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Innovation of Utilizing Turmeric Leaves (*Curcuma domestica Val*) as an Antioxidant to Improve Used Cooking Oil Quality through Peroxide Number Reduction

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ABSTRACT

The peroxide content found in used cooking oil can be prevented and reduced by adding antioxidants. This condition can improve the quality of used cooking oil, thereby reducing the risk of cancer. Utilizing natural resources in the environment is an alternative that can be used to reduce the use of synthetic materials. One natural material is turmeric leaves, which can be used as an antioxidant. This research aims to investigate the innovation of using turmeric leaves (*Curcuma domestica Val*) as an antioxidant to improve the quality of used cooking oil by reducing its peroxide value. This study employed a pure experimental method. Samples were intervened with turmeric leaf powder at a concentration of 5% for 24 hours, followed by examination of the peroxide value. The research results showed that the average peroxide value before adding turmeric leaves was 7.02 meqO2/kg, while after adding turmeric leaves, the peroxide value in the used cooking oil averaged 5.59 meqO2/kg. This research demonstrated a 20.4% decrease in peroxide value in the used cooking oil.

Keywords: *Used cooking oil, peroxide value, antioxidants, turmeric leaves*

INTRODUCTION

Frying oil is a food material formed from triglycerides and fatty acids derived from vegetable materials except palm oil (BPOM RI, 2019). The quality of frying oil is determined by its smoke point, which is the heating temperature of the oil until undesirable compounds are formed and can also cause itching or discomfort in the throat. The oil that we have used to fry the smoke point will decrease due to the hydrolysis of fats.

Oil has properties that are insoluble in water, but slightly soluble in alcohol, ethyl ether, and halogen solvents. The aroma and taste properties possessed by oil occur naturally due to the formation of short-chain acids as a result of oil or fat damage (Rengga, 2020).

Frying oil, besides being beneficial, can also harm the body health if used repeatedly. Used oil is oil from the remaining results of frying, both from coconut oil and palm oil. Used oil can cause oil to become foamy and frothy (Hambali et al., 2007).

The characteristics of damaged oil are with the emergence of stale and bitter flavors called the rancid process. Oil that is damaged is marked by the increasing number of peroxides. According to the SNI 01-3741-2013 standard for the quality of cooking oil in Indonesia, the maximum peroxide number is 10 mek O2 / kg. Oil is very susceptible to damage in the presence of hydrolysis and oxidation processes.

The peroxide number is a number that indicates that peroxide compounds in every 1000 grams of oil or fat and are parameters determining the quality of oil. Consuming oil containing high levels of peroxide can cause cancer, inflammation, atherosclerosis and aging (Mulyani and Sujarwanta, 2018).

Peroxides are formed due to heating, which causes damage to oils or fats. In frying oil, the peroxide number indicates the rancidity of the oil due to oxidation and hydrolysis processes. Damage to oils or fats from high-temperature heating can result in toxicity in the body and various diseases such as diarrhea, fat deposition in blood vessels, cancer, and reduced fat digestion.

Peroxide numbers with high levels found in oils can be prevented by adding antioxidants. Antioxidants are compounds or substances that can neutralize, counteract, or eliminate the effects of free radicals. Antioxidants act as inhibitors, inhibiting or preventing the interaction between free radicals and their target molecules.

The presence of antioxidants reduces the rate of oxidation processes in oils or fats (Winarno, 2004). Antioxidants can be obtained in synthetic and natural forms. One natural antioxidant is turmeric leaves because they contain flavonoids, phenolics, and tannins.

