Antioxidant Activity and Characterizations of Cinnamon (*Cinnamomum Burmannii*) Essential Oil from Lampung

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Abstract: Essential oil is one of the export commodities in Indonesia. Therefore, essential oils receive considerable attention from the government. In addition to being used as raw materials for flavourings and fragrances, essential oils are also reported to have biological activities, including antioxidants, anti-ageing, antibacterial, antifungal, anti-inflammatory, Cinnamon bark essential oil (*Cinnamomum burmannii*) produced by the distillation method. The essential oil obtained is liquid with a yellow tint and has characteristic aromatic cinnamon. This study aims to obtain content related to compounds and the availability of data on the antioxidant activity of cinnamon, the method used is DPPH. The chemical components of cinnamon bark essential oil analyzed using the Gas Chromatography-Mass Spectrophotometry (GC-MS) tool contained 50 compounds with 7 main compounds, namely Cinnamaldehyde (71.48%) which is the highest compound content among other compounds, Alpha-Pinene (2.85%), Camphene (1.38%), Beta-Pinene (1.42%), Eucalyptol (3.79%), Acetic Acid (9.62%), Caryophyllene oxide (2.53%). The value of IC_{50} of cinnamon essential oil of 11,793 ppm indicates that cinnamon essential oil has a very strong antioxidant activity.

1 INTRODUCTION

Cinnamon is a plant native to South Asia, Southeast Asia and mainland China, Indonesia is included in it. This plant belongs to the family Lauraceae which has economic value and is an annual plant that takes a long time to take its results. The main result of cinnamon is the bark of the trunk and branches, while the by-products are twigs and leaves. This commodity is not only used as a spice, its processed products such as essential oils and oleoresins are widely used in the pharmaceutical, cosmetic, food, beverage, cigarette, and other industries (Winda et al., 2014).

Indonesia is one of the countries producing essential oils as a commodity that produces foreign exchange. Therefore, essential oils receive considerable attention from the government. One of them is cinnamon essential oil (*Cinnamomum burmannii*) which comes from Indonesia, while 4.2% comes from Sri Lanka. As much as 80% of cinnamon in Indonesia is produced in the West Sumatra area

(Rusli, 2010). *Cinnamomum burmannii* cinnamon has been developing for a long time in Indonesia, even becoming one of the main commodities of Indonesian trade since the Dutch era. The growth of Cinnamomum burmannil in Indonesia is supported by the availability of mountainous land that stretches along the length of Sumatra, Java, and Sulawesi with adequate rainfall (Ferry, 2013).

Cinnamon has antimicrobial, antifungal, antiviral, antioxidant, antitumor, blood pressure lowering, cholesterol and has low-fat compounds. Cinnamon can be a source of antioxidants because it contains many compounds such as eugenol, safrole, sinamaldehyde, tannins, and calcium oxalate (Helmalia et al., 2019). Cinnamon bark essential oil product (Cinnamomum burmannii) using the method of distillation of moisture.

Cinnamon bark and leaves contain essential oils, saponins and flavonoids. The compounds cinnamaldehyde and linalool have been reported as one antioxidant compounds (Saleh, 2010). The main content of cinnamon essential oil is cinnamaldehyde (60.72%), eugenol (17.62%), and coumarin (13.39%) (Putri, 2019).

Antioxidants are compounds that can stabilize free radicals by complementing the lack of electrons owned by free radicals and inhibiting the occurrence

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of chain reactions from the formation of free radicals. Antioxidants are useful for regulating so that there is no continuous oxidation process in the body. In addition, antioxidants are also able to eliminate, cleanse, resist the effects of free radicals.

Testing the antioxidant activity of cinnamon ethanol extract conducted by (Antasionasti & I, 2021) obtained a value of 1,939 ppm. This shows that cinnamon bark extract has a very strong antioxidant activity because it has a value of < 50ppm$IC_{50}IC_{50}$. One of the methods used to identify antioxidant activity is *2,2-diphenyl-1-picrylhydrazy*/ (DPPH). DPPH is a free radical that when reacted with plant extracts containing antioxidants, there will be a reaction to the capture of DPPH free radicals (purple) which is converted into *1.1- diphenyl 2-picrolhydrazyl* (yellow).

