



Chemical Compound of Essential Oils from Three Different Area of Tobacco Leaves (*Nicotiana tabaccum L.*) in Indonesia

Elda Nurnasari* and Subiyakto

Indonesian Sweetener and Fiber Crops Research Institute, Indonesian Agency for Agricultural Research and Development
Ministry of Agriculture, Jl. Raya Karangploso Malang, 65152, East Java, Indonesia

*Corresponding's Email: eldanurnasari@yahoo.com

ABSTRACT: The purpose of this research aims to investigate the chemical compound of essential oil from three different area tobacco leaves in East Java, Indonesia. Essential oil obtained by steam distillation of tobacco (*Nicotiana tabaccum L.*) from three different area, Magetan (1000 g), Bojonegoro (740 g), Ngawi (1663 g) yielded 6.32×10^{-2} %, 8.43×10^{-2} %, and 2.16×10^{-2} % essential oil respectively. Composition and characteristics of chemical compound in essential oil were analyzed using GC-MS method. The result showed total of 7 components from Magetan's tobacco, 6 components from Bojonegoro's tobacco, and 7 components from Ngawi's tobacco. The major essential oil components were cis-11-tetradecenyl acetate, methyl eugenol, and solanone. This chemical compounds have the potential to be used as a mixture of perfumes, pesticides, and some of them have a pharmaceutical effects, so thus giving more benefits other than as raw material for cigarettes.

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INTRODUCTION

Tobacco is a plant cultivated for its fresh leaves as raw material for the manufacture of cigarettes. The negative effects on human health as a result of smoking causes many anti-smoking campaigns carried out by a several health activists and restrictions on cigarettes circulation in some countries. Therefore it is necessary to find out alternative uses of tobacco other than to make cigarettes [1].

Tobacco leaves contain several chemical compounds, there are acids, alcohols, aldehydes, ketones, alkaloids, amino acids, carbohydrates, esters, and terpenoids [2], and containing an abundance of potentially useful compound, such as protein, polysaccharides and aromatic compounds [3]. Essential oil from tobacco have been reported contains several useful compounds and can be used in perfumes and smoking cessation products [1, 4, 5, 6].

This study was aimed to find out the chemical compound of essential oil from three different area tobacco leaves in East Java, Indonesia.

MATERIALS AND METHODS

The main material used in this study is tobacco leaves obtained from different species and come from three tobacco-producing areas in East Java, Indonesia. Namely Magetan, Bojonegoro and Ngawi. All material is dried in the sun and then cut into small pieces ($\pm 0.5 \text{ cm}^2$). A total of 1000 grams of tobacco leaves from Magetan, 740 grams tobacco leaves from Bojonegoro, and 1663 grams of tobacco leaves from Ngawi distilled using steam distillation for about 4 hours. The oil was collected and the yield was calculated as follows:

$$\text{Tobacco essential oil (\%)} = \left[\frac{\text{essential oil weight (g)}}{\text{tobacco leaf weight (g)}} \right] \times 100$$

Essential oils are then analyzed using a combination of gas chromatography and mass spectroscopy (GC-MS). Analysis of essential oils is done using Gas Chromatography- Mass Spectrometry (GC-MS) (Shimadzu QP-2010S, Japan). The column used was Rastek RX-5ms ($p = 30 \text{ m}$, $\Phi = 0.25 \text{ mm}$). The carrier gas is helium with a flow rate of 3 ml / min and a column pressure of 12 kPa. Programmed column temperature of 60 °C to 215 °C. In the early stages programmed column temperature constant at 60 °C for 5 minutes, then raised to 215 °C (10 °C/minute).

The components of the essential oils were identified by matching their mass spectra and retention indices with those stored in the computer (US National Institute of Standards and Technology (NIST)).

RESULTS AND DISCUSSION

From the results of steam distillation 1000 gram of Magetan tobacco leaves was obtained 0.63 gram (6.32×10^{-2} %) with yellowish brown colour and a very specific aroma and pungent. From the GCMS analysis detected 7 chemical components. The main chemical components (> 2%) consists of 3 compounds, namely cis-11-tetradecenyl acetate (52.97%), metil eugenol (38.07%), and solanone (5,01%).

