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RESEARCH ARTICLE

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Enhancement of Patchouli Oils Quality Using Traditional Destillation Methods from Batang Indonesia by Plant Improvement

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Patchouli oil is an important product from Batang area which was very potential to develop due to their high economy value and became one of the dominant traditional export products. This production tends to decrease constantly and was not able to meet export demands. The main problem in the production of patchouli oil in this area was limited availability and quality of local patchouli plant. Improvement of introduced patchouli plant by selection, acclimatization and environmental adaptation had been conducted to evercome the problems. The quality of the patchouli oil from this improving plant by traditional distillation method by local farmer was not known comparing with local patchouli plant. The research objective was analyzed the quality of patchouli oil from local varieties of patchouli plant produced by traditional distillation. Research methods were conducted GCMS analysis on patchouli oil from improving plant and local patchouli plant produced from traditional distillation method technique. The results showed that patchouli alcohol from the improving patchouli plant showed higher content about 20.84% comparing with local patchouli plant about 14.45% which indicated the increasing quality of Batang patchouli oil.

Keywords: Essential Oil, Batang, Patchouli Alcohol.

1. INTRODUCTION

Industrial development of cosmetics, perfumes, medicines and pharmaceuticals has spurred patchouli oil production. Indonesia is the major supplier of patchouli oil to the world market about 90% of international trade. Indonesia produces around 1,200 tons per year, with a value of around US$70 to US$100 million.[1]

Indonesian patchouli plant (*Pogostemon cablin*) is an important producer of patchouli oil since 65 years ago and their volume of exports of essential oils tend to increase. The oil was suitable for aroma therapy relief of stress, anti bacterial and anti-inflammatory activity.[2] It has been reported that the essential oil from patchouli consists of patchouli alcohol (patchoulol) as a major component and several other minor components such as caryophyllene, α-, β-, γ- and δ-patchoulene, pogostol, seychellene, cycloseychellene, α- and β-bulnessene, α- and δ-guaiene and norpatchoulenol.[3]

Patchouli essential oil is an excellent product from Batang area which is not able to meet export demands. Unfortunately, the quality of local patchouli plant is low in producing patchouly oil a with small quantity of patchouli alcohol. Some researcher believed that this local patchouli plant was the member of Java patchouli (*P. heyneani*), a native Indian patchouli that grow in the forest on the island of Java.[4] In order to increase the production of patchouli oil from Batang area, some patchouli plant from several region in Indonesia like Aceh, Tawangmangu and Sukorejo were grown, adapted, selected, and acclimated to be introduced as improving patchouli plant. This experiment aims to analyze the quality of patchouli oil from improving plant that was planted and cultivated in Batang area comparing with local plant. The methods that to be used for this experiment was GCMS Analysis.

2. EXPERIMENTAL DETAILS

2.1. Plant Materials

Two varieties of *Pogostemon cablin* were used to collect their leaves separately in October 2016 from Batang region in Indonesia. The first varieties were collected from local patchouli plant.

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The second one is introduced, adapted and selected from other region to be growth in Batang region.

2.2. *Pogostemoncablin* Oil Extraction

The methods of extraction are performed using dried leaves of *P. cablin*. Before distilled, patchouli leaves dried in the sun for 4 hours (from 10.00 to 14.00) for 3–5 days depending on the sunlight and then extracted by traditional water-steam distillation.

2.3. GC-MS Analysis

A gas chromatography-mass spectroscopy (GC-MS) technique was used to analyze the chemical composition of patchouli oil. Patchouli oil was separated on a 30 m × 0.25 mm (Ix i.d.) capillary column coated with a 0.25 mm film of 5% phenyl methyl siloxane at a column temperature of 100 °C for injection. Temperature programming started at 60 °C and held 5 minute, then increased to 150 °C with rate 5°/minute and held for 5 min and then increased to 250 °C with rate 5 °C min^{-1} and held for 5 min. Using split less injection, (2 μL), helium was employed as the carrier gas with a flow rate of 1.2 mL/min. The spectrometer was operated in electron-impact (EI) mode, with electron energy of 70 eV and scan range of 40–500 amu. The ionization source and interface temperatures were 200 °C and 100 °C, respectively.