Based on the description above, the author is interested in conducting further research on the antioxidant activity of *Cinnamomum burmannii* from Lampung species using the *DPPH* method, so cinnamon is expected to be a very strong antioxidant activity.

2 MATERIAL AND METHODS

2.1 Cinnamon Bark Essential Oil

Essential oils are obtained from farmers in the Lampung area. The process to produce cinnamon essential oil by using the distillation method. This method is an appropriate method because the essential oil contained in cinnamon does not tolerate high heating and is volatile. The essential oil obtained is liquid with a yellow tint and has characteristic aromatic cinnamon.

2.1.1 Component Analysis with GC-MS

Volatile essential oils can be analyzed with GC- MS. GC (*Gas Chromatography*) serves to separate the components of essential oils and MS (*Mass Spectrometry*) serves to determine the molecular weight of each component based on fragmentation. When a vapour of an organic compound is passed in the ionization chamber of the mass spectrometer, this compound will be shot with high-energy electrons and cast high-energy electrons and cast electrons from the compound.

2.2 Characterization of Essential Oils

2.2.1 Organoleptic Characterization of Essential Oils

The characterization carried out is an organoleptic examination. The examination aims to determine the smell, warmth and clarity of cinnamon bark essential oil (*Cinnamomum burmanni*). The examination uses the senses by being seen, palpable and washed to find out the colour, clarity and smell of essential oils.

2.2.2 Type Weight Measurement

This type of weight measurement aims to determine the weight of the type of cinnamon bark essential oil (*Cinnamomum burmanni*) produced using a pycnometer.

2.2.3 Determination of Refractive Index

The refractive index for determining the purity of the essential oil, the tool used is a refractometer. The refractive index of essential oils is a comparison between the sine of the falling angle and the sine of the refractive angle if a beam of light of a certain wavelength falls from the oiling air with certain angle yang maintained at the hatching temperature p.

2.3 Test the Antioxidant Properties of Cinnamon Bark Essential Oil with DPPH Method

2.3.1 Solution Manufacturing

A total of 2 mL of DPPH solution was put into a test tube and then 2 mL of ethanol p.a was added and incubated for 30 min. Then the absorption spectrum is determined by UV-VIS spectrophotometry with a wavelength of 400-700 nm and determines the wavelength maximum.

2.3.2 Manufacture of Test Solution

Cinnamon essential oil is weighed as much as 10 mg and dissolved with ethanol until its volume is 10 ml, a mother liquor of 1000 ppm concentration is obtained. Then it is piped at 0.125 ml; 0.25 ml; 0.5 ml; 1 ml; and 2 ml, each of which is put into a 5 ml measuring flask and dissolved with ethanol until the limit mark, so that the concentration of cinnamon essential oil is obtained, namely 25 ppm, 50 ppm, 100 ppm, 200 ppm, and 400 ppm, respectively. Then each pickpocketed 2 ml is put into a test tube and 2 ml of DPPH solution is added, then the test solution is

measured for absorption at wavelength using UV-V is spectroscopy

2.3.3 Manufacturing of Vitamin C Comparison Solution

Vitamin C is weighed at 10 mg and dissolved with ethanol to a volume of 10 ml, a master solution of 1000 ppm concentration is obtained. Then vitamin C is picked up at 0.01 ml; 0.02 ml; 0.03 ml; 0.04 ml: and 0.05 ml, each put in a 5 ml measuring flask and dissolved with 80% ethanol until the limit mark, so that vitamin C concentrations are obtained, namely 2 ppm, 4 ppm, 6 ppm, 8 ppm, and 10 ppm, respectively. A total of 2 ml of it solution was picketed and added 2 ml of DPPH solution. Wavelengths using UV-Vis spectroscopy.

