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THE CHARACTERISTIC OF SOME PROSPECTIVE ESSENTIAL OILS IN INDONESIA[1)]

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ABSTRACT

There are about 40 kinds of essential oil found in Indonesia, twelve of them have been known in the world's market. Nowadays, some new essential oils are being developed, among other things are *Clausena anisata* Oliv (clausena), *Litsea cubeba* Pers (krangean), *Cimbopogon citratus* (D.C) Stapf (Lemongrass) and *Cinnamomum burmanii* BL (Cassia vera). The oil content of clausena leaf was between 1.6 and 2.2 % while the oil yield obtained by water and steam distillation was between 1.5 and 2.0 % (wet basis). The major component of clausena oil was anethole which was about 90 to 95% of the oil. The oil yield obtained by water and steam distillation of krangean leaves was about 8%, while the oil content was about 9% (dry basis). Krangean oil consisted of various components, among other things were cineole (30%), citral (16%) and linalol (9%). The oil content of lemongrass leaves was about 0.4% (wet basis), while the oil yield obtained by water and steam distillation was about 0.31% (wet basis). The major components of lemongrass oil were citral-a (41%) and citral-b (35%). The major component of cassia vera bark oil was cinnamaldehyde which was 45% - 75%, whereas the oil content was about 1.8% to 3.6% depended on the quality of the bark. The oil yield was between 0.3 and 0.9% depended on the distillation method used.

Key words : Essential oil, *Clausena anisata, Litsea cubeba, Cinnamomum burmanii, Cimbopogon citratus*

ABSTRAK

Karakteristik beberapa minyak atsiri prospektif di Indonesia

Sekitar 40 jenis tanaman minyak atsiri terdapat di Indonesia, dua belas di antaranya sudah umum dikenal di pasaran dunia. Dewasa ini beberapa tanaman atsiri sedang dikembangkan di antaranya *Clausena anisata* Olive (klausena), *Litsea cubeba* Pers (krangean), *Cimbopogon citratus* (D.C) Stapf (serai wangi) dan *Cinnamomum burmanii* BL (kayu manis). Kadar minyak daun klausena berkisar antara 1.6 - 2.2%, sedangkan minyak yang dihasilkan secara dikukus berkisar antara 1.5 - 2.0% (berat basah). Komponen utama minyak daun klausena adalah anetol (90 - 95%). Minyak hasil destilasi secara dikukus pada daun krangean adalah sekitar 8%, sedangkan kadar minyaknya sekitar 9% (berat kering). Minyak Krangean terdiri atas berbagai komponen, di antaranya sineol (30 %), sitral (16%) dan linalol (9%). Kadar minyak daun serai dapur adalah sekitar 0.4% (berat basah), sedangkan minyak hasil destilasi secara dikukus sekitar 0.31% (berat basah). Komponen utama minyak serai dapur adalah sitral-a (41%) dan sitral-b (35%). Komponen utama minyak kulit kayu manis adalah cinnamaldehid (45 - 75%), dengan kadar minyak antara 1.8 - 3.6% tergantung mutu kulit. Minyak yang dihasilkan antara 0.3 - 0.4% tergantung metode destilasi yang digunakan.

INTRODUCTION

Indonesia is one of the essential oils producing countries in the world. In Indonesia, there are about 40 plant species which are available to be extracted (Rusli *et al.*, 1985), but only 12 of them have been developed and exported, and only 9 out of 12 have a good export price stability (Tjiptadi, 1985 and Anon., 1970).

Most of the Indonesian essential oil commodities which enter the world market increased by number from year to year. In 1970, the exports were limited only to citronella, vetiver, patchouli, cajeput and cananga oil. In 1975, clove leaf oil began to enter the world market and followed by sandalwood, nutmeg, pepper, cubeb and gurjun oils in 1978 (Tjiptadi, 1985). The export of Indonesian essential oil is shown in Table 1.

