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(RESEARCH ARTICLE)

Sensory analysis of several aromatherapy scented candle formulations using cinnamon essential oil

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Abstract

Cinnamon is a spice plant that contains aromatic compounds that function as aromatherapy. Cinnamon essential oil produced by distillation process from cinnamon bark. Aromatherapy scented candle is derivative products that can be produced with the addition of cinnamon essential oil. Inhaled aromatherapy candles can relieve stress, increase mood and eliminate unpleasant room odors. The purpose of this study was to know the volatile compounds of cinnamon essential oil, and to obtain the best formulation of cinnamon aromatherapy scented candle through sensory analysis. Volatile compounds were detected using the Gas Chromatography-Mass Spectrometry (GC-MS). Aromatherapy scented candle is made in five formulations with the different cinnamon essential oil quantity. The parameters of sensory analysis were color, unburnt candle scent, burnt candle scent and overall acceptability. The data from sensory analysis is processed statistically, then proceed with the Duncan Multiple Range Test (DMRT) if the significance value is less than 0.05. The results showed that volatile compounds found in cinnamon essential oil were 42.09% for *(Z)-3-Phenylacrylaldehyde, 2-Propenal, 3-phenyl-Cinnamaldehyde*, 24.33% for *4H-Thiopyran*, and 13.14% for *Propylene Glycol*. The best formulation of cinnamon aromatherapy scented candle is A4, in the parameters of unburnt candle scent, burnt candle scent, and overall acceptability get the highest point of 6.47, 6.07 and 6.43 respectively. As for color parameter, the A3 formulation received the highest point of 6.40.

Keywords: Cinnamon; Aromatherapy; GC-MS; Candle

1. Introduction

Cinnamon is one of the spices plants that contains aromatic volatile compounds that have various benefits. Cinnamon grows well in Indonesia, namely in the provinces of West Sumatra, Jambi, and South Kalimantan. Cinnamon has many benefits such as: 1) aromatherapy products through cinnamon essential oil, 2) flavor and aroma enhancers in food and beverages, 3) mixers in fragrance oils, and 4) mixers in household products because it has antibacterial properties. The previous research, shows that cinnamon at a concentration of 100% is able to inhibit the growth of *Escherichia coli* in the 4.85 mm inhibitory zone [1].

Cinnamon essential oil is obtained through the extraction process from cinnamon bark stems. This extraction method serves to separate volatile compounds contained in cinnamon bark stem cells. Cinnamon essential oil has a warm, spicy aroma and is slightly sweet, so this oil is widely used also as an aromatherapy product. Cinnamon essential oil used as aromatherapy serves to reduce stress, improve mood, and eliminate unpleasant odors in any rooms. Derivative product that can be produced from cinnamon essential oil are aromatherapy scented candle.

Aromatherapy scented candle is an alternative to the use of cinnamon essential oil by inhalation [2]. Aromatherapy scented candle can also serve as a decoration in room, and lighting as a substitute for lamps. The raw material for

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aromatherapy candles used in this study was palm wax. The use of palm wax as an alternative to the use of paraffin. This is because paraffin can produce smoke and emissions that are harmful to indoor air quality [3]. Based on the description above, this study aims to 1) to know the volatile compounds of cinnamon essential oil, and 2) to obtain the best formulation of cinnamon aromatherapy scented candle through sensory analysis.

2. Material and Methods

2.1. Materials and tools

The materials used in this study were certified Cinnamon Essential Oil taken from the "*Tetesan Atsiri*" distillery in Bogor, Palm Wax, a natural wax dye without aroma, stearic acid, mineral water, and ground coffee for sensory analysis. The tools used in this study were Gas Chromatography-Mass Spectrometry (GC-MS), glass jar with a diameter of 5 cm and a height of 5 cm, knives, hotplates, beaker glass of 1000 mL, candle wicks, stick holders for candle wicks made of wood, tissues, masks and gloves.

2.2. Aromatherapy Scented Candles Production

Cinnamon essential oil is tested first using a Gas Chromatography-Mass Spectrometry (GC-MS), to determine the volatile compounds contained in it. Furthermore, aromatherapy scented candle in this study were made in several formulations. The formulation and procedures in this study based on trial and error in the Laboratory and refer to the modified previous research [4]. The formulations were differentiated based on the amount of cinnamon essential oil added to each treatment and one control treatment. The formulations of aromatherapy scented candle in this study described in Table 1.

