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Original Paper

Aromatherapy Oil Massage Formulation From Essential Oil: Tuberose Flower (Polianthes Tuberosa) And Lime Oil (Citrus Aurantifolia)

Andrew Setiawan Rusdianto[1], Andi Eko Wiyono[1], Felly Halsa Fiana[1]*
1) Department of Agricultural Industrial Technology, Faculty of Agricultural Technology, Jember Universit
**) Corresponding Author: andrew.ftp@unej.ac.id*

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***Abstract*— Aromatherapy is a therapy that utilizes steam from the essential oils of certain plants. Essential oils are oils produced from plant parts, such as roots, bark, stems, flowers, leaves, and seeds that have volatile properties at room temperature without undergoing decomposition by means of distillation. This study aims to determine the effect of a comparison of the concentration level of essential oils on physical properties and consumer preferences and to find out the aromatherapy of massage oil formulation that produces the best massage oil. This study uses a completely randomized design (CRD) with 1 factor, namely the difference in the ratio of the essential oil of the nightly flower to the essential oil of lime. The experiment was carried out 2 times. The usual dilution was 1 ml of essential oil in 50 ml of carrier oil. The treatments are P1 (0.2 ml of nightly essential oil: 0.8 ml of lime essential oil), P2 (0.4 ml of nightly essential oil: 0.6 ml of lime essential oil), P3 (0.5 ml nightly essential oils: 0.5 ml lime essential oil, P4 (0.6 ml nightly essential oils: 0.4 ml lime essential oil), and P5 (0.8 ml nightly essential oils), 2 ml of lime essential oil). The parameters observed were pH, specific gravity, viscosity, refractive index, color, and hedonic test.**

***Keywords*— Massage Oil, Aromatherapy, Essential Oil**

I. INTRODUCTION

Tuberose flower production in Indonesia across the years has increased. Based on data from [1] the total tuberose flower production in East Java in 2011 was 46,279,671 stems, in 2012 amounted to 56,123,387 stems, in 2013 amounted to 59,854,971 stems, in 2014 amounted to 62,526,940 stems. The most crowded market shares are holidays such as Christmas, Eid al-Fitr, New Year, Chinese New Year, and the anniversary of independence. Sedap night flowers are only used as cut flowers and raw materials for making essential oils, so it is necessary to innovate the use of various products with a variety of uses, one of which is for the manufacture of massage oil.

Aromatherapy massage oil is a product of innovation using ingredients from essential oils that are not only used as relaxation, but also have benefits as antioxidants Citrus aurantifolia extract and provides the greatest antioxidant activity 6.03%, followed by fruit skin extract 13.75% and fruit flesh 14.36% in methanol. Extracts, pulp, and rind from Citrus aurantifolia can be used as a source of natural antioxidants to fight free radicals. Contents of lime juice which provide antioxidant activity are alkaloids, phenols, saponins, tannins, steroids, and flavonoids [2] In addition, essential oils from tuberose flowers contain eugenol which is useful as an antioxidant [3].

Aromatherapy massage oil by type of use still use chemicals such as the 2-phenoxyethanol compound. Based on research from Agencev Nationaledev Sécurité Duv Médicament etdes ProduitsdeSanté (ANSM) that preservatives of 2-phenoxyethanol can cause suppression of the Central Nervous System (CNS), vomiting, and diarrhea in infants [4]. According to [5] 2-phenoxyethanol preservatives can cause local anesthetic effects on the lips, tongue, and other mucous membranes. So we need aromatherapy massage oil made from natural resources. Therefore, in this study aromatherapy massage oils were made of tuberose essential oil and lime essential oil based on Virgin Coconut Oil.

II. RESEARCH METHODOLOGY

A. *Materials and Research Tools*

The ingredients used include virgin coconut oil, tuberose essential oil, lime essential oil, distilled water, 1 mM DPPH solution, methanol, and a-tocopherol. The tools used include label paper, questionnaires, analytical scales, beaker glass, measuring cups, spatulas, pH paper, viscometer ostwald, sucker pipettes, stopwatches, pycnometers, color readers, Polypropylene (PP), abbe refractometers, incubators, and spectrophotometers. UV Vis.