The major essential oils producing provinces of Indonesia are West Java (citronella, vetiver and cananga), Central Java (clove leaf and cananga), North Sumatra (patchouli and gurjun), Aceh and West Sumatra (patchouly and nutmeg), East Nusa Tenggara (sandalwood), Lampung (pepper), Maluku (nutmeg and cajeput) and East Java (cananga and cajeput). In

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Table 1. Export of Indonesian essential oils from 1987 to 1990

Commodities	Quantity (kg)			
	1987	1988	1989	1990
cananga	54,550	8,766	45,704	28,430
citronella	503,720	253,550	599,355	651,737
cajeput	875	412	2,684	13,042
patchouli	876,459	435,070	684,541	872,529
vetiver	63,100	24,620	58,513	49,874
cloves	1,074,370	313,570	650,725	707,350
sandalwood	21,880	3,550	11,710	12,800
pepper	500	450	11,505	3,600
others	268,944	211,942	455,930	559,862
	2,882,397	1,257,930	2,520,305	2,889,224

Source : Tobing, (1991) and Moestopa, (1991)

the recent years, Indonesia has been developing other essential oils such as lemongrass, cubeb, cornmint, champor, cinnamon bark, clove bud, krangean, clausena etc. (Rusli and Wahid, 1990).

In relation to the development of some new Indonesian essential oils, RISMC (Research Institute of Spice and Medicinal Crops) has been doing some researches on them. One of the researches which has been done is the characteristics identification of clausena, krangean, lemongrass and cassia bark oils.

Clausena oil is produced from the leaf of *Clausena anisata* tree that belongs to Rutaceae family. RISMC has tried to develop the crop at Solok (West Sumatra) in a yellow red latosol soil at the altitude of 460 m above sea level. At this location the trees grow well. The oil is usually used in pharmacy, beverages and perfume industries.

Krangean oil is produced from the tree of *Litsea cubeba* Pers which can be found on hill side of mountains especially in Java and Sumatra as wild plants. Its leaf, bark and nut contain essential oil. There are two varieties of *Litsea* sp., namely krangean and trawas. Their chemical constituents and physico-chemical properties are very much alike.

Lemongrass oil is produced from *Cymbopogon nardus* var. *citratus* that belongs to Graminae family. It is usually used in cosmetic, soap, pharmaceutical industries and also as spice. Lemongrass could be found almost in all regions in Indonesia, mainly in West Java, Central Java and West Sumatra.

Indonesia is one of the world's largest cinnamon bark producers. The main producing area are West Sumatra, Jambi and North Sumatra. The cinnamon that has been cultivated in these three areas are *C. burmanii*. Its bark is popularly called as cassia vera. Indonesia usually exports cinnamon bark consists of several grades, among them are KA, KB and KC grade. However, recently, cinnamon bark oil begin to be produced and developed in West Sumatra (from *C. burmanii*) and in Central Java (from *C. cassia*) (Rusli *et al.*, 1985).

This paper presents the result of the experiment on the characteristic identification of the four essential oils mentioned above as the new Indonesian essential oils which are prospective to be developed.

MATERIALS AND METHOD

Material preparation

The preparation of the sample before distillation process was as follow : clausena leaves were stored in the room for 3 hours before distillation process with about 56% moisture content. Krangean leaves were dried until about 18 to 20% moisture content prior to distillation process. Lemongrass leaves were spread out in the room for 1 night before distillation process with about 63 to 72% moisture content. Dried cassia bark (11 - 16% moisture content) produced from *C. burmanii* (KA, KB and KC grade) were ground before distillation process.

Distillation process

The distillation equipment used was made from stainless steel with 110 l capacity. Clausena, krangean and lemongrass oils were produced by water and steam distillation method, while cinnamon oil was produced by water and steam distillation and direct steam distillation. Distilla-

tion time for each commodity was as follow :

Clausena leaf : 5 hours
Krangean leaf : 5 hours
Lemongrass : 3 hours
Cassia vera barks : 6 hours

Analysis of the oils

The yield and oil content were calculated on a dry basis for krangean and cassia vera, and on a wet basis for clausena and lemongrass. Determination of specific gravity was carried out with 5 cc Picnometer Flask at 25°C, refractive index with Abbe Refractometer at 25°C, optical rotation with Polarimeter (Karl Zeiss Jena Type). Analysis of the components of the oils were carried out using a VARIAN-3700 Gas Chromatography unit with a 10% carbowax 20M stainless steel column, packed with chromosorb W/HP of 80/100 msh and 2 meter length. Carrier gas used was N2 at 40 $ml.min^{-1}$. The column was programmed from 100 to 220°C at the rate of $5°C.min^{-1}$. The concentration of the components were calculated based on the area normalization method

RESULTS AND DISCUSSION

Clausena oil

The oil content of clausena leaves was around 1.6 to 2.2% while the oil yield obtained by water and steam distillation was about 1.5 to 2.0% (wet basis). It is better to distill the leaves in fresh condition to prevent the lost of the oil due to evaporation. The physico-chemical properties of clausena oil is shown in Table 2 and its chromatogram in Figure 1.

