

Physicochemical Properties of Margarine Containing Gambier Extract as Antioxidant

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Abstract – This study aims to evaluate the use of gambier extract as a source of catechine used as antioxidant in margarine preservation. Gambier extracted using water with ultrasonication. The extract was rich in antioxidant and polyphenol content. The result showed that the margarine elaborated with gambier extract with catechin levels of 957.01 µg / mg resulted in margarine with physicochemical characteristics with moisture content from 6.9% to 8.37%, FFA 0.03-0.07%, iod number 16.68-18.92%, melting point 48 to 50 ° C, Emulsion stability 100% and spreadability about 8.75 to 13 cm.

Keywords – Gambier Extract, Catechine, Margarine.

I. INTRODUCTION

Margarine is a water phase emulsion semi-solid fat product in the fat phase with a fat content greater than 80% and less than 90% [1]. Margarine is used as a substitute for butter with a look, smell, consistency, taste and nutritional value similar to butter [2]. If butter made from animal fats, margarine is made from vegetable oils. Animal fats contain cholesterol. Cholesterol is dangerous to health because it can cause constriction of blood vessels [3]. In addition, vegetable oil has a lot of availability in terms of quantity and is cheap in terms of price so that more margarine products are chosen by the public as a substitute for butter [4].

Margarine generally uses BHT (butylatedhydroxytoluene) and BHA (butylatedhydroxyanisole) as sources of artificial antioxidants to extend margarine shelf life [5]. In some countries, the use of BHT and BHA has begun to be restricted because it has adverse health effects. BHA and BHT are reported to be associated with tumor triggers, hormone-disrupting asthma, and are carcinogenic. According to WHO in 1989, the acceptable daily limit for BHA use or ADI (Acceptable Daily Intake) is 0–0.5mg / kg body weight and 0-0.05 mg / kg body weight for BHT [6]. To replace the role of BHA and BHT in margarine products, catechins can be used as a source of natural antioxidants to produce margarine with a long shelf life and are not harmful to health.

Catechins are a group of natural polyphenol compounds (flavanols) from the flavanoid family that have high antioxidant properties, are fat soluble, and are resistant to high temperatures. Therefore, catechins have the potential to become preservatives in oil or fat-based foods. Catechins can be found in the leaves of the tea plant (*Cameliasinensis*) and gambier [7].

Gambir is an extract of the gambier plant (*Uncaria gambir* Roxb.) with the main chemical contents including catechins and epicatechins [7]. The content of catechins in gambier is a characteristic that determines the quality level of gambier. Catechins in

their pure state give a sweet taste, are crystalline, white to yellowish in color, while tannins taste sepic, reddish brown to black in color [8]. Gambier plant and gambier shown in Fig 1.

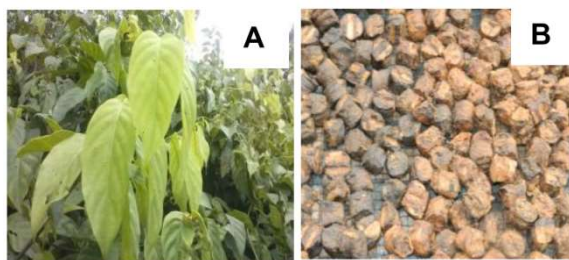


Fig 1. Gambier Plant (*Uncaria gambir* Roxb.) (A), Gambier (B) [8]

Catechin extraction from gambier has been widely used. The best catechin extraction treatment from gambier is done by using repeated extraction with water and then using gallic acid so that the catechin content is up to 98% [8]. However, because the catechin extraction results in the original gambier will be applied in food ingredients, a catechin extraction method is needed without the use of chemicals so that the extraction process is more environmentally friendly and safe for consumption. The application of ultrasonic and temperature combination in the extraction process with water is expected to increase the value of catechin extraction.

With the help of ultrasonics, the process of extracting organic compounds in plants and seeds using organic solvents can take place faster. The cell wall of the material is broken down by ultrasonic vibrations so that the contents in it can come out easily so that it can speed up the extraction process compared to thermal extraction or conventional extraction, this ultrasonic method is safer, shorter, and increases the amount of crude yield [9].