2.4. Quantification of Patchouli Alcohol in Patchoulioils by GC-MS

Quantitative analysis was performed by GC-MS using searching and matching with data library in Wilye9.lib. The searching index minimum between target analysis and library data was 90%. Compound concentration in sample was calculated with ratio area and total area.

3. RESULTS AND DISCUSSION

Patchouli (*P. cablin*) originated from Southeast Asia. Patchouli plants that grow in Batang generally Sidikalang varieties from Aceh although Batang area also had their own patchouli plant which believed to be Java patchouli varietis. Improving plant from several region like Aceh, Sukorejo and Bandungan that was selected, acclimated and adapted on Batang area resulted improving characteristic patchouli plant as illustrated in Figure 1. Sidikalang varieties is one of the results of patchouli plant explored by Balittro which known from their morphological characters, patchouli oil content, physical and chemical properties of oil and the nature of their resistance to disease and drought.[5] Patchouli is an herbaceous plant measuring about half to one meter. Patchouli growth requires the intensity of light is not too strong because it is easy to wilt when water shortages. Patchouli has a woody stem quadrangular. Green leaves arranged in opposite pairs. Oval, 10 cm long, 8 cm wide, with a slightly pointed tip. About 4 cm petiole reddish green. Patchouli can grow anywhere, either in lowland and highland (0–1200 m asl) but grows well at 200–600 m above sea level. Conditions other growth needed patchouli are rainfall 2000–3500 mm/yr, latitude 20° LS–20° N, the dry months (CH< 60 mm/month) 3 months, the maximum temperature of 30–32 °C, minimum 18–21 °C with an optimum temperature of 27 °C. Plant propagation is usually done vegetatively. Patchouli-growing and well-maintained can be harvested at the age of 6–8 months and then be harvested every 3–4 months after the first harvest.[6] Harvesting is done when the leaves are still dark green and not turn brown. Patchouli herb harvesting was done in the morning or in the afternoon in order to obtain a high oil content. Patchouli oil content highest in the leaves is 4–5%. The water content of dried herb optimal patchouli leaves are 12 to 15%. Several characters that are commonly used to distinguish local patchouli plant on Batang area and improving patchouli plant was summarize on Table I. Morphological characters showed that improving patchouli plant on Batang having similar characters with patchouli plant varietis from Aceh.

Fig. 1. Batang local patchouli plant (left), Improving patchouli plant.

3.1. GCMS Analysis

The chromatogram of GC-MS analysis of patchouli oil from local patchouli plant and improving plant was shown on Figure 2. The chemical compounds of both patchouli plant was summerized on Table II. which reveals that the both patchouli oil used in this experiment is having 22 similar compounds. Local patchouli plant having more compounds (34 compounds) comparing with improving patchouli plant (30 compounds). Different chemical compounds in both patchouli oil mainly caused by different varietis of plant. Other factors also affect the product including the geographic locations where growing patchouli, harvesting time, parts of the plant are harvested, and the processing method. Patchouli oil yield can be improved with proper handling of raw materials. The highest yield of patchouli oil obtained from the combined treatment of the drying time of 2 hours and 9 days of withering.[7] The highest levels of patchouli alcohol obtained from the combination treatment of the drying 6 hours and 9 days of withering.

The chemical compounds as summarize on Table II reveals that Batang local patchouli plant tend to have higher value of almost all of the compound except for .alpha.-Guaiene. It is also showed more compounds about 34 comparing with improving patchouli plant about 30 compounds. The advantages of improving patchouli plant reside in its patchouli alcohol content which improving patchouli plant having 44% higher

Table I. Character of Batang local patchouli plant and improving patchouli plant.