Tabel 1 Formulations of aromatherapy scented candle

Formulations	Palm Wax	Cinnamon Oil	Stearic Acid
A1	100 g	0 mL	33.3 g
A2	100 g	2.5 mL	33.3 g
A3	100 g	5 mL	33.3 g
A4	100 g	7.5 mL	33.3 g
A5	100 g	10 mL	33.3 g

The first step is the process of heating palm wax using a temperature in range of 50-70 °C until the wax melts as a whole. The addition of stearic acid is done with a ratio of stearic acid and wax, which is 1:3. Next, the melted wax is allowed to stand for approximately 15 minutes. Poured wax into a jar that has been paired with a stick holder in the middle of the jar with a candle wick in it. This stick holder serves to hold the wick of the candle upright until the candle hardens. The addition of cinnamon oil according to the treatment of A1, A2, A3, A4 and A5 is carried out. Next, the same amount of dye is added to each jar. Before the candle is lit, let the aromatherapy candle sit for 1-3 days until it hardens.

2.3. Sensory Analysis

Sensory analysis, also known as organoleptic, is an assessment made by humans using the five senses. The quality of a sensory analysis is determined by the information produced, therefore there needs to be a good approach to each process [5]. The sensory analysis conducted in this study was a hedonic test. The scale used is a scale of 1-7, namely, 1=strongly dislike, 2=dislike, 3=somewhat dislike, 4=ordinary, 5=somewhat like, 6=like and 7=very like.

The panelists used in this study were untrained panelists of 30 people who were randomly selected in terms of age, gender and profession. Panelists will be given the aroma of coffee to neutralize the aroma when conducting a hedonic test of cinnamon aromatherapy scented candles. The hedonic test result data will be calculated using the statistical analysis method of variance (ANOVA) using IBM SPSS Statistics 23. If there is a significant difference in each treatment, it will be continued on the Duncan Multiple Range Test (DMRT).

3. Results and discussion

3.1. Aromatherapy Scented Candles

The cinnamon essential oil used is a certified essential oil produced by "Tetesan Atsiri" in Bogor City. The main content of cinnamon oil is *cinnamaldehyde* and *eugenol* [6]. However, other volatile compounds also play an important role and have good benefits even in small amounts. The results of cinnamon essential oil testing using Gas Chromatography-Mass Spectrometry (GC-MS) tool, in this study can be seen in Figure 1 and Table 2.