The solubility of clausena oil in ethanol increased by the increase of the ethanol concentration (Table 2). The major component of clausena oil was anethole as trans isomer (95.1%) as shown in Fig.1. The anethole content of clausena oil was slightly higher than that of anise oil (80 - 90%) (Guenther, 1953). Clausena oil also contained small amount of cis-anethole, estragol and anise aldehyde.

Table 2. The physico-chemical properties of clausena oil

Characteristics	Value
Colour	light yellow
Specific gravity, 25°C/25C	0.9840 - 0.9842
Refractive index, 20°C	1.558 - 1.561
Optical rotation, (°)	(-0.6) - (-0.8)
Solubility in 70% ethanol	insoluble
80% ethanol	1 : 8, soluble and clear
90% ethanol	1 : 1, soluble and clear
Anethole content, (%)	90 - 95

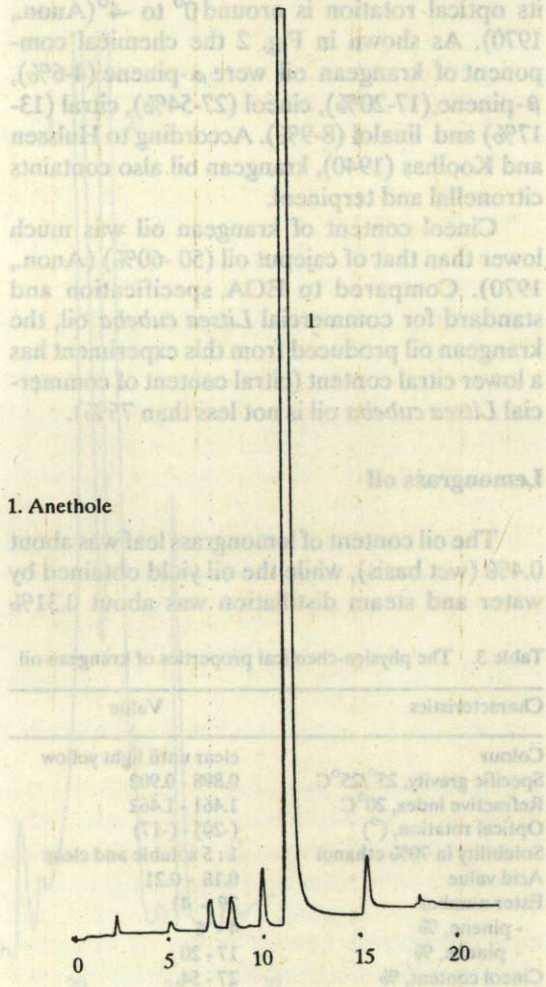

Figure 1. The chromatogram of clausena oil

Krangean oil

The oil content of *Litsea cubeba* leaves was about 9%, while the oil yield obtained by water and steam distillation was about 8% (dry basis). The physico-chemical properties of krangean oil is shown in Table 3 and its chromatogram in Figure 2.

The odour of krangean oil was very much alike cajeput oil but its refractive index and optical rotation were different. The refractive index of cajeput oil is between 1.466 and 1.472, while its optical rotation is around 0° to -4°(Anon., 1970). As shown in Fig. 2 the chemical component of krangean oil were α-pinene (4-6%), β-pinene (17-20%), cineol (27-54%), citral (13-17%) and linalol (8-9%). According to Hulssen and Koolhas (1940), krangean oil also containts citronellal and terpineol.