Essential oil from Bojonegoro tobacco leaves (740 g) was obtained 0,62 gram (8.43×10^{-2} %) with the same colour as essential oil from Magetan tobacco leaves. From the GCMS analysis detected 6 chemical component. The main chemical components (> 2%) consists of 3 compounds, namely cis-11-tetradecenyl acetate (73.28%), metil eugenol (18.44%), and solanone (4.86%).

Steam distillation 1663 g of Ngawi tobacco leaves produced 0.36 gram essential oil (2.16×10^{-2} %) with yellow colour. GCMS analysis detected 7 chemical component, the main chemical components (> 2%) consists of 3 compounds, namely cis-11-tetradecenyl acetate (74,67%), metil eugenol (12,78%), and solanone (7,94%). Chromatogram profile of each of the essential oils are presented in Figure 1,2, and 3.

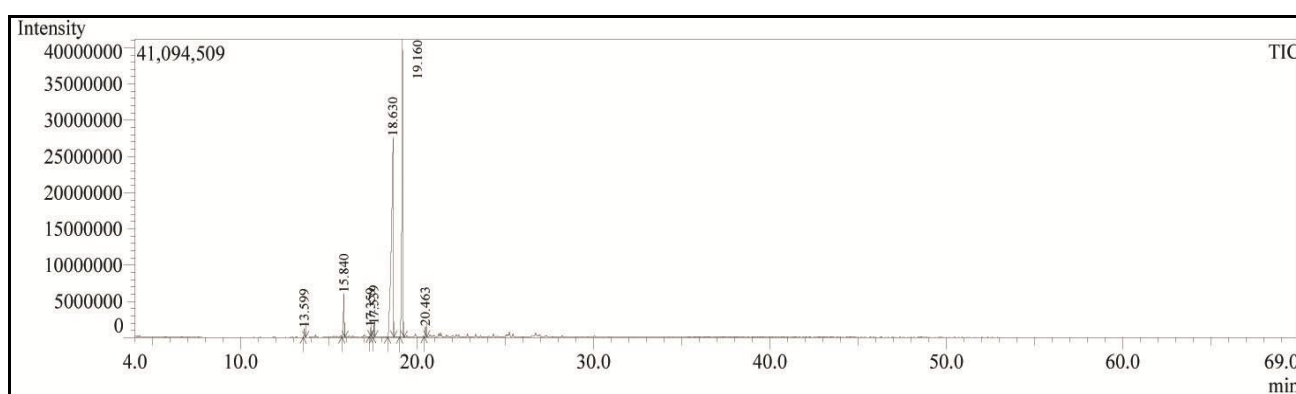


Figure 1. GC Chromatogram of essential oil from Magetan tobacco leaves

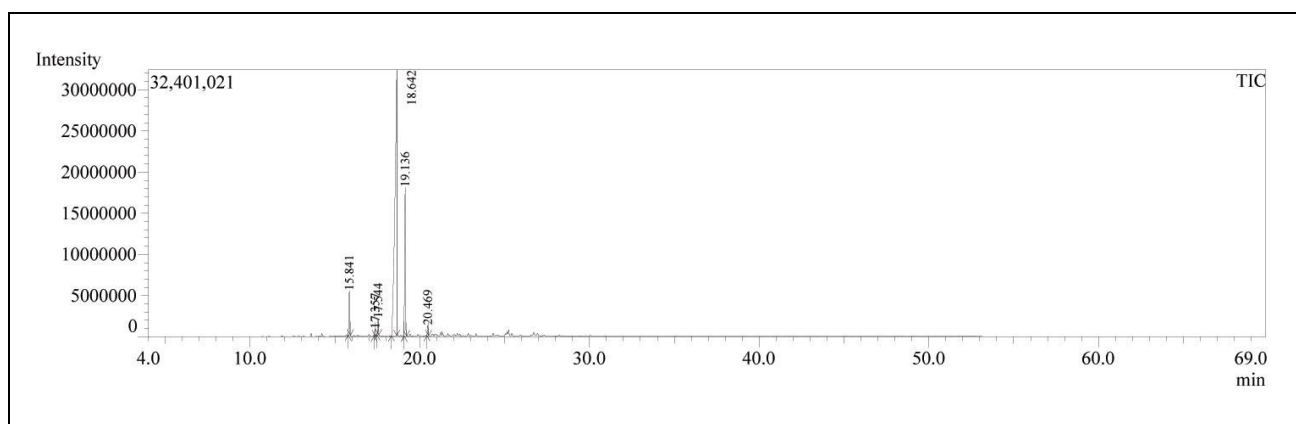


Figure 2. GC Chromatogram of essential oil from Bojonegoro tobacco leaves

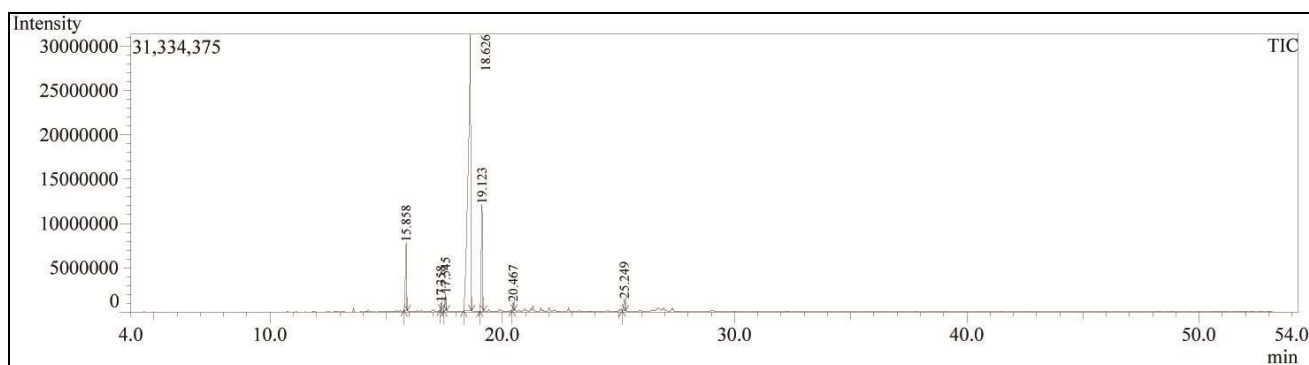


Figure 3. GC Chromatogram of essential oil from Ngawi tobacco leaves

Based on the differences in their chemical structure and molecular formula, constituents of the essential oil can be grouped into several groups such as monoterpene, monoterpene oxygenated, seskiterpene, seskiterpene oxygenated, benzene derivatives, organic acids, aliphatic esters, aromatic and aliphatic hydrocarbon ester (Table 1).

From the result of the GCMS analysis showed that three types of essential oils tobacco have a chemical component that is almost the same, although with different concentrations. Main constituent of essential oil compounds are cis-11- Tetradecenyl acetate. This could be due because three area of origin where the tobacco are planted (Magetan, Bojonegoro and Ngawi) is adjacent area, so that the environment in which tobacco to grow the condition almost the same. Therefore, most of the chemical compounds of three types of essential oils of tobacco is the same compound.

In general components of essential oils consists of monoterpena (C10), seskiterpena (C15), a derivative of benzene (C11), organic acids, aliphatic esters, aromatic esters and aliphatic hydrocarbons. The types of compounds found in tobacco essential oil shown in Table 2.

