Literature Review :The Impact of Rosemary (Rosmarinus officinalis L.) Essential Oil Extraction Using Distillation Method on the Produced Yield.

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Abstract

Diseases can easily attack humans today due to ongoing weather changes resulting in a decrease in the immune system. Essential plants contain natural compounds that have the ability as antioxidants and modulate the human immune system to increase resistance and immunity. Rosemary (*Rosmanirus Officinalis* L.) is a plant with high antioxidant content. The use of rosemary plant can include the extraction of essential oil from the plant. This study aims to analyze the differences in extraction yields using different methods through a literature review. To produce rosemary essential oil, there are several extraction methods that can be used, namely water distillation, water vapor distillation, steam distillation, and hydro distillation. In the extraction process using the water distillation method, the amount of rosemary essential oil obtained was 0.78%. The yield obtained from water-vapor distillation ranged from 0.54 to 2.82%. The steam distillation process can be carried out with or without relying on enzymes in the process. The yield of rosemary essential oil obtained through the steam distillation process without using enzymatic assistance was 1.0.74%. However, when steam distillation is carried out with enzymatic assistance, the resulting yield increases to 1.36%. In the hydro distillation method, the amount of rosemary essential oil produced was 1.35%. The difference in yield results obtained in each method is due to the different treatment of materials and different extraction processes.

Keywords: Distillation, Extraction, Rosemary, Yield

I. INTRODUCTION

Indonesia boasts a diverse array of apice and herbal plants that are highly beneficial for human health. In this era, human bodies are particularly vulnerable of diseases due to the influence of viruses and constantly changing weather conditions(1). This has prompted individuals to focus on enhancing their immune systems. Natural compounds derived from herbal plants exhibit antioxidant activity and immune modulation (2). Compounds found in herbal plants have the ability to neutralize free radicals, thus protecting cells and tissues. Antioxidant nutrients have been proven to enhance human immunity (3).

One of the herbal plants rich in antioxidant compounds is Rosemary (*Rosmanirus Officinalis* L.)(4). Various parts of the Rosemary plant, including leaves, shoots, and branches produce essential oil and oleoresin that are beneficial for medicinal purpose, aromatherapy, perfumery, and culinary applications (5). The potent antioxidant compounds found in the extracts and essential oil of Rosemary (*Rosmanirus Officinalis* L.*)*. Responsible for biological activities, including anti-diabetic and anti-cancer properties. Additionally, they can used to alleviate despression, neurodegenerative diseases, and obesity (6).

Essential oils also known as etherial oils or volatile oils, a highly promising commodity in indonesia. Essential oil is natural extract derived from specific plants, including leaves, flowers, wood, seeds, and even flower petals (7). To obtain essential oil from the Rosemary (*Rosmanirus Officinalis* L.*)*, extraction is cariied out using the distillation method. Distillation is defined as the separation of components in a mixture of two or more liquids based on differences in vapor pressure and boiling points (8). There are several distillation techniques, such as water distillation, water and steam distillation, and steam distillation (9). In this research, the distillation of rosemary will be conducted using the water and steam distillation method.

Water and steam distillation is a method used for distillation where the material being processed does not have direct contact with water, as a barrier is placed between the water and the material. The principle is that when water boils, steam will carry essential oil particles to flow into the condenser, then to a separator that automatically separates water and oil due to the difference in specific gravity. Since to specific gravity of oil is lower than thar of water, the oil will be on top and the water be below (8). After the oil is separated from the water, essential oil is obtained.

II. METHODOLOGY

This research is a literature review study. The definition of a literature review study is a term used to refer to certain research or research and development carried out in order to collect and evaluate related research on a particular topic (10). The writings used are writings published from the last 10 years, namely the range of 2013-2023 with a discussion of the effect of the extraction method used on the essential oil yield obtained from rosemary (*Rosmanirus Officinalis* L.).

III. RESULTS AND DISCUSSION

Distillation of essential oil from rosemary (*Rosmanirus Officinalis* L.) using the distillation method. There are several distillation methods used in distillation, namely water distillation, water vapor distillation, steam distillation (8), and hydro distillation (11). Differences in distillation treatment will result in different yields. In a study conducted by Elyemni et al. (11), rosemary distillation used the hydro distillation method without microwave and with microwave assistance. The operational mechanism is depicted in Figure 2. The purpose of this study was to compare 2 essential oil extraction methods on rosemary. The optimal yield of essential oil from rosemary produced is by using the hydro distillation method obtained a maximum yield of 1.35%.

In research conducted by Teshale et. al (12), the extraction of rosemary essential oil using the steam-water distillation method. The operational mechanism is depicted in Figure 3. This study aims to optimize rosemary extraction conditions. The yield in optimal conditions using this method is obtained in the range of 0.54-2.82%. Further research conducted by Jaimand et.al. (13), using water distillation, steam distillation, and water distillation methods using microwave assistance. The purpose of this study was to determine the optimal method of rosemary essential oil extraction. The maximum yield obtained in this study was 0.78% using water distillation using microwave assistance. The operational mechanism is depicted in Figure 4.