No.	Character	Batang local patchouli plant	Improving patchouli plant
1	Leaf surface	Smooth	Coarse
2	Leaf thicknes	thick	thin
3	Leaf edges	jagged pointy	serrated blunt
4	Leaf tip	tapered	pointy
5	Main stem	green	purple

Table II. Extraction of patchouli oils from dried leaves from local and improved patchouli plant.

	Compounds	Concentration (%) Local patchouli plant	Improving patchouli plant
1	Patchouli alcohol	14.46	20.84
2	AZULENE,	8.18	13,94
	1,2,3,4,5,6,7,8-OCTAHYDRO-1,4-DIMETHYL-7-(1-METHYLETHENYL)-, [1S-(1.ALPH		7.52
3	1,3-Cyclopentadiene, 1,3-bis(1-methylethyl)-	3.93	3.32
4	Seychellene (CAS)	3.69	3.16
5	.beta.-Patchoulene	1.90	1.80
6	trans-Caryophyllene	1.24	1.11
7	Cyclohexanone, 2,3,3-trimethyl-2-(3-methyl-1,3-butadienyl)-, (Z)-(CAS)	0.95	0.80
8	2H-Pyran-2-one, 3-acetyl-4-hydroxy-6-methyl-	0.84	0.61
9	Globulol	0.70	0.58
10	Cycloheptane, 4-methylene-1-methyl-2-(2-methyl-1-propen-1-yl)-1-vinyl-	0.35	0.29
11	Phenol, 2-methoxy-4-(2-propenyl)-(CAS)	0.33	0.34
12	Bicyclo[5.3.0]decane, 2-methylene-5-(1-methylvinyl)-8-methyl-	0.30	0.13
13	.alpha.-Guaiene	0.30	1.82
14	.beta.-elemene	0.27	0.24
15	(-)-Spathulenol (CAS)	0.26	0.15
		0.18	
16	POGOSTOL	0.23	0.21
17	4,4-Dimethyl-3-(3-methyl-3-buten-1-yliden)-2-methylidenbicyclo[4.1.0]heptane	0.19	0.15
18	7-Tetracyclo[6.2.1.0(3.8)0(3.9)] undecanol, 4,4,11,11-tetramethyl-	0.18	0.15
19	trans-Caryophyllene	0.18	0.14
20	Seychellene (CAS)	0.16	0.13
21	Glycyl-L-proline	0.14	0.12
22	1,3,5-Cycloheptatriene, 3,4-diethyl-7,7-dimethyl-	0.16	0.15
1	.beta.-Selinene (CAS)		40.41
2	.alpha.-Gurjunene (CAS)		1.12
3	(-)-DEHYDROAROMADENDRENE		0.21
4	(-)-Spathulenol (CAS)		0.17
5	Tricyclo[5.2.2.0(1,6)]undecan-3-ol, 2-methylene-6,8,8-trimethyl-		0.15
6	germacrene A (CAS)		0.14
7	6-Isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol		0.11
1 2	.delta.-Guaiene (CAS)	41.79	
		14.44	
2	Alloaromadendrene (CAS)	2.27	
3	1,2.ALPHA.,4-METHENOINDAN, 3A.BETA.,4.BETA.,5,6,7,7A-HEXAHYDRO-5.ALPHA.-ISOPRO	1.25	
4	LONGIFOLENALDEHYDE	0.17	
5	(-)-.alpha.-Panasinsen	0.15	
6	(-)-Caryophyllene oxide	0.14	
7	1-Naphthalenamine, 4-bromo-(CAS)	0.13	
8	Valerenal	0.13	
9	Pregan-20-one, 2-hydroxy-5,6-epoxy-15-methyl-	0.13	
10	(-)-.beta.-Elemene	0.13	
11	2H-Cyclopropa[g]benzofuran, 4,5,5a,6,6a,6b-hexahydro-4,4,6b-trimethyl-2-(1-methylethenyl)-(CAS)	0.12	

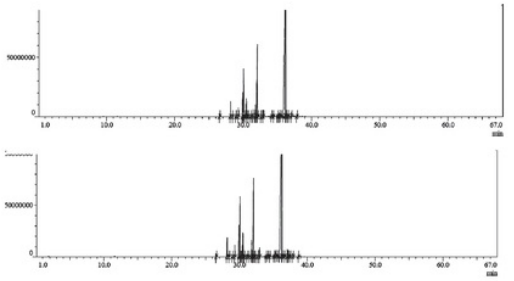

Fig. 2. Chromatogram of improving patchouli plant (top) and Batang local patchouli plant.