B. *Research Implementation*

1) *Research design*

The research method used is a completely randomized design method (CRD) with 1 factor. The factor is the difference in comparison of tuberose flower essential oil with lime essential oil. According to [7] the usual dilution is 1 ml of essential oil in 50 ml of carrier oil.

TABLE 1. Treatment Plan

Code	Type of Treatment
P1	0.2 ml of tuberose essential oil: 0.8 ml of lime essential oil
P2	0.4 ml of tuberose essential oil: 0.6 ml of lime essential oil
P3	0.5 ml of tuberose essential oil: 0.5 ml of lime essential oil
P4	0.6 ml of tuberose essential oil: 0.4 ml of lime essential oil
P5	0.8 ml of tuberose essential oil: 0.2 ml of lime essential oil

2) *Research procedure*

The research procedure of aromatherapy massage oil formulation from tuberose essential oil and lime essential oil can be seen in Figure 1.

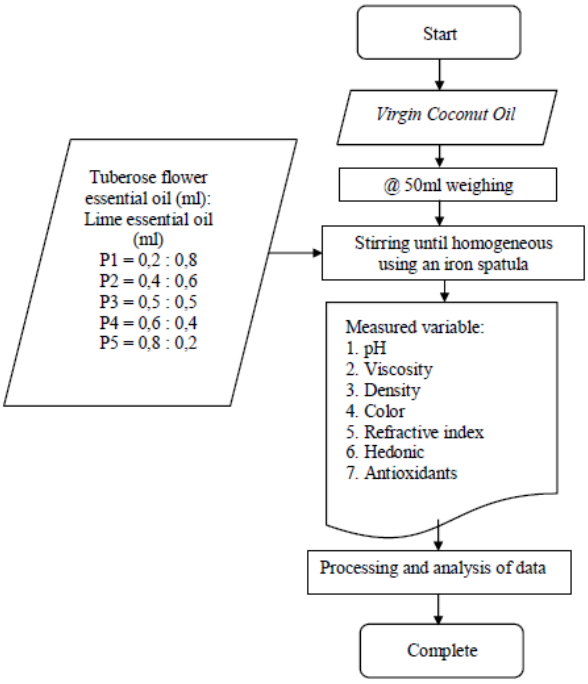

Fig. 1. Research procedure of aromatherapy massage oil formulation from tuberose flower essential oil and lime essential oil

C. Analysis Procedure

1) *PH test*

The pH test was carried out using pH paper. The pH paper was dipped into the sample, until pH paper's color changed. After the color on the pH paper had changed, the researchers identified the pH of the sample by comparing the results against color indicator to.

2) *Viscosity Test*

Viscosity test is calculated using the following formula:

$$\frac{\eta 1}{\eta 2} = \frac{\rho 1.t1}{\rho 2.t2} \quad (1)$$

where:
$\eta 1$ = sample viscosity (cP)
$\eta 2$ = viscosity of aquades (cP)
$\rho 1$ = Density sample (g / ml)
$\rho 2$ = Density of aquades (g / ml)
$t1$ = The time taken for the sample to pass through the capillary tube (s)
$t2$ = The time taken for aquades to pass through the capillary tube (s)

3) *Density*

Measurement of density uses the following formula:

$$\rho = \frac{m_1 - m_3}{m_2 - m_3} \quad (2)$$

where:
ρ = density (g / ml)
m1 = mass of pycnometer with massage oil (g)
m2 = mass of pycnometer with aquades (g)
m3 = empty pycnometer mass (g)

4) *Density*

The tool used for color measurement in this study is the color reader. The measurement method used is the measurement of absolute color systems L *, a * and b *.

5) *Index of refraction*

The refractive index in oil can show the ability of the oil to deflect the light being passed so it approaches or moves away from the normal line. Refractive index testing is done using an abbe refractometer.