In another study conducted by Arafa (14), rosemary essential oil extraction using the steam distillation method. The operational mechanism is depicted in Figure 5. The purpose of this research is to study the effect of rosemary oil extraction using the steam distillation method. The maximum yield of rosemary essential oil produced from the steam distillation method is 1.074% using fresh leaves and twigs. Whereas in research conducted Na liu et.al.(15), the extraction of rosemary essential oil using the steam distillation method with enzymatic assistance has increased the amount of yield produced. The operational mechanism is depicted in Figure 6. The purpose of this study is to find the maximum level of extraction using enzymatic assistance with steam distillation of 5mg/g. The highest yield level of rosemary essential oil obtained in this study was 1.36%.

The difference in yield obtained is based on the treatment and conditions of different materials. Treatment of materials such as drying ternayta produce different yields. Materials that have been dried produce essential oils that are much higher than fresh materials, this is because the oil cells in fresh leaves are still closed so drying the material first is needed (16).

Extraction of rosemary essential oil using microwaves has the advantage that distillation using microwave assistance involves a partial pressure gradient so that the compound is more volatile and excessive heat on the inside will cause the cell walls to break faster so that the yield of essential oil produced is greater (17). The time of the essential oil extraction process is also faster so that distillation using microwaves is more efficient.

The yield produced is also different in distillation using the steam-water distillation method. By creating optimal conditions, the yield produced can be higher (18). The longer the extraction time, the higher the yield of essential oil. However, it can also be caused by the temperature used (19), as well as the mass of material that is too much or too little, thus affecting the amount of oil / yield produced (20). The use of enzymes in the distillation process can affect the rate of extraction of essential oils from rosemary (15). In another study, it was shown that the addition of enzymes to the distillation process makes the extraction process more efficient because it can reduce energy consumption during distillation (21). Therefore, the yield of essential oil from rosemary obtained can vary depending on the method and treatment used in the extraction, and the more optimal the method and treatment used, the more it will increase the yield of rosemary essential oil.

IV. CONCLUSIONS AND NEWNESS

Based on the results of the research that has been done, it can be concluded that there is an effect of rosemary yield on the distillation method in the extraction of rosemary essential oil. The distillation methods used include water distillation, water-vapor distillation, steam distillation (without enzyme and using enzyme), and hydro distillation. The yields obtained were 0.78%, 0.54-2.82%, 1.074%, 1.36, and 1.35% respectively. The yields obtained differed depending on the treatment of the material and the extraction process.

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TABLE AND FIGURE

Table 1. Yield of Rosemary with various methods

No	Author	Extraction method	Yield of Rosemary Oil
1	Elyemni et.al	Hydro distillation with microwave assistant	1,35%
2	Teshale et.al	Steam water distillation	0,54 – 2,82%
3	Jaimand et.al	Water distillation	0,78%
4	Arafa	Steam distillation	1,074%
5	Na liu et.al	Steam distillation with enzymatic assistant	1,36%

$$Y = \frac{M_{oil}}{M_s} \times 100 \ldots\ldots$$

Where: Y: Percentage of Essential oil yield [w/w].

M_{oil}: Mass of essential oil [g].

M_S: Mass of dry plant [g].