Cineol content of krangean oil was much lower than that of cajeput oil (50 -60%) (Anon., 1970). Compared to EOA specification and standard for commercial *Litsea cubeba* oil, the krangean oil produced from this experiment has a lower citral content (citral content of commercial *Litsea cubeba* oil is not less than 75%).

Lemongrass oil

The oil content of lemongrass leaf was about 0.4% (wet basis), while the oil yield obtained by water and steam distillation was about 0.31% (wet basis). The physico-chemical properties of lemongrass oil is shown in Table 4 and its chromatogram in Figure 3.

The specific gravity, refractive index, optical rotation and the citral content of lemongrass oil produced met the EOA standard. However, the solubility in 90% ethanol was better than that of in EOA specification and standard (Table 4).

Table 3. The physico-chemical properties of krangean oil

Characteristics	Value
Colour	clear until light yellow
Specific gravity, 25°/25°C	0.898 - 0.902
Refractive index, 20°C	1.461 - 1.462
Optical rotation, (°)	(-20) - (-17)
Solubility in 70% ethanol	1 : 5 soluble and clear
Acid value	0.18 - 0.21
Ester number	29 - 41
- pinene, %	4 - 6
- pinene, %	17 - 20
Cineol content, %	27 - 54
Citral content, %	13 - 17
Linalol content, %	8 - 9

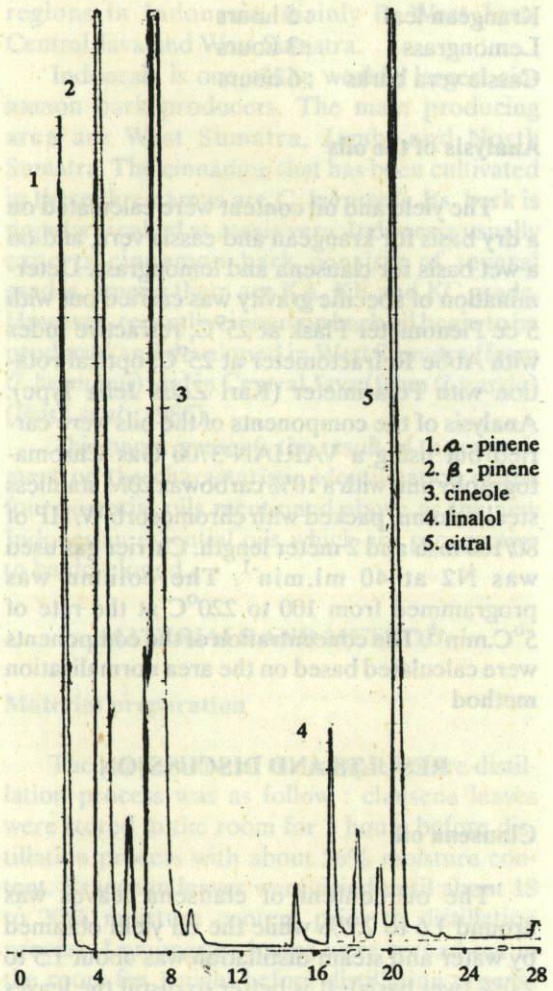

Figure 2. The chromatogram of krangean oil

Table 4. Physico-chemical porperties of lemongrass oil

Characteristics	Value	EOA standard*)
Colour	light yellow	light yellow to brown
Specific gravity, 25°/25°C	0.872-0.874	0.869 - 0.994
Refractive index, 20°C	1.483-1.486	1.483 - 1.489
Optical rotation, (°)	(-0.6)-(-0.1)	(-3) - (+1)
Solubility in 90% ethanol	1 : 1 soluble and clear	cloudy in 70,80,90 and 95% ethanol
Citral content, %	76 - 83	not less than 75%

*) Anonymous, 1970

As shown in Figure 3, the major component of lemongrass oil was citral which consisted of citral-a (39-44%) and citral-b (34 - 38%). The concentration of these components were calculated by area normalization method.