6) *Hedonic Test*

Hedonic tests include the overall appearance of massage oil, aroma, color, and thickness produced by massage oil. This test was conducted using 30 panelists aged 18 to 65 who were physically and mentally healthy. The parameters used in the hedonic test are as follows:
Value 1 = Strongly dislike
Value 2 = Dislike
Value 3 = Fairly dislike
Value 4 = Neutral
Value 5 = Fairly like
Value 6 = Like
Value 7 = Strongly like

7) *Index of refraction*

The antioxidant activity test using DPPH method uses 1,1-diphenyl2 picrilhidrazil (DPPH) as a free radical. The ability of antioxidants is expressed by the percentage of radical capture:

$$\%\, radical\ capture = \frac{A_o - A_I}{A_o} \times 100\% \quad (3)$$

where:
Ao = Absorbance form
AI = Absorbance sample

D. Data analysis

Research data were processed using Microsoft Excel and the SPSS (Statistical Package for the Social Sciences) application. Before the test, a data of normality test was conducted with the Kolmogorov-Smirnof test. If the results of normality test data were fulfilled, then the one way analysis of variance analysis (ANOVA) will be performed at a confidence level of 0.05 (5%) to determine the effect of the treatment on the measured parameters and if the treatment shows a difference between the mean treatment, a test continued using Duncan's Multiple Range Test (DMRT) at a significance level of 5%. If normality of data is not met, then the Kruskall Wallis statistical test and Post-Hoc analysis will be employed using the Mann-Whitney test. Hedonic tests use non-parametric Friedman tests. Data normality is tested by Kolmogorov-Smirnof.

III. RESULTS AND DISCUSSION

A. Aromatherapy Massage Oil Physical Test Results

1) PH Test Results

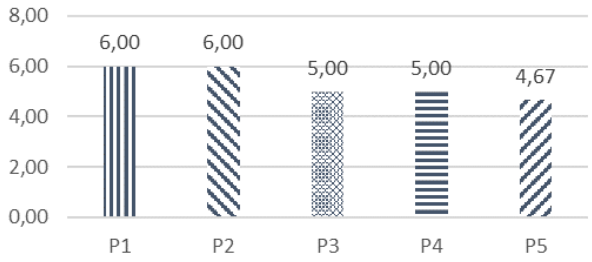

Figure 2. Measurement results of pH Massage Aromatherapy

The pH values for the five aromatherapy massage oil produced were in the range of 4.67 to 6.00. The results of pH test of the essential oil at night were 5.0, whereas that of the lime essential oil had a pH of 6.0. The greater the composition of lime essential oil is, the greater the pH is produced. The analysis results with a 5% significance level resulted in the insignificance of 0.061, which explained that the change in the composition of the added essential oil did not affect the pH value of aromatherapy massage oil products. Overall the pH value shown is in the range for pH on human skin, which is 4.67 to 6.0. According to [7] human skin tends to be alkaline, with acidity values of around 4.5 to 6.5. If the pH value for massage oil is within that range, massage oil is safe for use on human skin.

2) Proactiveness Construct

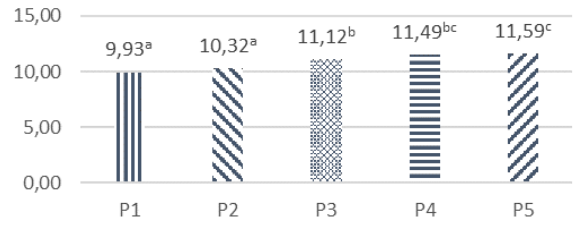

Figure 3. Viscosity Measurement Result of Aromatherapy Massage Oil

The value of viscosity for the five aromatherapy massage oil produced is in the range of 9.93 cP to 11.59 cP. The results of analysis of variance with a 5% significance level resulted in significance of 0.001, where the results explained that changes in the composition of the added essential oil could affect the viscosity of aromatherapy massage oils. The increase in the viscosity value is influenced by its density, where the magnitude of the viscosity is directly proportional to the density of the fluid [8].

According to [7] massage oil needs to satisfy the viscosity requirements generally ranging from 2.3 to 6.0 cP. When referring to [7], it can be explained that the five aromatherapy massage oil has exceeded the required viscosity level, which means that aromatherapy massage oil tends to be thicker.

