodium thiosulfate is a reducing agent in this reaction, while iodine is an oxidizer.

The peroxide number test is done because the oil contains unsaturated fatty acids that form free radicals if heat and UV light are the initiators. When in contact with oxygen in the air, these free radicals will form active peroxides or highly reactive peroxide radicals. The formation of peroxide radicals will attack other oil-unsaturated fatty acids and then form hydroperoxides and other free radicals (Lempang et al, 2016).

The results of measuring the peroxide number in bulk cooking oil without heating and adding antioxidants (starting oil) are 3.6851 MekO_2 / Kg. The results show that the higher the temperature in the heating process, the higher the number of peroxides because the more unsaturated fatty acids in the oil undergo an oxidation process, the more hydroperoxide is formed **(see Table 5)**. In addition, antioxidants can inhibit the oxidation process so that the peroxide number decreases.

Table 5. Data from peroxide number analysis

Bulk cooking oil treatment	Number peroxide (MekO_2/Kg)		Condition SNI 2019
	Warming 60˚C	Warming 180˚C	
Oil without antioxidants	7.9730	14.1114	
Oil + TBHQ	4.9132	7.9774	≤ 10 MekO_2/ Kg
Oil + Senggani leaves	6.1449	9.8271	
Oil + Suruhan Leaves	6.1556	10.0020	

Organoleptic Test Results

Organoleptic tests were carried out only on senggani leaf extract because the results of the analysis of the number of free fatty acids and peroxides did not differ significantly. This organoleptic test was applied to frying crackers with and

without adding senggani leaves to bulk cooking oil and was carried out on 15 panelists. This organoleptic test aims to determine the effect of adding senggani leaves on the results of frying crackers. Crackers were chosen as frying samples because crackers have a distinctive taste, aroma, color, and texture, so this study wanted to know the differences in taste, aroma, color, and texture of crackers fried with bulk cooking oil adding senggani leaves.

Table 6. Organoleptic test results

Parameter	Crackers from frying with bulk cooking oil		Significance
	No leaves Senggani (S1)	Addition of leaves Senggani (S2)	
Color	4.67 ± 0,488	4.53 ± 0,516	0.473
Aroma	4.73 ± 0,458	4.67 ± 0,488	0.702
Taste	4.73 ± 0,458	4.27 ± 0,799	0.060
Texture	4.73 ± 0,458	4.73 ± 0,458	1.000

Organoleptic results on color, aroma, taste, and texture parameters can be known based on the results of data processing using one-way analysis of variance (ANOVA) with the SPSS (Statistical Package for the Social Sciences*)* application. The organoleptic test results **in Table 6** show that color, aroma, taste, and texture are more significant than the standard (P > 0.05), which means that there is no significant color, aroma, taste, and texture difference between crackers fried in bulk cooking oil with and without the addition of senggani leaves.

Overall, adding senggani leaves to bulk cooking oil does not affect the color, aroma, taste, and texture of frying crackers when senggani leaf extracts are added in small amounts, namely 90 ppm. It is appropriate that antioxidants should have no harmful physiological effects and do not cause taste, aroma, color, and texture changes.

Conclusion

From the results of the study, it can be concluded that based on phytochemical tests contained in the extracts of Suruhan *(Peperomia pellucida* (L.) Kunth) and Senggani (*Melastoma malabathricum* L.) leaves are phenolics, flavonoids, tannins, and saponins. The antioxidant activity of Suruhan *(Peperomia pellucida* (L.) Kunth) and Senggani (*Melastoma malabathricum* L.) leaf extracts is known to have moderate antioxidant activity with IC_{50} values of 131.5575 and 119.0362 ppm, respectively. Extracts of Suruhan *(Peperomia pellucida* (L.) Kunth) and Senggani (*Melstoma malabathricum* L.) leaves have the potential to be developed as natural antioxidants in bulk cooking oil with the ability to reduce free fatty acid levels and peroxide number. The organoleptic test results show there was no significant difference in the taste, aroma, color, and texture of crackers fried with bulk cooking oil, the addition of senggani leaf extract with crackers fried in bulk cooking oil without the addition of senggani leaf extract.

Conflict of Interest

The authors declare that there is no conflict of interest. Role of the author: author 1/corresponding author: conceptualization, methodology, writing, review, editing, and journal submission. Author 2: data curation, checking, and evaluation. Authors 3 and 4: research assistants. Author 5: validation, evaluation, and review.

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