Based on the description above, a study was conducted to determine how the Physicochemical Properties of Margarine Containing Gambier Extract as Antioxidant

II. MATERIALS AND METHODS

A. Materials

Dry Gambier (*Uncaria gambir* Roxb.) from Tarusan, South Pesisir, West Sumatra was used, beeswax from Brataco Padang, West Sumatera. Stearin from PT.Incasi Raya Padang, West Sumatera. Coconut oil Arrow from SJS Padang, salt, soya lechitine, and milk.

B. Chemicals and Equipment

The chemicals used were Aquabidesstilata Ika from Indomedifa Padang, Sigma brand catechin standard, DPPH, methanol, Na_2CO_3 , Folin-Ciocalteu reagent, HPLC methanol, PA methanol, formic acid and water. The equipment used included blender to break down dry gambier, mixer to blending margarine and Universal 320 Rcentrifuges, HPLC equipment, spectrophotometer for analysis, and oven.

C. Gambier Re-extraction with water

A modification of [8] was used for extraction. Crude gambier was reduced to powder and mixed with distilled water (1: 5), mixed in a vortex mixer, then ultrasonicated (ultrasonic water bath (280 W, 50/60 Hz, S 10H Elmasonic) supplied by Elma (Singem, Germany) for 90 minutes at 50°C. The mixture was filtered and then the filtrate was left to stand for 24 hours. The precipitate obtained was repeatedly washed with water until a yellowish suspension was obtained and then centrifuged to re-settle out the precipitate which was dried in an oven at 40°C for 15 hours.

D. Incorporation of gambier extract in margarine

To determine the concentration required to be incorporated in the margarine, four concentrations of gambier extracts were tested. The concentrations are 0, 150, 300 and 600 ppm. Margarine were manually produced at laboratory scale. Lipid and liquid phase were prepared. The lipid phase contained coconut oil, melted stearin, melted beeswax, and soya lecithin. The liquid phase contained milk and salt. After dosage of the two phase, the emulsion passed through agitation and cooling at 7°C.

III. RESULT AND DISCUSSION

A. Gambier extract

The antioxidant content in gambier extract using IC50 method showed that 1.36 mg gambier extract can prevent 50% free radicals from 1L. According to [8], if the IC50 value is less than 50 ppm, it means that the antioxidants in the material are classified as very strong antioxidants, 50-100ppm are strong antioxidants, 100-150ppm are intermediate antioxidants and above 150ppm are weak antioxidants. According to [7], the antioxidant content of gambier is polyphenols, catechins, epicatechins, and caffeine.

Table 1.gambier extracted components

Parameter	Result± SD
IC50 (ppm)	1.36± 0.19
Polyphenol (ppm)	4.09 ± 1.15
Catechin (µg/mg)	957.01±10.46

SD: Standard Deviation

The polyphenol content in gambier extracted are high. The results showed that there are 4.08 ppm polyphenol content from 5 ppm gambier extract. Its mean there are about 81% polyphenol in this product. The catechin content of gambier extract with this method is much greater than the content of the original gambier catechins from several types of gambier in West Sumatra according to [7], catechin content of Gambir Cubadak is 261.3 µg / ml, Gambir Shrimp 253µg/ml, and Gambir Riau Mancik 270µg/ml. The chromatogram of gambier extracted shown in Fig 2.