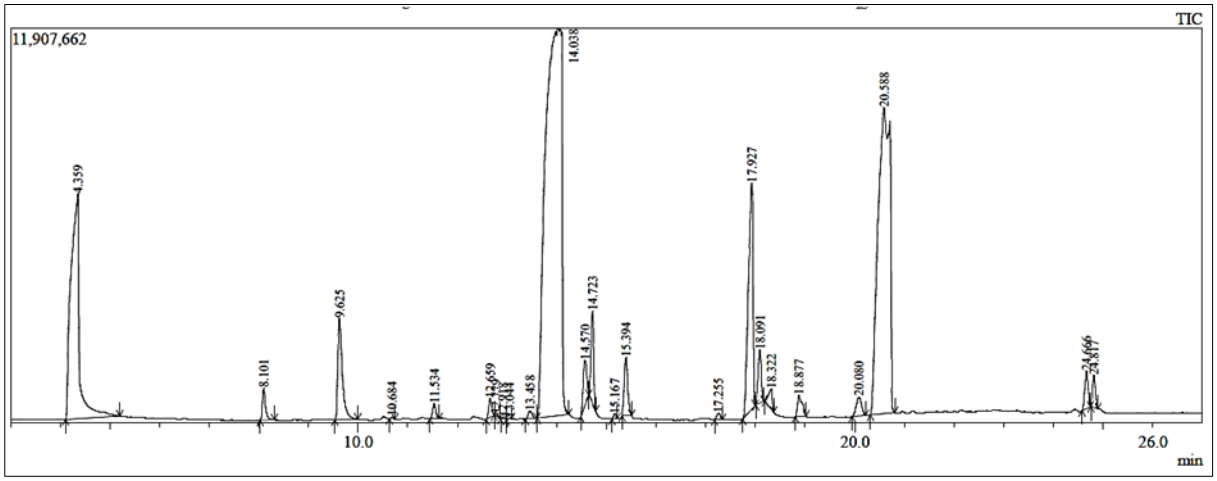

Figure 1 Chromatogram GC-MS of Cinnamon Essential Oil

Table 2 GC-MS Report of Cinnamon Essential Oil

Peak	Retention Time	Area %	Volatile Compounds
1	4.359	13.14	Propylene Glycol
2	8.101	0.65	Benzaldehyde
3	9.625	3.11	Benzyl alcohol
4	10.684	0.03	dI-Isopulegol
5	11.534	0.30	Naphthalene
6	12.659	0.39	(Z)-3-Phenylacrylaldehyde
7	12.779	0.03	Geraniol
8	12.918	0.02	2-Decenal
9	13.044	0.01	Citral
10	13.458	0.22	1,3-Dioxolane, 4-methyl-2-phenyl
11	14.038	42.09	(Z)-3-Phenylacrylaldehyde,2-Propenal, 3-phenyl-Cinnamaldehyde
12	14.570	1.12	2-Propen-1-oI, 3-phenyl
13	14.723	1.56	Triacetin
14	15.167	0.08	Propanoic acid, 2-phenylethyl ester
15	15.394	1.40	3-Allyl-6-methoxyphenol
16	17.255	0.14	Caryophyllene

17	17.927	7.03	Acetic acid, cinnamyl ester
18	18.091	1.14	Coumarin
19	18.322	0.49	2-Propenoic acid, 3-phenyl
20	18.877	0.67	4H-thiopyran-4-one, 2,3-dihydro-2-pheny
21	20.080	0.68	2-Propenal, 3-(2-methoxyphenyl)
22	20.588	24.33	4H-Thiopyran
23	24.666	0.84	Benzyl Benzoate
24	24.817	0.56	Tetradecanoic acid, ethyl ester
		100.00	

The results of the Gas Chromatography-Mass Spectrometry (GC-MS) of cinnamon essential oil, contained in large amounts of volatile compounds, namely 42.09% for *(Z)-3-Phenylacrylaldehyde, 2-Propenal, 3-phenyl-Cinnamaldehyde*, 24.33% for *4H-Thiopyran*, 13.14% for *Propylene Glycol compounds*. Apart from large amounts of compounds, there are other compounds with small amounts. *Cinnamaldehyde* is a compound that plays an important role in cinnamon essential oil, which functions as an antibacterial [7]. In the study of [7], cinnamon essential oil with three different extraction methods was tested using GC-MS and the largest volatile compound was *Cinnamic Aldehyde* of 73.345% for steam distillation method, 72.371% for ultrasonic assisted steam distillation, and 67.211% for microwave-assisted steam distillation. Similar to the other previous research [8], volatile compounds that make up essential oils are *trans-cinnamaldehyde* by 68.87%. The difference in volatile compounds in each cinnamon essential oil is assumed to be due to differences in the place where plants grow and the extraction process carried out.

The aromatherapy scented candles produced in this study have a characteristic cinnamon aroma, and a slightly brown color. The use of palm wax as a wax material in the process of making aromatherapy scented candles functions very well in holding volatile compounds from evaporating quickly. Thus, the aroma of the resulting aromatherapy scented candles has a longer aroma resistance. Cinnamon aromatherapy candles can be seen in Figure 2.

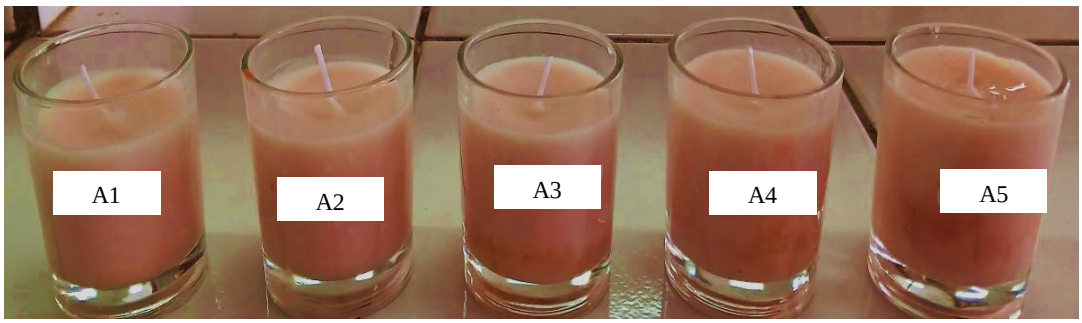

Figure 2 Aromatherapy Scented Candles

Aromatherapy scented candles add the same amount of dye, but the addition of different amounts of essential oils to each treatment, affects the color of the aromatherapy candles. The greater the amount of essential oil added, the more concentrated the brown color on the aromatherapy scented candle. The burning time of cinnamon aromatherapy candles is also different, where the results of this study show that the more essential oils added, the burning time in cinnamon aromatherapy candles is also getting longer.

The burning time of aromatherapy scented candles can also be affected by the type of candle used. The previous research [9], making lemongrass aromatherapy scented candles with raw materials of a mixture of soy wax and bee wax with a burning time of 2 hours. In the study of [10], the burning time of soy wax-based aromatherapy candles and bee wax averaged 6-8 hours. The burning time of cinnamon aromatherapy candles in this study can be seen in Table 3.