3) Specific Gravity Test Results

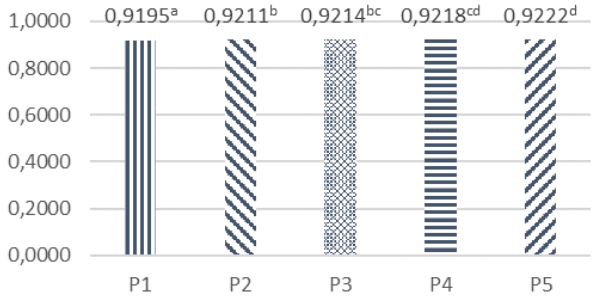

Figure 4. Results of Aromatherapy Massage Oil Specific Gravity Measurement

The results of specific gravity testing for the five treatments of aromatherapy massage oil showed values in the range of 0.900 g / ml. Results of analysis of variance with a 5% significance level resulted in significance of 0.001, where the results explained that the change in composition of the added essential oil affected the specific gravity of aromatherapy massage oil. The difference in specific gravity is influenced by the composition of fatty acids and the purity of raw materials. Specific gravity will increase with decreasing carbon chain length and increasing number of double bonds in fatty acids [9]. The lime essential oil has a specific gravity of 0.855 to 0.863, while the savory essential oil has a specific gravity of 1.015 to 1.027 [10]. This explains that the more addition of essential oil at night, the higher the specific gravity value produced.

4) Index of Refraction Test Results

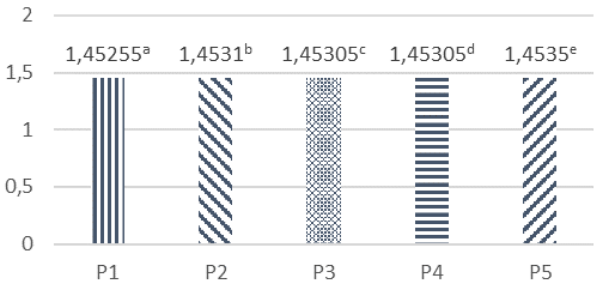

Figure 5. Measurement Results of index of refraction Massage Aromatherapy Oil Index

The test results of the five aromatherapy massage oil samples shown are in the range of 1.4526 to 1.4535. According

to [11] on citrus essential oils, the refractive index value generally ranges from 1.474 to 1.476, but according to [12] the refractive index values for tuberose essential oils are in the range of 1.455 to 1.503.

When comparing the results of the refractive index testing of the five samples of aromatherapy massage oil against the refractive index values according to [11-12], it is clear that the refractive index for the five samples of aromatherapy massage oil is close to the refractive index discussed in previous studies. Simply put, the five aromatherapy massage oil has a high level of purity. If you pay attention to the results of ANOVA with p 5%, we will see a p 0.001. The results explain that changes in the composition of the added essential oils affect the refractive index value of aromatherapy massage oil.

5) Color Composition Test Results

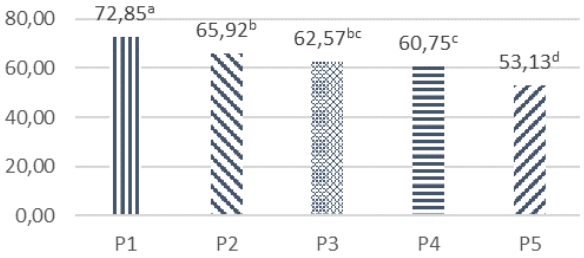

Figure 6. Results of Color Brightness Measurement (L *) Aromatherapy Massage Oil

The diagram demonstrates that the brightness level for the five products is above 50%, which means that aromatherapy wind oil with the addition of tuberose flower essential oils and lime essential oils tend to be brightly colored. p 0.001. The results explain that changes in the composition of essential oils added to the effect of the color brightness aromatherapy massage oil. According to [12] essential oils from tuberose flowers tend to be bright yellow. While the essential oils from orange peels also tend to be pale yellow. That is, the greater the amount of essential oil mixed, the brighter the color of the oil is. This also applies to the results of aromatherapy massage oil testing.