2.3.4 Statistic Analysis

Data analysis in this study was carried out using the standard curve method of linear regression y = ax + b made based on absorbance and concentration data from the standard solution. The activity of an antioxidant can be seen from the value of IC (*Inhibition Concentration*). The concentration of the sample and its inhibition per cent are plotted on the x-axis and y-axis respectively on the linear regression equation. The equation is used to determine the value of each sample with a value of y of 50 and the value of x to be obtained as IC_{50}.

3 RESULTS AND DISCUSSION

Here are the results of the analysis of the components of cinnamon essential oil on the use of the GC-MS tool, which aims to determine the content of the active substances contained in the essential oil. In the GC chromatogram image of sinamon oil the most compounds are the 23rd peak synamaldehide (RT = 18.808) and the other majority compounds contained in cinnamon essential oil. The spectrum provides information that the compound synamaldehide is the most compound content of sinamon oil from cinnamon as much as 71.48%.

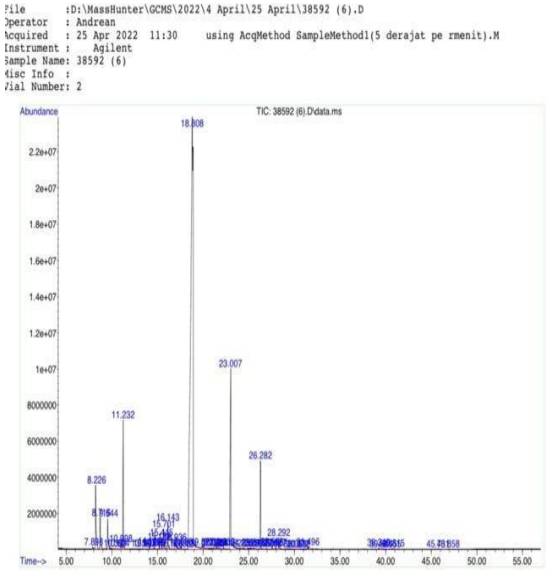

Figure 1: Chromatogram of GC.

Cinamaldehyde is the main essential oil component of cinnamon (Cinnamomum burmanni) which is produced naturally in the bark and leaves of cinnamon plants of the genus Cinnamomum which is believed to have many medicinal properties and also contains natioxidants. In the previous study conducted by Wijayanti (2011) explained that the largest cinnamon content (Cinnamommum burmanni) is an essential oil that has the main content of the compound cinnamaldehyde (60.72%) the same results were also obtained by Daniel (2011) in his research which explained that cinnamaldehydede content was 63.61%. This proves that the largest compound content in cinnamon bark essential oil (Cinnamommum burmanni) is Cinnamaldehyde in accordance with SNI which is at least 50%.

Free radical compounds their reactivity is largely determined by the presence of a free -OH (hydroxyl) functional group and the double bond of the phenol compound. The compound suspected to be an antioxidant in cinnamon bark essential oil is Cinnamaldehyde. The compound Cinnamaldehyde in cinnamon is one of the very powerful antioxidants that can effectively fight free radicals including superoxide anions and hydroxy radicals.

Table 2: Essential Oil Characteristics.

Charachteristic test	Result	SNI 06-3734-2006
Oraganoleptis : **a.** Shape **b.** Colour **c.** Construction	Fall Clear Yellow Typical Cinnamon Smell	- Light yellow-Light brown Typical Cinnamon
Type Weight	1,032	1,008-1,030
Refractive Index	1,51	1,559-1,595

The results of essential oil identification are carried out to determine the characteristics of physical properties and chemical properties. On organoleptic observations of essential oil Cinnamon bark (*Cinnamommum burmanni)* was identified as having a liquid form, clear yellow in colour, and a characteristic cinnamon smell.

Based on the research conducted obtained the specific gravity of cinnamon bark essential oil (*Cinnamommum burmanni*) is 1,032. This result can be said to be reproducible because the deviation is small. The specific gravity of oil is determined by the chemical components contained in it, the higher the content of its components the heavier the type of the specific gravity. The smaller the size of the material in the distillation process penetrates more steam so that the solid fraction evaporates faster.

