CHARACTERISTICS OF VETIVER OIL WITH METHOD OF REFINING OF PRESSURIZED-STEAM

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Abstract*--Indonesia is a country that has the potential in the development of essential oils in the world because it has different kinds of essential oil-producing plants. Vetiver is a supreme essential oil-producing plant in which vetiver has a fairly large volume of production, i.e. 20-30 tons/year. Vetiver oil has a strong aroma, therefore this oil is widely used as a raw material for a wide range of perfumery products, aromatherapy materials, fixative substances, cosmetics industry, as an insect repellent and deterrent, and as a flavoring agent. The purpose of this experiment is to obtain the components of chemical compounds contained in vetiver oil carried out by steam refining method. Boiler pressure distilled at a pressure of 2 bar. The material used are dry and old vetiver plants. In refining 2 bars it is performed for 8 hours and the oils resulted consists of light and heavy oil fractions, afterwards it is tested with the GC-MS analysis to determine the fraction of components that there are light and heavy fractions.*
The results of GC-MS analysis of vetiver oil steam refining at a pressure of 2 bar suggested that components of light fraction vetiver oil are sesquiterpene hydrocarbons of 64.94%, 8.96% vetiverol, and 26.07% vetivone. While the heavy fraction has components of sesquiterpene hydrocarbons of 41.28%, 35.63% vetiverol, and 23.08% vetivone.

Keywords--*Essential oil, vetiver, steamrefining,*

I. INTRODUCTION

Indonesia is a country that has the potential in the development of essential oils in the world because it has different kinds of essential oil-producing plants. Essential oils are derived from aromatic plants that are spread throughout the world. The raw materialsof this oil are obtained from various parts of plant such as leaves, flowers, fruits, seeds, husks, stalks, roots, or rhizomes. In Indonesia, there are about 20 types of essential oils that are known in the market around the world; and 15 of them have become an export commodity such as fragrant lemongrass oil, patchouli, vetiver, cananga, ylang-ylang, eucalyptus, clove leaf, clove stem, sandalwood, nutmeg, massoi, Kruing, aloes, mace, and turpentine (Sintha 2009).

Vetiver oil has a strong aroma (Luu in Tutuarima 2009), therefore this oil is widely used as a raw material for a wide range of products fragrances in perfumes, deodorant, lotion, soap, as an aromatherapy ingredient (Luu in Tutuarima 2009), as an agent fixatives and components of the mixture in the cosmetics industry (Martinez et al. within Tutuarima 2009), as an insect repellent and deterrent (Kardinan in Tutuarima 2009); in herbal medicine as a stimulant (Lavania 1988 in Tutuarima 2009); in the food industry they are used as a flavoring agent in asparagus canning and a variety of beverages (Martinez et al in Tutuarima 2009).

Vetiver is an essential oil-producing plant in which vetiver has a fairly large volume of domestic production and has been very well known in the export market. Indonesia is able to produce vetiver oil of 20-30 tons/year (Rusli 2010). Essential oilobtained from vetiver is one of essential oils that has a high market demand in the market as it is estimated 100 tons/year (Rusli, 2010). Guenther (1990), stated that essential oil obtained from vetiver contains α-and β-vetivenon, vetivenol (vetiverol), vetivenil vetivenat, palmitic acid, benzoate acid, and vetivena. The first result of vetiver oil is a lighter fraction than water (light oil);while near the end of refining the result will be heavier fraction than water (heavy oil). Vetiver oil research conducted at the Bandung Institute of Technology Laboratory of the production unit (Yuliani, 2010) suggested that refining optimization results showed the pressure at 2 bar. Therefore, it is necessary to refinery vetiver oil with 2 bar pressure to know the content of the components that presents in both light and heavy fractions.

II. REVIEW OF THE STUDY

Essential oils arealso known asethericoilsor volatile oils that are producedfrom the plant. The oil isease to evaporate at the room temperaturewithout undergoingdecomposition,bittertaste, fragrantas the smell of the plants it is produced, generallysoluble inorganic solventsand insolublein water(Ketaren, 1987). Essential oilsare

chemicallycomposedof a mixture ofvariouscompounds that havea particular scent. Some of theessential oilsbelong to the classof terpene and terpenoid organiccompoundsthat aresolublein oil (Ketaren, 1987). Essential oilsare generally composed ofvarious mixturesof chemical compoundsthat are formedfrom theelementscarbon(C), hydrogen(H), and oxygen(O). In general,most of theessential oilconsistsof a mixture ofhydrocarboncompoundsandoxygenatedhydrocarbongroup(Ketaren, 1987).