According to Edriana's research (2014) in her study "Antioxidant Activity Test of Turmeric Leaf Extract (*Curcuma domestica Val*) Using the DPPH Method (1,1-Diphenyl-2-Picrylhydrazyl)," turmeric leaf extract can be used as a natural antioxidant alternative because it has an IC50 value of turmeric leaf extract of 148.51 ppm. Turmeric leaves have many benefits. Turmeric

leaves function to reduce the fishy smell in meat or fish dishes. This seasoning is widely used in Sumatran kitchens, usually added to coconut milk dishes such as rendang, curry, and kalio. Besides, other benefits that can be found from turmeric leaves are as natural anti-inflammatory, beauty, to natural antiseptic. Turmeric leaves contain essential oils of monoterpene, sesquiterpene, diterpene, polyterpene, alcohol, flavonoids, aldehydes, ketones, esters, and ethers. In addition, the essential oil components successfully identified include limonene, pinene, and myrcene. The leaf part of the turmeric plant also has antimicrobial activity. Hasyim et al. (2016) flavonoids and phenolics are one of the secondary metabolite compounds produced by plants and have many functions, one of which is antioxidants.

Given the widespread use of recycled cooking oil among the public and turmeric leaves (*Curcuma domestica Val*) being one of the antioxidants, there is interest in exploring the innovation of using turmeric leaves as a natural antioxidant to reduce the peroxide value in recycled cooking oil, thereby improving its quality. The general objective of this research is to determine the reduction in peroxide value in recycled cooking oil using turmeric leaves (*Curcuma domestica Val*) as a natural antioxidant. Specifically, the aim is to determine the percentage reduction in peroxide value in recycled cooking oil using turmeric leaves (*Curcuma domestica Val*).

METHODS

The materials used in this study were turmeric leaves purchased from Al-Mahirah Market, Lamdingin, Banda Aceh. The reagents used included acetate-chloroform (3:2), potassium iodide, potassium dichromate (K2Cr2O7) 0.01 N, HCl 3 N, sodium thiosulfate (Na2S2O3) 0.01 N, and 1% starch solution.

The research method used was a laboratory experimental study conducted at the Applied Chemistry Laboratory of Politeknik Kesehatan Kemenkes Aceh, Department of D-III Medical Laboratory Technology. The sampling technique used was purposive sampling, which involves selecting samples based on specific considerations. In this case, the consideration was the fried food vendors in the Kopelma Darussalam area of Banda Aceh who use repeatedly-used frying oil. The sample for this study consisted of 300 ml of used cooking oil obtained from nugget, sausage, and meatball vendors in the Kopelma Darussalam area.

The Stage of Making Turmeric Leaf Simplisia

1. Turmeric leaves are washed with clean running water and dried.
2. They are placed in an oven at 120°C until dry, usually for 1-2 hours.
3. The dried turmeric leaves are then ground using a mortar.
4. Subsequently, the ground turmeric leaves are sifted using a mesh sieve (Setyorini et al., 2016).

The Stage of Immersing Used Cooking Oil Using Turmeric Leaf Simplisia

1. Place 100 ml of used cooking oil into an Erlenmeyer flask.
2. Weigh 5 grams of turmeric leaf simplisia and add it to the used cooking oil in the flask.
3. Stir the mixture until the turmeric leaf simplisia is evenly distributed in the used cooking oil.
4. Let the mixture of used cooking oil and turmeric leaf simplisia soak for 24 hours.

Procedure for Determining Peroxide Value

a. Weigh 5 grams of the soaked oil into a 250 ml Erlenmeyer flask with a cover.
b. Add 30 ml of acetic acid - chloroform solution (3:2) to the flask.
c. Shake the mixture until all components are dissolved.
d. Add 0.5 ml of saturated potassium iodide (KI) solution.
e. Allow the mixture to stand for 1 minute while shaking.
f. Add 30 ml of distilled water to the flask.
g. Titrate with 0.01 N thiosulfate solution until the yellow color almost disappears.
h. Add 0.5 ml of 1% starch solution and titrate again until the blue color begins to disappear.

