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# Isolation and Sunscreen Activity Test of Cinnamon Oil from Flores Island, Indonesia

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**Abstract**

Essential oils have various functions in both the perfume and pharmaceutical industries. Researchers in the world until now continue to conduct research to find new sources of essential oils. In line with essential oil research, research on the discovery of new organic sunscreens is still being carried out to antisipated increasing cases of skin cancer. In this study, the isolation and sunscreen activity test of essential oils from the *Cinamommun burmannii* was carried out. The research was conducted in four stages i.e ; (1) Sample preparation of *Cinamommun burmannii*, (2) isolation of essential oil using steam distillation method, (3) characterization of chemical compounds in oil using gas chromatography-mass spectrometry method and sunscreen activity test was carried out by ultraviolet spectroscopy method. The results of the isolation of cinnamon oil from Flores island showed that the oil produced was obtained as a clear yellow, with oil content in cinnamon bark is 5.44%. The results of the characterization using gas chromatography-mass spectrometer showed that the cinnamon oil contain four main components, i.e cinnamaldehyde, 3-phenyl acetate, methyl salicylate and linalool with successive abundances; 80.85%, 6.32%, 2.41% and 1.92%. Sunscreen activity test showed that cinnamon oil from Flores islands had ultra protection (SPF= 25.0) at a concentration of 10%. Cinnamon oil from Flores Island can be used as an igredient in sunscreen lotion.

***Keywords:*** isolation; sunscreen; activity; essential oil; characterization and Cinamommun burmannii.

## 1. Introduction

Essential oils are a large group of vegetable oils in the plants. Their form of viscous liquids at room temperature but volatile so that they give a distinctive aroma [1,2]. The three largest countries which essential oil producing essential oil in the world are Haiti, Bourbon and Indonesia [3,4].

Essential oils have been used for thousands of years in various cultures for medicinal and health purposes. They are concentrated hydrophobic liquid containing volatile chemical compounds from plants.

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They are recently gaining popularity as a natural, safe and cost-effective therapy for a number of health concerns because of their antidepressant, stimulating, detoxifying, antibacterial, antiviral and calming properties. Essential oils are aromatic compounds found in great quantities in oil sacs or oil glands present at different depths in the fruit peel, mainly flavedo part and cuticles [5].

The physical properties of essential oil are strong odor and formed from various plants metabolites. They are limpid and soluble in lipid/organic solvents and possess density less than water. Essential oils are generally obtained by hydro or steam distillation [6,7]. Freeze drying, rotary evaporation, gas-chromatography assays among others are also the most effective processes which are employed in these extraction process. One of the essential oil-producing plants is Cinnamomum spp.They were first developed by the Arabs in the Middle Ages and were known for their fragrances and various other medicina properties like antiseptic, bactericidal, virucidal and fungicidal. Cinnamomum spp is one of the oldest herbs that are widely used in the food, pharmaceutical and cosmetics industries. The part that is widely used is the inner bark. In the United States and European markets, two varieties of cinnamon are known, namely Ceylon and Cassia [8]. Ceylon cinnamon is also known as "true cinnamon" and comes from Cinnamomum verum [9]. While Cassia cinnamon comes from several countries, one of which is Chinese cassia, cultivated mainly in Southern China, Burma (Myanmar) and Vietnam. While Indonesian cinnamon, which grows and is cultivated in Indonesia is *Cinnamomum burmannii* Blume, mainly originating from Sumatra [10].

There are a variety of methods used in the extraction of the essential oils, which includes maseration extraction and low pressure or highpressure distillation. The type of the products extracted depends on the quantity, quality, soil composition, climate, plant organ, age and vegetative stage of plants [10,11,12]. The content of chemical compounds in *Cinnamomum burmannii* is also influenced by where it grows and also differences in plant parts. The content of chemical compounds in the leaves is different from that in the bark and roots [13,14]. Research on *Cinamomun burmanii* that has been carried out includes; potency of *Cinnamomum burmannii* as antioxidant and α glucosidase Inhibitor and their relation to trans cinamaldehyde and coumarin contens [15,16,17] and the content of chemical compound in *Cinnamomum burmannii* [9,18].