Tabel 3 Burning time of cinnamon aromatic candle

Formulation	Palm Wax	Cinnamon Oil	Stearate Acid	Burning Time
A1	100 g	0 mL	33.3 g	3 hours
A2	100 g	2.5 mL	33.3 g	4 hours
A3	100 g	5 mL	33.3 g	4.5 hours
A4	100 g	7.5 mL	33.3 g	6 hours
A5	100 g	10 mL	33.3 g	7.5 hours

3.2. Sensory Analysis

This hedonic test serves as a benchmarking test of different products, in order to choose which products are the most preferred and which are the least preferred. Panelists performed a hedonic test of cinnamon aromatherapy scented candles on the color, unburnt candle scent, burnt candle scent, and overall acceptability. The hedonic test results of cinnamon aromatherapy scented candles can be seen in Figure 3.

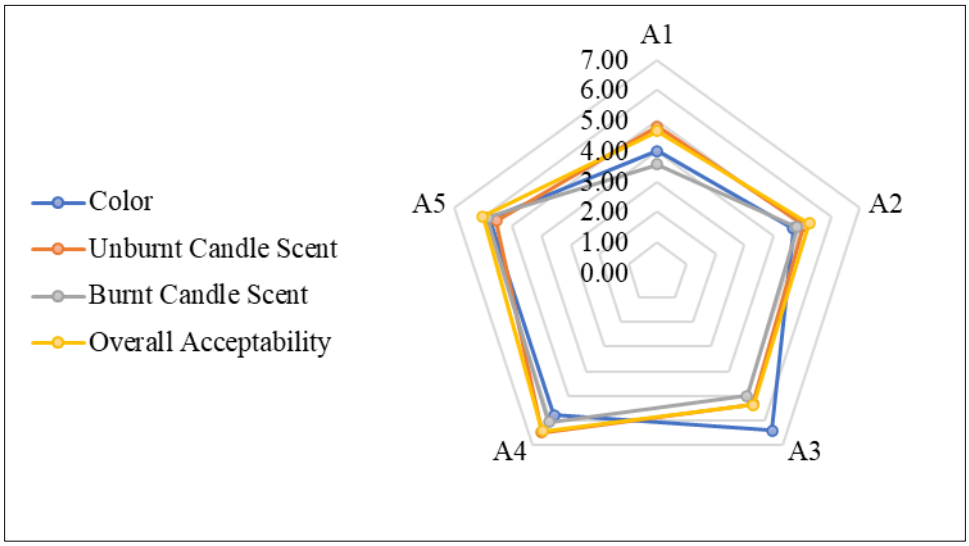

Figure 3 Spider Chart of Sensory Analysis of Cinnamon Aromatic Candle

The data from the hedonic test results were then analyzed variance (ANOVA). The color test results get a significance value below 0.05, which is significantly different between A3 formulations and other formulations. The A3 formulation, with the addition of 5 mL of cinnamon essential oil, received the highest point by the panelists, which was 6.40 points. For the assessment of unburnt candle scent, burnt candle scent, and overall acceptability also get a significance value below 0.05, where the A4 formulation is significantly different from other formulations and gets the highest point. A4 formulation points on the unburnt candle scent assessment are 6.47, burnt candle scent 6.07 and overall acceptability 6.43. For this reason, the A4 formulation is the best formulation because it gets the highest assessment on three of the four parameters measured.

Product acceptance by the public is now very important so that the product can be well received by many enthusiasts. Aromatherapy scented candles are products used to increase good atmosphere in a room, be it a room, living room, or office room [11]. For this reason, formulations that get the best acceptance need to be carried out further research so that products can be developed and sold in the market.

4. Conclusion

Volatile compounds with the largest amount found in cinnamon essential oil are 42.09% for *(Z)-3-Phenylacrylaldehyde, 2-Propenal, 3-phenyl-Cinnamaldehyde*, 24.33% for *4H-Thiopyran*, 13.14% for *Propylene Glycol*. Apart from large amounts of compounds, there are other compounds with small amounts. The best formulation of cinnamon aromatherapy

scented candles is the A4. Sensory analysis showed that the parameters of unburnt candle scent, burnt candle scent, and overall acceptability of the A4 formulation received the highest points of 6.47, 6.07 and 6.43 respectively. As for color parameters, the A3 formulation received the highest with 6.40 points.

Compliance with ethical standards

Disclosure of conflict of interest

The authors state that there are no conflicts of interest in the publication of this article.

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