2.1.Vetiver Oil

Guenther(1990), stated that vetiver essential oil contains α-and β-vetivenon, vetivenol(vetiverol), vetivenilvetivenat,palmiticacid,benzoate acid, and vetivena.

A method that is used to collect vetiver oil is steam refining. Refining system using steam is typically used to extract the raw materials essential oils obtained from the parts of plants such as bark, wood and hardseeds(Rusli, 2010). The selection of refining method will determine the success and efficiency of the refining process. Direct steam refining has higher efficiency than purified water and water-steam refining, but it requires more complex and expensive equipment(Risfaheri &MulyonoinTutiTutuarima, 2009). Tutuarimain Ketaren(2009)recommended the steam refining for the materials containing high boiling point oil/heavy fraction that is more stableto heat such aspatchouli, vetiver, sandalwood, and nutmeg, as it can shorten the time of refining.

III. RESEARCH METHOD

Research material. Dry vetiver. Tool. Refining kettle, boiler, condenser, oil separator. Research Step. Vetiverin the refining kettle is steamed from boiler for 8hours.The steamof refining result is condensedby the condenser, then the oil is separated from the water in the oil separator withthe decantation principle.

IV. RESULTS AND DISCUSSION

Before the process of refining, the first thing to prepare the material is cutting the vetiver. Refining is performed at 2 bar pressure, the steam which is used as the heating is obtained from the boiler. Moisture will penetrate the cells of the materials and bring the steam of essential oils into the condenser. The refining process needs 8 hours; in which the fraction of light oil will dripafter one-hour refining, while the fraction of heavy oil will start dripping after 6 hours. Oil produced from the refining process has brownish-yellow color, very creamy texture and strong aroma. The oil produced from refining process is then tested with GC-MS analysis to determine the components contained in a light oil and heavy oil. The results of GC-MS analysis of fraction of light vetiver oil are presented in table 1 and fig. 1.

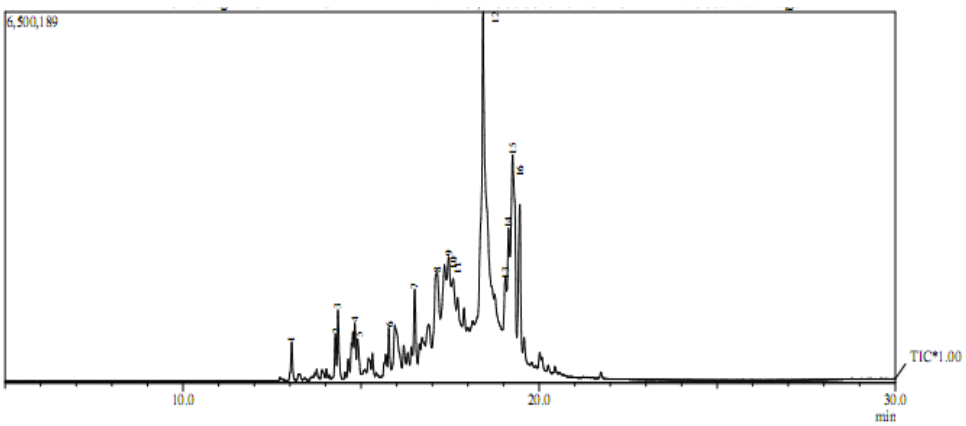

Fig. 1. Chromatogram of Fraction of Light Vetiver Oil

Table 1. The results of GC-MS analysis of Fraction of Light Vetiver Oil

No	Component	Formula	Molecule weight	Percentage (%)
1	1,8-nonadien-6-YNE 2,8 dimethyl 3 methylene	$C_{12}H_{16}$	160	1,32
2	β-caryophyllene	$C_{15}H_{24}$	204	1,54
3	Khusimene	$C_{15}H_{24}$	204	2,58
4	Delta guaiene azolene	$C_{15}H_{24}$	204	3,82
5	α-copaene	$C_{15}H_{24}$	204	1,66

6	Cycloisolongifolene	$C_{15}H_{22}$	202	1,23
7	Valencene	$C_{15}H_{24}$	204	2,73
8	Viridiflurol	$C_{15}H_{26}O$	222	7,53
9	Cycloisosativene	$C_{15}H_{24}$	204	12,52
10	α-salinene	$C_{15}H_{24}$	204	3,84
11	Duvatriendiol	$C_{15}H_{34}O_2$	306	1,43
12	Clovene	$C_{15}H_{24}$	204	28,48
13	Nootkatone	$C_{14}H_{22}O$	218	3,18
14	1,5 cycloundecadiene 8,8 dimethyl 9 methylene	$C_{14}H_{22}$	190	5,22
15	Valerenal	$C_{15}H_{22}O$	218	16,00
16	Zierone	$C_{15}H_{22}O$	218	6,89
Total				100

The fraction of light vetiver oil in Table 2 above contains 64.94% sesquiterpene hydrocarbons, 8.96% vetiverol, and 26.07% vetivone. According to research by Anon et al (2006) in Siregar, a major component of essential oil of vetiver is a sesquiterpene compound group (30-40%), sesquiterpenol (18-25%) and sesquiterpenon such as benzoic acid, vetiverol, furfurol, α and β vetivone, vetivene and vetivenil vetivenat.