The studies have shown that Cinnamon bark, leaf and root oils differ significantly in their chemical composition with cinnamaldehyde, eugenol and camphor being the major constituents respectively. This unique property of Cinnamon has given rise to much interest in the biosynthetic pathways of their chemical constituents. Thus Cinnamon offers a variety of oils with different aroma characteristics and compositions to the flavor industry [19]. The root bark was reported to have camphor as the main constituent [18]. The highest monoterpene content is found in the roots, the highest phenyl propanoid in the leaves and sesquiterpenes are found in the fruit. The highest monoterpene content was found in the roots, the highest phenyl propanoid in the leaves and the highest sesquiterpenes were found in the fruit.

Cinnamaldehyde is the main component contained in cinnamon oil [12]. Structure has a long enough conjugated double bond between the carbonyl group and the benzene ring, it is very possible that cinnamaldehyde can absorb ultraviolet radiation (UV-B) very well. Ultraviolet B (UVB) rays can penetrate the superficial part of the epider mis to the basal part of the epidermis which has the potential to cause the formation of reactive oxygen

species (ROS) or reactive nitrogen species (RNS), inflammation, sunburn, premature ageing and even cancer [20].

Considering that the content of chemical compounds in *Cinnamomun burmanii* is strongly influenced by the place where it grows, this study was conducted to isolate, identify the chemical compounds and test sunscreen activity in *Cinnamomun burmanii* from Flores islands, Indonesia. Cinamomoum burmani is one of the types of agricultural commodities exported by Indonesia [21], so that research that leads to increasing the usability of this plant is very important to do.

## 2. Materials and Methods

### *2.1. Material and Instrumentation*

Materials Cinnamomum burmannii bark is taken from two regions in East Nusa Tenggara Indonesia, namely Sumba and Flores Island and ethanol 96%. The instrumentation consist of glass equipment and Shimadzu QP 2010 gas chromatography-mass spectrometer.

### *2.2. Procedure*

This study consisted of three stages, namely the extraction of essential oils using the maceration method, identification of chemical compounds using the Gas Chromatograpy-Mass Speecrtroscopy (GC-MS) method and sunscreen activity test using UV-Vis spectrophotometer.

### *2.3. Extraction*

Extraction was carried out by maceration method using 96% ethanol solvent. Weighed a total of 1000 grams of cinnamon bark from each region then put it in a glass container and then added 96% ethanol solvent. The immersion is allowed to stand for 24 hours, while stirring at each specified time interval, then filtered. Repeat three times, or until the extracted liquid looks clear. The extract then was evaporated usung Rotary Vacuum Evaporator Buchii until slvent-free oil is obtained.

### *2.4. Chemical Compounds Identification*

Extract solution was made with a concentration of 100 ppm in ethanol solvent. Furthermore, the extract was injected into the GC-MS apparatus, with an operating temperature of 250 $^{o}$C. Chromatogram and mass spectrum were analyzed to determine the number and types of compounds in the essential oil.

### *2.5. Sunscreen Activity Test*

The sunscreen activity of a compound is determined by the value of the sun protection factor (SPF), the greater the SPF value the higher its ability to protect the skin from harmful ultraviolet rays. Determination of the SPF value is done by measuring the absorbance of the cinnamon oil solution using a UV Vis spectrophotometer at a wavelength of 290-320 nm. The concentration of cinnamon oil were prepared are 1%, 3%, 5%, 7% and 10%.

Then the data obtained is processed with the Mansur equation. The value of EE x I can be seen in Table 1

$$SPF\ spectrophootometric = CF \times \sum_{290}^{320} EE\ (\lambda) \times I(\lambda) \times Abs(\lambda)$$

The SPF value can be calculated by multiplying the value of the correction factor (CF=10), the erythema effect spectrum (EE), the intensity spectrum from the sun (I) and also the absorbance (Abs) of the tested lotion sample. The SPF value is read at a wavelength of 290-320 nm adjusted to the wavelength of UV-B light [22].