The data on the peroxide value of the used cooking oil before and after the addition of cassava leaves was obtained directly from laboratory analysis using the iodometric method and presented in tabular form. Subsequently, the data will be analyzed using the peroxide value determination formula with the iodometric method, which is:

$$\text{Peroxide number} : \frac{\text{ml Titration} \times N \times 1000}{\text{sample weight}}$$

Note that:

N : Normality (concentration of $Na_2S_2O_3$)

Then the obtained results are analyzed to observe the decrease in peroxide numbers using the following formula:

$$\text{Reduction (\%)} = \frac{(x - y)}{x} \times 100\%$$

Note that:

x = The peroxide number value before the addition of turmeric leaves
y = The peroxide number value after the addition of turmeric leaves

RESULTS AND DISCUSSION

The research results conducted on used cooking oil for determining the peroxide number before and after the addition of turmeric leaves, as carried out in the Applied Chemistry Laboratory of the Medical Laboratory Technology Study Program, can be seen in Table 1.

Table 1. The results of the peroxide number examination in used cooking oil before adding turmeric leaves.

Repetition-	Sample weight (gr)	Titration volume (ml)	Peroxide Number (meq O_2/kg)
1	5,0202	2,6	7,04
2	5,0179	2,6	7,04
3	5,0556	2,6	6,99
Average	5,0312	2,6	7,02

Table 1 shows the laboratory examination results where the average titration volume before adding turmeric leaves was 2.6 ml, and the average peroxide number in the used cooking oil was 7.02 meq O2/kg. Subsequently, the used cooking oil titration continued with an experimental treatment involving the addition of 5 grams of turmeric leaves per 100 ml of used cooking oil. Further examination of the peroxide number was then conducted, and the results can be seen in Table 2.

Table 2. The results of the peroxide number examination in used cooking oil after adding turmeric leaves.

Repetition-	Sample weight (gr)	Titration volume (ml)	Peroxide Number (meq O_2/kg)
1	5,0035	2,1	5,70
2	4,9986	2,1	5,71
3	5,0626	2	5,37
Average	5,0215	2,06	5,59

The results in Table 2 show that the average peroxide number is 5.59 meq O2/kg in used cooking oil that has been added with 5% (v/v) turmeric leaves and soaked for 1 × 24 hours.

Table 3. Results of peroxide number calculation

Treatment	Peroxide Number (meqO_2/kg)
Before adding turmeric leaves	7,02
After adding turmeric leaves	5,59

The percentage difference in peroxide number in used cooking oil before and after adding turmeric leaves is 1.43 meq O2/kg. Then, calculating the percentage decrease using the formula for percentage decrease, the average reduction in peroxide number is found to be 20.4%.

Based on the data from the research, it can be observed that turmeric leaves can reduce the peroxide number in used cooking oil. This occurs because according to the findings in Table 1, the average peroxide number in used cooking oil before adding turmeric leaves was 7.02 meq O2/kg. This could be due to fried food vendors in the Kopelma Darussalam area not reusing cooking oil repeatedly. These results still comply with the SNI 01-3741-2013 standard, where the maximum peroxide number for cooking oil in Indonesia is 10 meq O2/kg.

In Table 2, the peroxide number results for the used cooking oil after adding turmeric leaves and soaking for 1 × 24 hours averaged 5.59 meq O2/kg. This is attributed to the antioxidant properties of turmeric leaves. According to Putri (2020), turmeric leaves contain flavonoids, phenolics, and tannins, which are natural antioxidants capable of reducing peroxide numbers.

In Table 3, the results show that before adding turmeric leaves and after adding 5% (b/v) turmeric leaves for 1 × 24 hours, there was a decrease in peroxide number by 20.4%. This reduction in peroxide number is due to the antioxidant properties of turmeric leaves, which function to minimize oxidation processes in the oil. This aligns with the findings of Erlidawati and Safrida (2018), who noted that natural antioxidants reduce peroxide numbers in used cooking oil.

According to Winarno (2004), peroxide numbers in oil can be prevented by adding antioxidants, which can be obtained in natural and synthetic forms. Ahmad et al. (2015, cited in Sumakno 2021) stated that natural antioxidants include turmeric leaves due to their content of secondary metabolites such as curcumin, phenolics, tannins, and flavonoids. This aligns with Endriana's research (2014), which suggests that turmeric leaf extract can serve as a natural antioxidant alternative, with an IC50 value of 148.51 ppm.