Cassia vera bark oil

The oil content of cassia vera bark was between 1.8 to 3.6 % depending on the grade/ quality of the barks, while the oil yield was be-

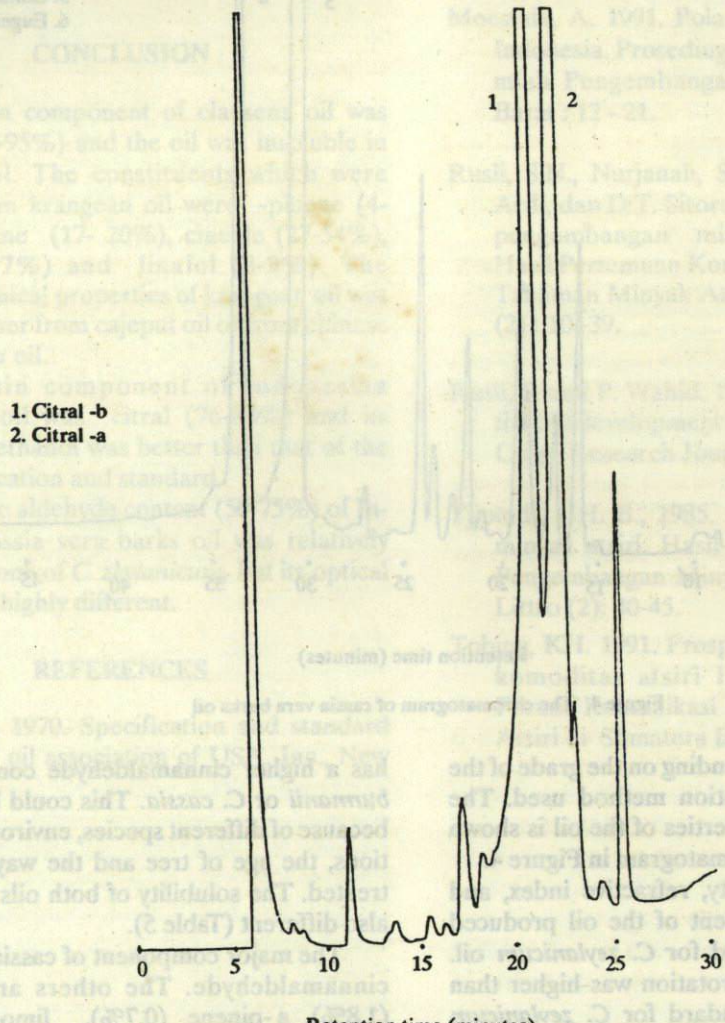

Figure 3. The chromatogram of lemongrass oil

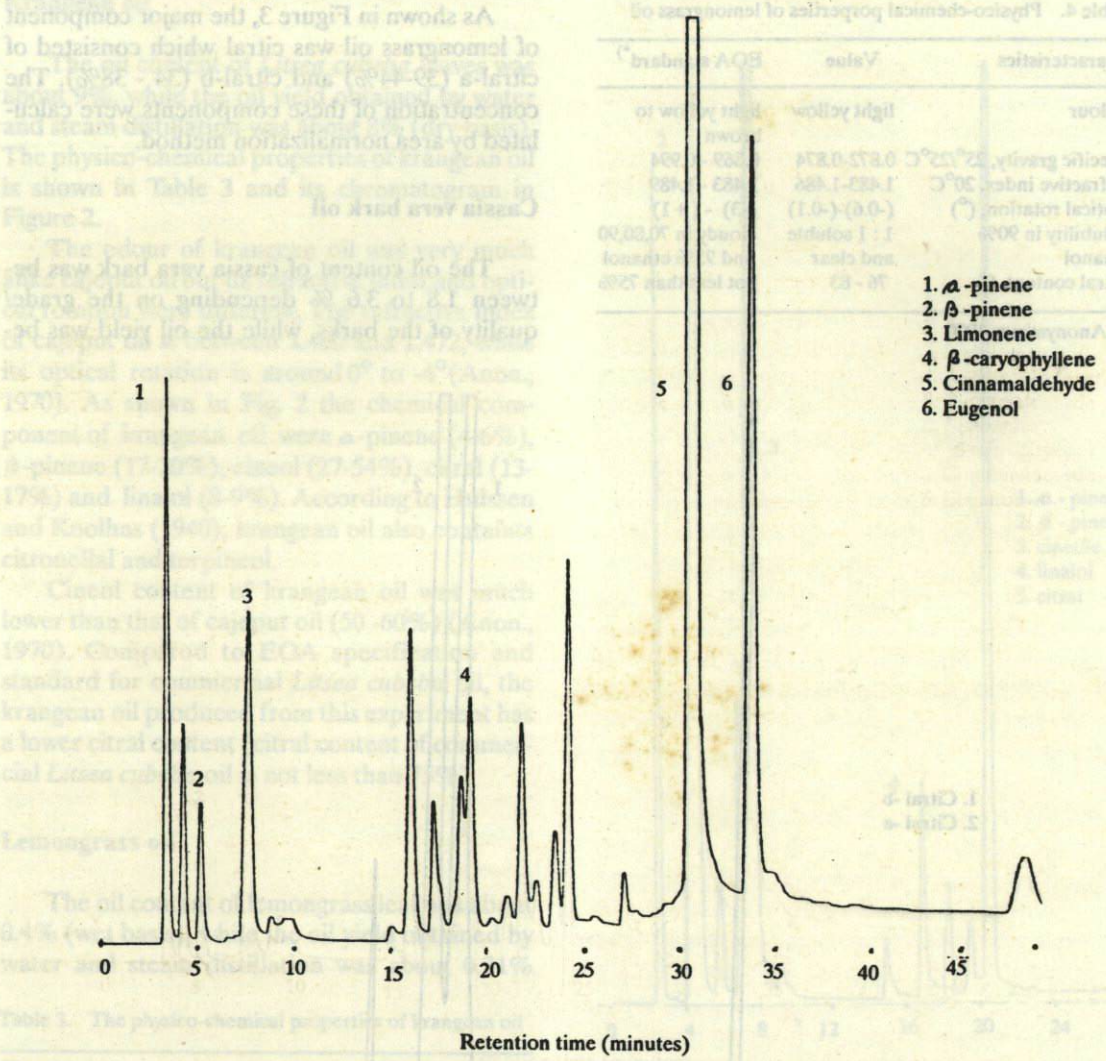

Figure 4. The chromatogram of cassia vera barks oil

tween 0.3 to 0.9% depending on the grade of the barks and the distillation method used. The physico-chemical properties of the oil is shown in Table 5, and its chromatogram in Figure 4.

The specific gravity, refractive index, and cinnamaladehyde content of the oil produced met the EOA standard for *C. zeylanicum* oil. However, the optical rotation was higher than that of the EOA standard for *C. zeylanicum* (Table 5). This fact is deviated from the statement of Arctander (1960) that *C. zeylanicum* oil has a higher cinnamaldehyde content than *C. burmanii* or *C. cassia*. This could be happened because of different species, environment conditions, the age of tree and the way sample was treated. The solubility of both oils in ethanol is also different (Table 5).

The major component of cassia vera oil was cinnamaldehyde. The others are α-pinene (1.8%), β-pinene (0.7%), limonene (2.4%), β-caryophyllene (1.7%) and eugenol (5.9%).