Steam refining of vetiver oil produces fractions of heavy oil after 6-hours refining. Fraction of heavy oil is oil that has a high boiling point; this oil has a specific gravity heavier than water. Compared to fractions of light oil,the refining produces more fractions of heavy oil. The oil produced has a brown color with a very creamy texture. The data from GC-MS analysis of fractions of heavy vetiver oil are presented in Table 2 and Fig. 2.

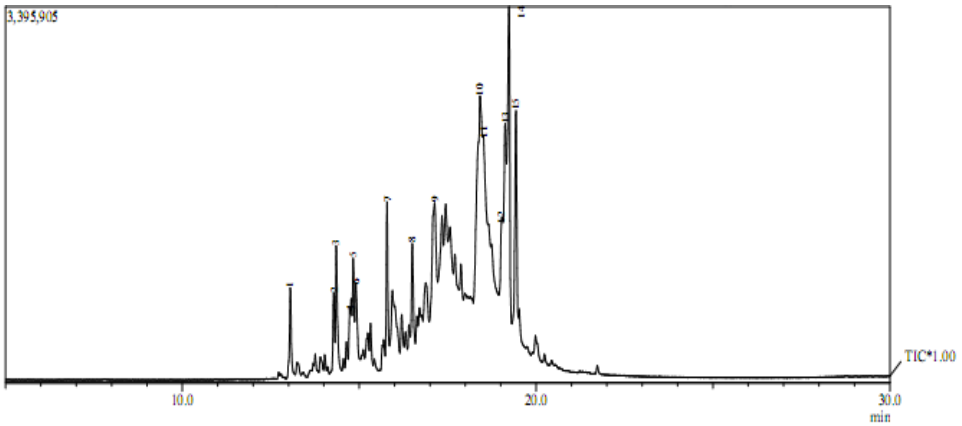

Figure 2. Chromatogram of Fraction of Heavy Vetiver Oil

Table 2. The results of GC-MS analysis of Fraction of Heavy Vetiver Oil

No	Component	Formula	Molecule weight	Percentage (%)
1	1,8-nonadien-6-YNE 2,8 dimethyl 3 methylene	$C_{12}H_{16}$	160	3,03
2	β-caryophyllene	$C_{15}H_{24}$	204	2,63
3	Khusimene	$C_{15}H_{24}$	204	4,74
4	α-amorphene	$C_{15}H_{24}$	204	3,30
5	Delta guaiene	$C_{15}H_{24}$	204	3,32
6	β-copaen-4 alpha-ol	$C_{15}H_{24}O$	220	3,44
7	Dehydroaromadendrene	$C_{15}H_{22}$	202	4,72
8	Valencene	$C_{15}H_{24}$	204	3,56
9	Viridiflorol	$C_{15}H_{26}O$	222	7,61
10	Valerenol	$C_{15}H_{24}O$	220	19,24
11	Davana ether 2 davana oil	$C_{15}H_{22}O_2$	234	5,34
12	Nootkatone	$C_{15}H_{22}O$	218	5,34
13	Megastigmatrienone	$C_{13}H_{18}O$	190	9,09
14	α-copaene	$C_{15}H_{24}$	204	15,98
15	Zierone	$C_{15}H_{22}O$	218	8,65
Total				100

The fraction of heavy vetiver oil in Table 3 contains 41,28% sesquiterpene hydrocarbons, 35,63% vetiverol, and 23,08% vetivone. According to research by Anon et al (2006) in Siregar, sesquiterpene compound group (30-40%), sesquiterpenol (18-25%) and sesquiterpenon such as benzoic acid, vetiverol, furfurol, α and β vetivone, vetivene and vetivenil vetivenat.

V. CONCLUSION

Based on the results of the study, it can be concluded as follows:

1. Fractions of light vetiver oil have components such as 64.94%sesquiterpene hydrocarbons, 8.96% vetiverol, and 26.07%vetivone.
2. Fractionsof heavy vetiver oil have components such as 41.28% sesquiterpene hydrocarbons, 35.63% vetiverol, and 23.08% vetivone.

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