**Table 1:** List of EE X I Values.

| Wavelength (λ) (nm) | EE x I |
|---|---|
| 290 | 0.015 |
| 295 | 0.0817 |
| 300 | 0.2874 |
| 305 | 0.3278 |
| 310 | 0.1864 |
| 315 | 0.0839 |
| 320 | 0.018 |
| Total | 1 |

## 3. Results

### *3.1. Isolation and Characterization of Cinnamon Oil from Flores Island*

Isolation and identification of chemical compounds of cinnamon bark essential oil (*Cinamommun burmannii*) from Flores island was conducted. The aim was to determinened the levels of essential oils contained in cinnamon bark (*Cinnamomum burmannii*) originating from those island and identificate the chemical compounds in the samples. Cinnamon samples taken were old cinnamon, aged 20 years, with an average bark thickness of ±1cm.

The samples was taken in September and December, because in these months the cinnamon bark contains enough sap flow between the wood and the bark so that the skin peels off easily. Cinnamon bark that has been clean, then peeled off the bark from the base of the tree/bark near the ground to the bark near the branch. The freshly cinnamon bark is then stored in a plastic bag.

Although in the long term the sample is still good for research.

The next process is to sliching the sample in to small sizes. The results of sliching the sample can be seen in Figure 1 below. The purpose of the cinnamon bark is sliced thinly into small sizes, so that the contact area between the sample and the extracting solvent is getting bigger. The larger the contact area, the more effective the solvent in attracting the chemical compounds contained in the cinnamon bark.

**Figure 1:** Cinnamon bark samples from Flores island.

The extraction of essential oils was conducted by maceration method using ethanol as solvent. The results of the extraction of cinnamon oil from Flores island showed that the oil was obtained as a clear yellow, with oil content in each cinnamon bark of 5.44%. Meanwhile, the results of the characterization using gas chromatography-mass spectrometer (GC-MS) for the cinnamon oil is presented in figure 3. Figure 3 shows that the cinnamon oil from from Flores consists of 17 compounds with the main content of cinnamaldehyde of 80.85%.

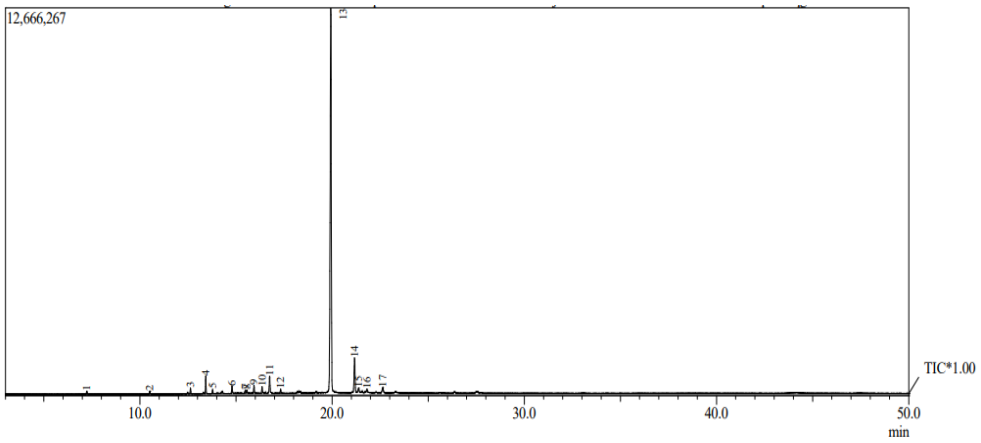


**Figure 3:** The cinnamon oil gas chromatogram.

Essential oils from Flores also contain several other types of compounds as shown in Table 2. They are linalol, methyl salisilate and 3-phenyl acetate.

**Table 2:** Main Components of Oil Composition from Flores Island.

| No | Compounds | Flores | | |
|---|---|---|---|---|
| | | Peak | Abudance | Retention Time |
| 1 | Linalool | 4 | 1,92% | 13.428 |
| 2 | Metyl salisilat | 11 | 2,41% | 16.751 |
| 3 | 3-phenyl acetate | 14 | 6,32% | 21.169 |

The cinnamaldehyde content in cinnamon oil from Flores is slightly lower than that in cinnamon oil from the Timor island, Indonesia. The cinnamaldehyde content in cinnamon oil from Timor is 83.65% [12]. It is caused by the composition of chemical compounds in cinnamon plants is influenced by differences in growing places, climate and soil composition. Cinnamaldehyde is a compound that has many benefits in medicine and cosmetics.