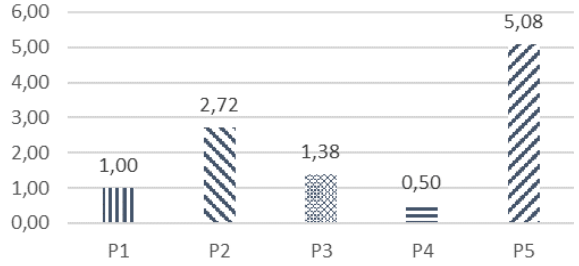

Figure 7. Results of Chromatic Color Red-Green (a *) Aromatherapy Massage Oil

The color test results indicates a (*) notation, which shows the chromatic color of aromatherapy oils that have been mixed with essential oils in red and the value - a * (negative) from 0 to -80 for green. However, the overall results for chromatic color notation in the five samples of aromatherapy massage oil tend to be red, because the values shown tend to be equally small. This result was also strengthened using analysis of variance of 5% significance level resulting in 0.574 significance, where the results explained that changes in the composition of essential oils did not affect the chromatic red-green color of aromatherapy massage oils.

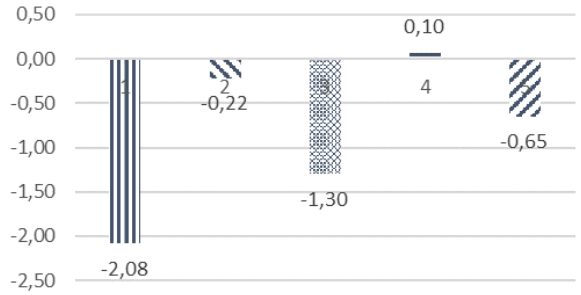

Figure 8. Chromatic Color Measurement Results Blue - Yellow (b *) Aromatherapy Massage Oil

According to [13] the value of the color notation + b * (positive) is in the value of 0 to +70 means that it shows the tendency of yellow, while when showing the value of 0 to -70 indicates the tendency of blue. The color test results show that the value of b* notation for the five samples of aromatherapy massage oil tends to be small, which means that the chromatic colors owned tend to be blue. This result is reinforced by the ANOVA results with a 5% significance level, producing α 0.574, where the results explain that the change in the composition of the added essential oil has no effect on the chromatic blue-yellow color of the aromatherapy massage oil.

B. Aromatherapy Massage Oil Hedonic Test Results

1) Color

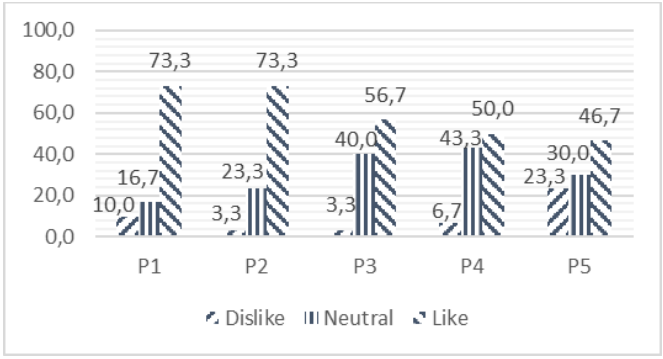

Figure 9. Comparison of Hedonic Tests for Color Massage Oil Aromaterapi (Persentase)

Based on the hedonic test results on the color of aromatherapy massage oil, it is known that the P1 and P2 samples have the color most preferred by panelists. The panelist preference value for the two samples of massage oil was 73.3%. Sample P1 is a sample of massage oil with the largest amount of lime essential oil and the smallest delicious flower essential oil and P2 sample is also the same but with a smaller amount of lime essential oil. This gives rise to a bright yellow color in aromatherapy oils for product samples P1 and P2. The results explain that aromatherapy massage oils preferred are bright yellow colored with dominant lime essential oil content. This result is reinforced by the Friedman test results yielding

significance 0.292, where the results explain that the change in the composition of the added essential oil has no effect on the panelists' preference for the resulting color parameters. As explained by [14], the greater addition of essential oils, especially lime essential oils, will tend to generate a yellowish color with a high level of brightness.