Table 5. The physico-chemical properties of cassia vera barks oil and the EOA standard for C. zeylanicum oil

Chracteristic	Cassia vera barks oil	EOA standard for *C. zeylanicum* oil
Specific gravity, 25°/25°C	0.987 - 1.042	1.010 - 1.030
Refractive index, 20°C	1.543 - 1.603	1.573 - 1.591
Optical rotation, (°)	(-3) - (-23)	(-0) - (-2)
Solubility in 70% ethanol	soluble in 2 to 8 volume	soluble in 3 or more volume
Cinnamaldehyde content,%	50 - 75	55 - 78

Anonymous, (1970)

CONCLUSION

The main component of clausena oil was anethole (90-95%) and the oil was insoluble in 70% ethanol. The constituents which were detected from krangean oil were -pinene (4-6%), -pinene (17- 20%), cineole (27-54%), citral (13-17%) and linalol (8-9%). The physico-chemical properties of krangean oil was different either from cajeput oil or from chinese *Litsea cubeba* oil.

The main component of Indonesian lemongrass oil was citral (76-83%) and its solubility in ethanol was better than that of the EOA specification and standard.

Cinnamic aldehyde content (50-75%) of Indonesian Cassia vera barks oil was relatively equal to the one of *C. zeylanicum,* but its optical rotation was highly different.

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