### *3.2. Sunscreen Activities Test*

Sunscreen activity test was carried out using the ultraviolet spectrometry method. The principle of this method is to determine the absorbance of the sample at a certain concentration, at UV-B wavelengths (290-320 nm). The absorbance value at each concentration is entered into the Mansur equation, to determine SPF value. Measurements were taken in the UV-B region, because these rays are the main cause of skin cancer. The results of determining the sunscreen activity of cinnamon oil are as shown in Figure 4.

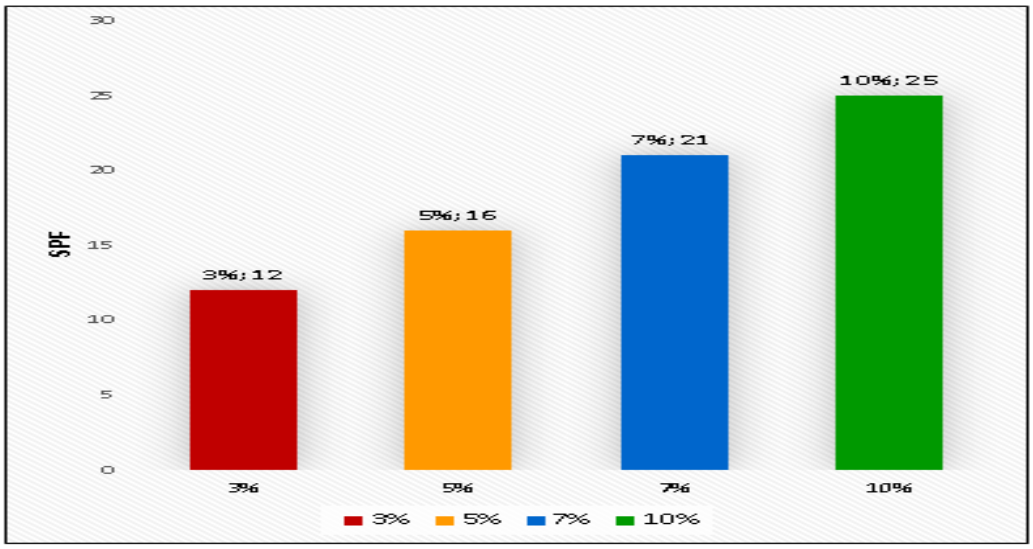


**Figure 4:** Cinnamon oil SPF value at various concentrations.

The results of sunscreen activity test showed that the higher the concentration, the greater SPF value. Is is caused the greater concentration, the greater cinnamaldehyde component, so that more molecules are able to absorb UV-B rays. The structure of Cinnamaldehyde as in Figure 5.

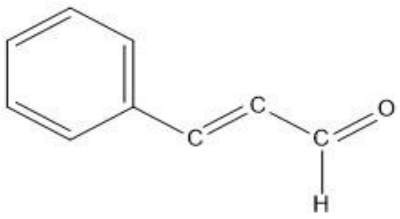


**Figure 5:** Structure of cinnamaldehyde.

Cinnamaldehyde has the ability to absorb UV-B radiation, due to its long conjugated double bond structure. The

overlap of the phi bonds in the two benzene rings with the C=O bonds results in a perfect conjugation of the molecule. This causes the C=O group to lose its character. Most organic sunscreen compounds have alternating carbon chains, which will result in delocalization of phi bonds. This conjugation is the basis of the absorption of UV light by a sunscreen compound. Exciting the electrons in this double bond to a higher energy level releases excess energy which is generated in the form of heat [21]. This SPF value is greater than the SPF value of the ethanol extract *Muntingia calabura* L pada konsentrasi yang sama. The SPF value of ethanol extract (*Muntingia calabura* L) at a concentration of 3% was 7.65 [22].

## 4. Conclusion

The content of cinnamon oils and the number of chemical compounds in *Cinnamomum burmanii* plants originating from Flores Island is 5.44% and 17 chemical compounds. The biggest component in oil is cinnamaldehyde with a percentage of 80.85%. Cinnamon oil from Flores Island can be used as an igredient in sunscreen lotion.

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