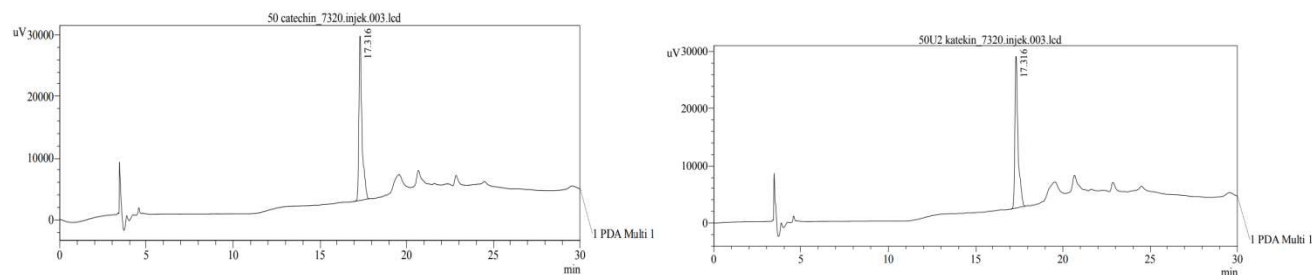


Fig 2.The Chromatogram of Catechin from Gambier Extracted

B. physicochemical properties of Margarine

After obtaining the best gambier extract with catechin levels of 957.01 µg/mg or about 95.7%, margarine was made with several concentrations of the gambier extract mixture, namely 0 ppm, 150 ppm, 300 ppm, and 600 ppm from a mixture of coconut oil, stearin. and beeswax. Furthermore, testing is carried out to see the characteristics of the margarine produced and compared with margarine that has been sold commercially. physicochemical properties of Margarine shown in Table 2.

Table 2.physicochemical properties of Margarine

Parameter	Result				
	0 ppm	150 ppm	300 ppm	600 ppm	Commercial
Water Content (%)	7.97	7.43	8.37	6.90	16.57
FFA (%)	0.07	0.06	0.04	0.03	0.03
Iod Number (%)	17.51	16.68	18.07	18.92	17.17
Melting Point (°C)	49	50	48	49	36
Emulsion stability (%)	100	100	100	100	100
Spreadability(cm)	13	11.5	9.25	8.75	7.25

Water content can affect margarine shelf life. The difference in water content of margarine can be affected by the raw materials used. Water content of margarine with gambier extract ranged from 6.9% to 8.37%. The water content of this gambier extract

margarine meets the margarine quality requirements of SNI, which is not greater than 18%. However, the water content of gambier extract margarine is quite low compared to the water content of commercial margarine which is 16.57%.

According to Sarunggalo [10], the presence of free fatty acids in products indicates a hydrolysis process so that the higher the free fatty acid content, the lower the product quality. The presence of free fatty acids in oils and fats can be used as an early indicator of oil and fat damage due to the hydrolysis process. The hydrolysis reaction occurs due to the presence of a certain amount of water in the oil and fat. Margarine free fatty acid levels in this study ranged from 0.03% to 0.07%. The more gambier extract that is added, the smaller the free fatty acid content in margarine. The free fatty acid content of commercial margarine used as a comparison in this study was the same as the free fatty acid content of margarine with the highest concentration of catechin gambier added.

According to Gustone and Norris [11], the iodine number states the amount of iodine absorbed indicates the degree of saturation of the fat. The higher the iodine number, the more double bonds to add and the higher the degree of unsaturation of the oil. The margarine iodine number in this study ranged from 16.68g iod/100g to 18.92g iod/100g. The commercial margarine iodine number used as a comparison in this study was 17.17%.

According to Lawson [12], the melting point is the temperature at which solid fat becomes liquid. The melting point of blending margarine made from a mixture of stearin, beeswax and coconut oil is quite high, ranging from 48-50°C. this yield is much higher than the melting point of commercial margarine tested which is 36 °C.

Emulsion stability is a system that shows the level of instability of a product or material because each particle has a tendency to combine with other particles. The emulsion stability of margarine are 100%. This very high emulsion stability can occur due to the uniformity of margarine droplets formed during homogenization by the help of emulsifiers and product tempering. The higher the viscosity of an emulsion system, the lower the average value of the precipitation that occurs, as a result, the emulsion stability is higher

The spreadability is the main quality attribute of a margarine product. Margarine must have good spreadability, which is easy to apply, spread easily and evenly, and can be well absorbed by bread [13]. The spreadability is calculated from the length (cm) of the distance traveled by margarine when spread on bread. The more the addition of gambier extract in the manufacture of margarine, the lower the spreadability of the margarine. The spreadability of margarine mixed with gambier extract ranges from 8.75 cm to 11.50 cm. The spreadability of margarine without the addition of gambier extract was 13 cm, while the spreadability of commercial margarine was 7.25 cm.

C. Margarin Sensory Analysis

Sensory analysis using the sense of sight, sense of touch, sense of smell and sense of taste. Sensory analysis was carried out on the color, taste, aroma, spreadability and texture of the margarine. The test used a scale of 1-5, the scale (1) really dislikes it; (2) dislike; (3) ordinary; (4) like; (5) really like. In this study, sensory analysis was carried out on 25 untrained panelists. Margarine sensory analysis result shown in Table 3.