Based on the results obtained, the refractive index of cinnamon essential oil is 1.51 at a temperature of 20 °C. The value of the refractive index of essential oils is closely related to the components composed in the resulting essential oil, which is the case with specific gravity, where the constituent components of essential oils can affect the value of the refractive index. The more long-chain or oxygen-lumped components are distilled, the density of the essential oil medium will increase. So until the light comes will be more difficult to refract.

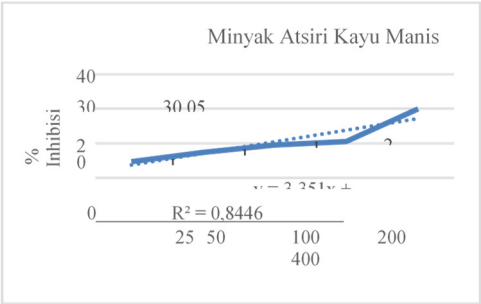

Figure 2: Graph of Antioxidant Activity of Cinnamon Essential Oil.

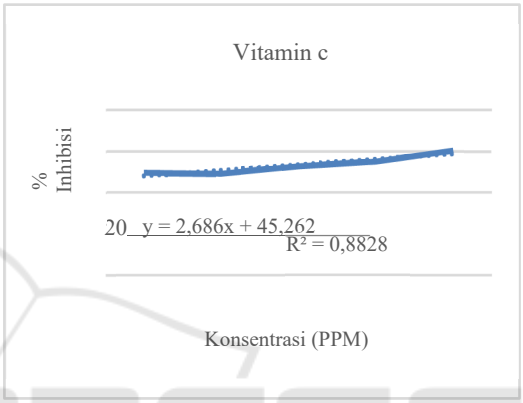

Figure 3. Graph of Antioxidant Activity of Vitamin C

Testing the antioxidant activity of Cinnamon Essential Oil in using the DPPH method (*4, I-diphenyl-2-picrylhydrazyl*) was chosen because it is simple, easy, fast and sensitive and requires only a small sample. As a positive control used ascorbic acid (Vitamin C), a Sample containing antioxidants can be seen by the presence of a decrease in the intensity of DPPH colour. Antioxidant compounds will react with DPPH radicals, causing a change in DPPH colour from purple to yellow.

Free radical compounds reactivity is largely determined by the presence of a free -OH (hydroxyl) functional group and the double bond of the phenol compound. The compound suspected to be an antioxidant in cinnamon bark essential oil is cinnamaldehyde. The compound cinnamaldehyde in cinnamon is one of the very powerful antioxidants that can effectively fight free radicals including superoxide anions and hydroxy radicals.

In the previous study conducted by (Ramadhani, 2017) the activity of manus wood essential oil showed that the IC_{50}value was 133.53 ppm. The IC_{50} value of cinnamon bark is in the range of 101-105 ppm, this indicates that cinnamon bark essential oil has a moderate potential as an antioxidant.

In this study, a spectrum of DPPH maximum wavelength of 516 nm was obtained. Figure 2 shows that DPPH free radical suppression has occurred after adding cinnamon bark essential oil, where the higher the concentration of cinnamon bark essential oil, the greater % of dampening is characterized by lowering the absorbance value.

To see the value of IC_{50} obtained from the equation Y = ax + b, by entering the value of Y of 50 so that a value of x is obtained which is represented by the amount of IC_{50} for essential oils (*Cinnamomum burmannii*) which is 11.79. From the results, it is shown that the antioxidant activity in cinnamon essential oil has a very strong activity with a value of <50 ppm.

4 CONCLUSION

Based on the analysis of GC-MS showed results that in cinnamon bark essential oil the amount of 50 compounds and 7 main compounds, namely, Cinnamaldehyde with the amount (71.48%) is the highest compound containing antioxidants, Alpha-Pinene (2.85%), Camphene (1.38%), Beta-Pinene (1.42%), Eucalyptol (3.79%), Acetic Acid (9.62%), Caryophyllene oxide (2.53%).

The antioxidant activity of cinnamon bark essential oil obtained through the test method with DPPH is included in the group of very strong antioxidants with an IC50 value of 11,793 ppm because it enters the standard, which is <50 ppm.

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