According to Tyas (2011, cited in Ramadhani 2018), peroxides containing oxygen are polar compounds, and turmeric leaves contain flavonoids that are readily soluble in polar solvents. This property makes them effective in reducing peroxide numbers.

CONCLUSION

This study concludes that the innovation of utilizing turmeric leaves at a concentration of 5% for soaking over 1 × 24 hours serves as an antioxidant capable of reducing peroxide levels in used cooking oil by 20.4%. This improvement enhances the quality of used cooking oil.

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REFERENCES

BPOM RI. (2019). "*Peraturan Badan Pengawas Obat dan Makanan Nomor 34 Tahun 2019 Tentang Kategori Pangan"*. Badan Pengawas Obat dan Makanan Republik Indonesia.

Edriana, N. (2014). *"Uji Aktifitas Antioksidan pada Ektrak Daun Kunyit (Curcuma domestica Val) dengan Menggunakan Metode DPPH (Laporan Penelitian)."* Jakarta: Syarif Hidayatullah.

Erlidawati., & Safrida. (2018). *Potensi Antioksidan Sebagai Antidiabetes*. Cetakan Pertama. Banda Aceh: Syiah Kuala University Press.

Ferdian, A., Hairunisa., Justicia, A. K., & Andhika. (2017). "Penurunan Bilangan Peroksida dengan Kulit Pisang Kepok (*Musa normalis L*)." *Jurnal Ilmiah Ibnu Sina* Vol. 2.

Hambali, E., Mujdalipah, S., Tambunan, A., Pattiwiri, A. W., & Hendroko, R. (2007). *Teknologi Bioenergi*. Jakarta: PT AgroMedia Pustaka.

Mulyani, HRA., & Sujarwanta, A. (2018). *Lemak Dan Minyak*. Cetakan Pertama. Lampung: Lembaga Penelitian UM Metro.

Murray, R. K., Bender, D. A & Bottam, K. M. (2014). *Biokimia Harper Edisi 29*. Jakarta: Penerbit Buku Kedokteran EGC.

Putri, A. (2020). *"Uji Daya Hambat Ekstrak Daun Kunyit (Curcuma longa linn) Terhadap Pertumbuhan Jamur Candida albicans (KTI)."* Padang: Sekolah Tinggi Ilmu Kesehatan Perintis Padang.

Rahmadhani, F. (2018). *"Pemanfaatan Kulit Pisang Kepok Terhadap Penurunan Angka Bilangan Peroksida Pada Minyak Goreng Bekas Di Kelurahan Mabar (KTI)."* Medan: Politeknik Kesehatan Kemenkes RI Medan.

Rahmayanti., Putri, S. K., & Wahab, I. (2021). "Uji Efektifitas Perasan Kulit Mentimun (Cucumis sativus L) Sebagai Larvasida Terhadap Larva Nyamuk Culex sp." *Jurnal Biology Education* Vol. 9 (2), 143-149.

Ramadhani, T. D. (2018). *"Pemanfaatan Karbon Aktif Cangkang Telur Ayam Terhadap Penurunan Bilangan Peroksida Pada Minyak Goreng Bekas Di Desa Batang Kuis (KTI)."* Medan: Politeknik Kesehatan Kemenkes Medan.

Setyorini, H. A., Kurniatri, A. A., Adelina, R., & Winarsih. (2016). "Karakteristik Mutu Ekstrak Daun Sirsak *(Annona Muricata L.)* Dari Tiga Tempat Tumbuh." *Buletin Penelitian Kesehatan* Vol. 44..

Sumakno, S. W. (2021). *"Formulasi Dan Uji Aktivitas Antioksidan Hair Tonic Ekstrak Daun Kunyit (Curcuma domestica Val) (Tugas Akhir)"*. Tegal: Program Studi Farmasi Politeknik Harapan Bersama.

Winarno, F. G. (2004). *Kimia Pangan Dan Gizi*. Jakarta: PT Gramedia Pustaka Utama.