From the organoleptic radar that showed in Fig. 2 compared to the commercial margarine, the sensory of margarine with gambier extract has a lower value. This is because commercial margarine uses food additives such as food coloring and flavoring so that commercial margarine products can be preferred by panelists.

The sensory analysis of margarin with gambier extract in terms of color ranged from 2.96 (not like to ordinary) to 3.48 (ordinary). The most preferred margarine color by panelists is commercial margarine because it uses additional ingredients such as CI 40800 beta-carotene food coloring so that the color of margarine turns yellow while other margarine does not have added coloring. The addition of gambier extract affects the resulting margarine color to be slightly darker. In general, according to the panelists, the margarine color with the addition of gambier extract is on a scale of 3 (normal).

Sensory analysis of margarine withgambier extract in terms of taste ranged from 3.00 (ordinary) to 3.28 (ordinary). The most preferred aroma of margarine by panelists is commercial margarine with a value scale of 4.04 (likes) because commercial margarine is given additional ingredients. Margarine with the addition of gambier extract is not made by adding other ingredients to add the taste of margarine so that we can know the effect of adding gambier extract on the taste of margarine.

Sensory analysis of margarine withgambier extract in terms of flavour ranged from 3.08 (typical) to 3.36 (typical). The aroma of margarine treatment tends to be accepted by the panelists even without the addition of artificial aromas. The aroma of margarine

most favored by panelists is commercial margarine because margarine is given additional ingredients in the form of natural and artificial aromas.

Sensory analysis of margarine with gambier extract in terms of texture ranged from 2.76 (close to ordinary) to 3.80 (ordinary to like). The sensory analysis rating scale for the texture of commercial margarine was 4.12 (like).

Table 3. Margarine Sensory Analysis

Parameter	Result				
	0 ppm	150 ppm	300 ppm	600 ppm	Commercial
Color	2.96	3.16	3.24	3.48	4.16
Taste	3.00	3.28	3.28	3.20	4.04
Flavour	3.08	3.32	3.32	3.36	4.04
Spreadability	2.80	3.20	3.20	3.72	4.08
Texture	2.76	3.28	3.36	3.80	4.12

The test used a scale of 1-5, the scale (1) really dislikes it; (2) dislike; (3) ordinary; (4) like; (5) really like.

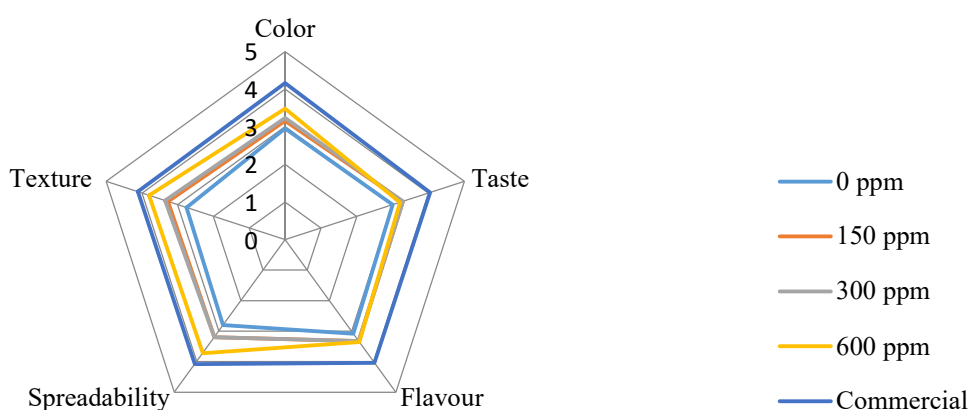


Fig 2. Organoleptic radar

IV. CONCLUSION

This study was designed to replace the commonly used artificial antioxidant for margarine preservation, by extract obtained from by product represented in this case by gambier. Gambier have significant levels of catechin content that play an important role against oxidation.

The different concentrations of gambier extract incorporated in margarine showed that the addition of catechins in margarine has an influence on the physicochemical properties of margarine. In terms of organoleptic, the resulting blending margarine still has lower organoleptic value compared to commercial margarine, so it is advisable to add additional ingredients such as dyes and flavor enhancers of margarine.

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