(20.84%) than local plant (14.46%). Patchouli alcohol was the main components that determine the quality of patchouli oil.[8] The research result also gained the dominant compounds on patchouli plant consist of azulene, Cyclopentadiene, Seychellene, β-patchoulene, trans caryophyllene, β-Selinene and δ-Guaiene. The major component which make difference between both plant with the highest percentages was δ-Guaiene (41.46%) in local patchouli plant and β-Selinene (40.41%) in improving plant. Other researcher[9] showed little different result in the patchouli oil components from Tapaktuan, South of Aceh District, Aceh Province, Indonesia, with high percentages of patchouli alcohol, δ-guaiene, α-guaiene, seychellene and α-patchoulene. This finding is in agreement with other researcher[10] which described five major components of the patchouli oil as patchouli alcohol, δ-guaiene, α-guaiene, seychellene, and α-patchoulene. They also supported this research result which showed that patchouli oil from Indonesia instead of having 41 compounds its also gained four new compounds: γ-gurjunene, germacrene D, aciphyllene and 7-epi-α- selinene). Patchoulenes, guaiene, seychellene are responsible for the aroma of patchouli oil. Other chemicals commonly found in patchouli oil instead of patchouli alcohol is patchoully camphor, benzaldehyde, eugenol, cinnamic aldehyde, seychellene, aciphyllene, α-bulnesene, α-, β and δ-patchoulene-patchoulene, β-caryophyllene, α- and δ-guaiene, pogostone δ-cardinene, germacrene-B, α-guaiene, δ-guaiene, β-elemene, frieddelin. trans-caryophyllene, epifriedelinol, pachypodol, retusine, oleanolic acid, β-sitosteroldaucosterol and pogostol.

Analysis result by GCMS methods from both plant also found new compound from patchouli oil such as α-gurjunene, Dehydroaromadendrene, Spathulenol, germacrene A, Alloaromadendrene, Panasinsen Caryophyllene-oxide, Naphthalenamine, Valerenal, beta.-Elemene. Other researcher find other elements like α-pinene, pogostol, β-pinene, and aciphyllene, limonene, α-patchoulene, cycloseychellene, δ-elemene, 7-epi-α-selinene, α-copaene, seychellene, caryophyllene oxide, α-patchoulene, β-caryophyllene 1,10-epoxy-11-bulnesene, norpatchoulenol, γ-gurjunene, nortetrapatchoulol, patchoulenone, 9-oxopatchoulol, α-humulene, isopatchoulenone, and germacrene D against Indonesian patchouli.[11] The chemical composition of patchouli oil varies among samples collected from different geographic locations.[12] The significant effect also reletad with different habitats, collection periods, collection time and processing methods on the volatile oil yield and its main constituents.[13]

This quality and chemical composition of patchouli oil from Batang area was affected mainly by the traditional distillation methods. Like the other region in Indonesia, the production of most essential oils is still mostly carried out by small farmer production using simple distillation equipment. This home industry had produced an important contribution to the incomes. This home scale industry was offering a promising potency to be improved further by application of such techniques to improving patchouli plant. The techniques that can be conducted such as selected source for raw material of patchouli plant, management of colection periods and time, processing methods like duration of distillation time, improvement of extraction method, temperature and dryng process for patchouli oil production.

4. CONCLUSION

In conclusion, this experiment shows patchouli alcohol from the improving patchouli plant showed higher content of patchouli oil quality comparing with local patchouli plant. This result was offering a promising potency of patchouli oil quality to be improve and increased it as an export product.

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