Table 1. Chemical component of essential oil tobacco leaves from three different area (Magetan, Bojonegoro and Ngawi)

No.	Chemical Component	Chemical	Molecular	Percentage (%)		
		Formula	Weight	Magetan	Bojonegoro	Ngawi
1	Solanone	C ₁₃ H ₂₂ O	194	5.01	4.86	7,94
2	Geranylacetone	C ₁₃ H ₂₂ O	194	0.75	0.60	0,57
3	3-Decen-1-yne	C ₁₀ H ₁₆	136	1.36	1.78	1,84
4	cis-11-Tetradecenyl acetate	C ₁₆ H ₃₀ O ₂	254	52.97	73.28	74,67
5	Methyl eugenol	C ₁₁ H ₁₄ O ₂	178	38.07	18.44	12,78
6	5-ethyl-2-heptanone	C ₉ H ₁₈ O	142	1.01	1.05	0,74
7	4,6,8-trimethylnonane	C ₁₂ H ₂₄	168	-	-	1,46
8	n-octane	C ₈ H ₁₈	114	0.82	-	-

Table 2. The types of compounds found in tobacco essential oil

Types of compounds	T. Magetan	T. Bojonegoro	T. Ngawi
Monoterpena (%)	-	-	-
Monoterpena oxygenated (%)	-	-	-
Seskiterpena (%)	-	-	-
Seskiterpena oxygenated (%)	-	-	-
Derivative of benzene (%)	38.07	18.44	12.78
Organic acids (%)	52.97	73.28	74.67
Aliphatic esters (%)	-	-	-
Aromatic esters (%)	-	-	-
Aliphatic hydrocarbons (%)	2.18	1.78	3.30
Others (%)	6.77	6.51	9.25

The main chemical compound in tobacco essential oil is cis-11- Tetradecenyl acetate, this compound are sex pheromone chemical component identified from female *Lepidoptera*, causing aggregation of males prior to mating [7]. Pheromone used by insect to communicate intraspecifically and resource-related volatiles to forage or localize hosts. Pheromones in general and more specifically sex pheromones are mostly blends of a few components emitted in a species-specific ratio [8]. Cis-11- Tetradecenyl acetate (Figure 4) contained in essential oil in tobacco leaves can be used as one of the ingredients to make attractant for some insect.

The second compound in essential oil tobacco leaves are methyl eugenol (Figure 5). Methyleugenol is a yellowish, oily, naturally occurring liquid with a clove-like aroma and is present in many essential oils. Methyleugenol is used as a flavoring agent, as a fragrance and as an anesthetic in rodents [9]. Therefore, the tobacco leaf has a distinctive aroma and pungent.

Methyl eugenol is a naturally occurring substance found in the essential oils of several plant species, typically for use as flavour or fragrance ingredients. The amount of methyl eugenol in an essential oil extracted from a given type of plant varies with the variety, plant maturity at harvest, harvesting method, storage conditions and extraction method [10]. Methyl eugenol is also a component of certain fragrances present in 15

pest control products in Canada. In the United States, methyl eugenol is used as a bait attractant for insect traps and lure products for control of fruit flies in fields and orchards [11].

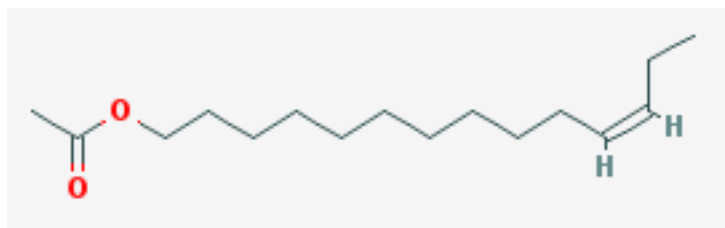


Figure 4. Cis-11-Tetradecenyl acetate

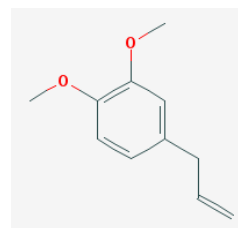


Figure 5. Methyl eugenol

CONCLUSION

The major chemical compound found in essential oil tobacco leaves from three different area were cis-11-tetradecenyl acetate, methyl eugenol, and solanone. These three types of chemical compound have different in percentage, this may be caused by differences in location, climate and type of tobacco grown place. Based on the content of chemical compounds have been identified that essential oils have the potential to be used as a mixture of perfumes and pesticides, thus giving more benefits other than as raw material for cigarettes.

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