Figure 1. Formula of yield Essential Oil

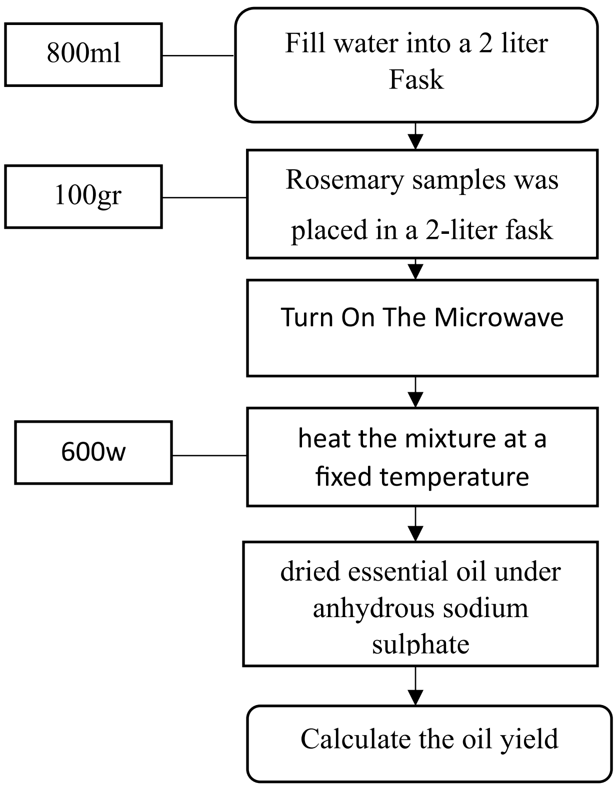

Figure 2. Operational principles of Hydro distillation with microwave assistant

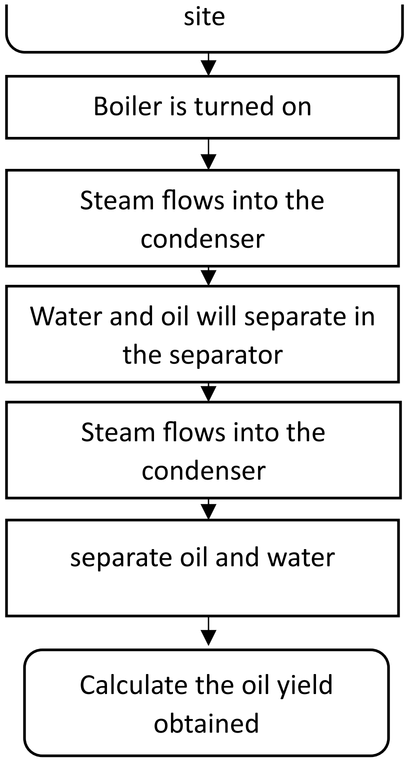

Figure 3. Operational principles of Steam water distillation

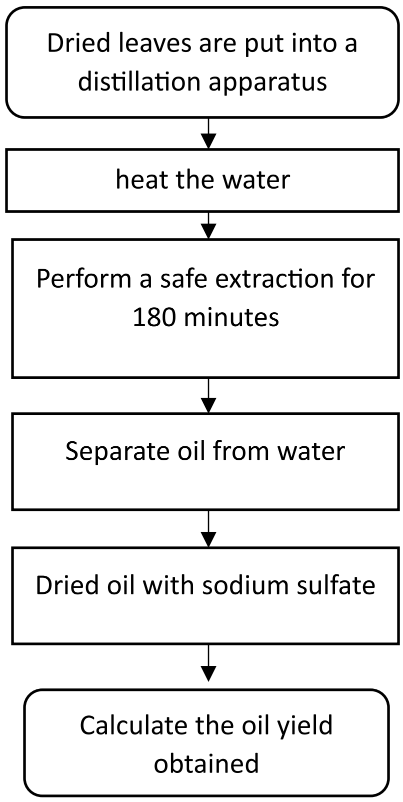

Figure 4. Operational principles of Water distillation

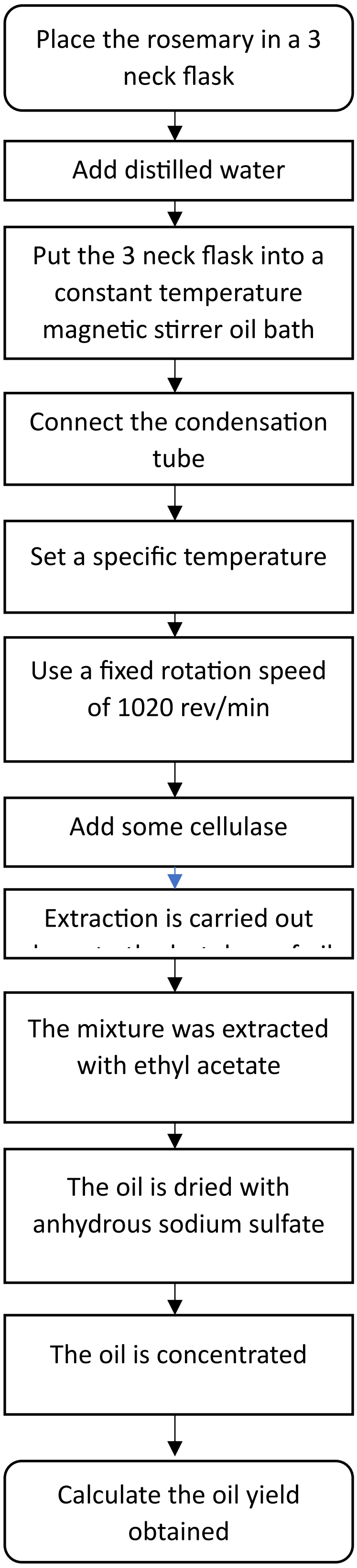

Figure 5. Operational principles of Steam distillation with enzymatic assistant

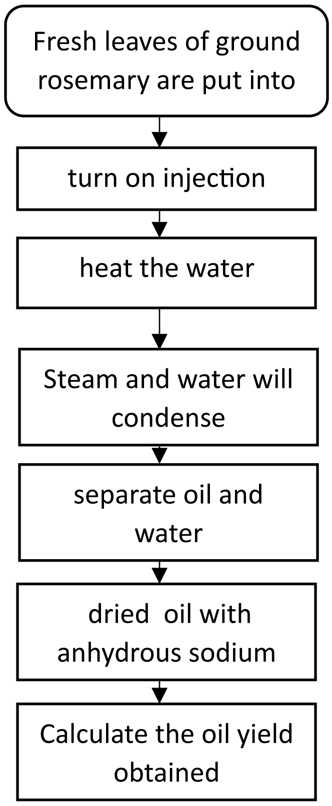

Figure 6. Operational principles of Steam distillation