2) Aroma

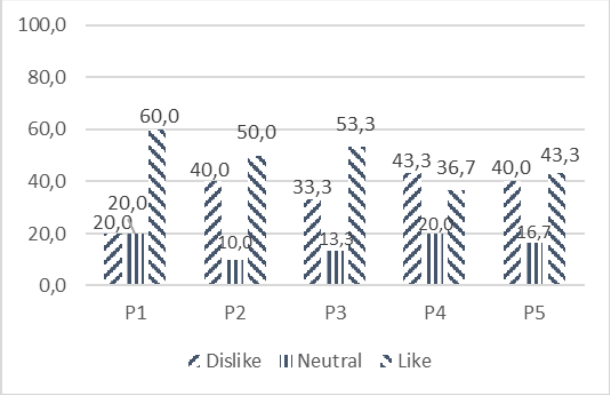

Figure 10. Comparison of Hedonic Tests to Aroma Massage Oil Aromatherapy (Percentage)

These results explain that aromatherapy massage oil with the addition of lime essential oil which is more than tuberose flower essential oil tends to be preferred. According to [15], lime essential oil has a scent which can improve one's mood. This result is strengthened by the Friedman test results yielding significance of 0.106, where the results explain that the change in the composition of added essential oil has no effect on panelist preferences with the resultant aroma parameter.

3) Viscosity

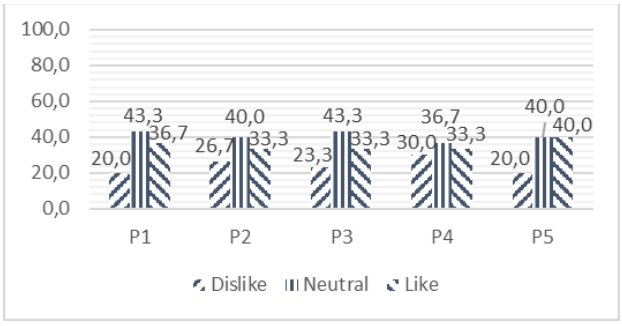

Figure 11. Comparison of Hedonic Tests to the Level of Viscosity of Aromatherapy Massage Oil (Percentage)

These results explain that the massage oil with the addition of the largest tuberose flower essential oil and with the addition of the smallest lime essential oil become the most preferred product sample for the viscosity level. When looking at the percentage of preferences for the five products, it does not differ significantly. The lowest preference is 33.3%, while the highest preference level is 40%. This percentage explains that basically the panelists prefer the presence of a mixture of essential oils from tuberose flowers and orange essential oils lime on aromatherapy massage oil. This result is confirmed by the Friedman test results yielding a significance of 0.908, where the results explain that the change in the composition of the added essential oil has no effect on the panelists' preference for the resulting viscosity parameter. [16] reveals that the content of lime essential oil in massage oil has benefits for stimulation and is safe for oily skin, sensitive skin, and wrinkled skin.

4) Warmth

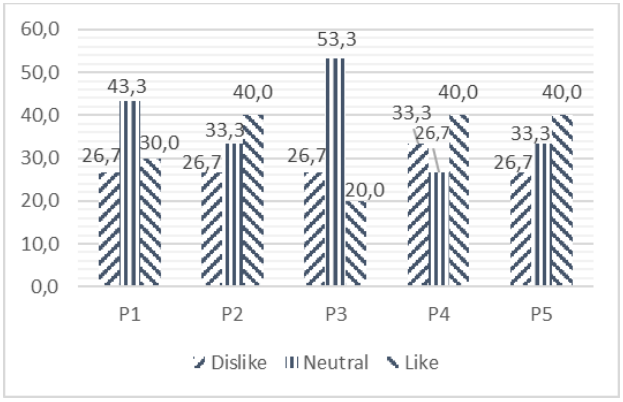

Figure 12. Comparison of Hedonic Tests to Warmth of Aromatherapy Massage Oil (Percentage)

These results explain that the panelists contend that all offered massage oils have an appropriate level of warmth, which is indicated by the value of the percentage of preference that is not far adrift. In P3 panelists tend to be neutral with the level of warmth they assess. Such conditions can occur because basically panelists assess aromatherapy massage oil as having the main function of being safe for the skin, so that differences in warmth do not influence their preference. This is explained also in the research results by [17] which explain that the safety aspects of aromatherapy massage oil need to be safe for the skin, which means it is non-irritating and safe for sensitive skin. Friedman test results yield significance 0.715, where these results explain that changes in the composition of the added essential oil does not affect the panelists' preference for the resultant warmth parameter. The warmth felt by the panelists was caused by the presence of methyl salicylate content in the essential oil of the flower at night. Methyl salicylate can function as an analgesic to reduce joint and muscle pain [18]. Pain or tenderness in muscles, joints, and tendons will be diverted by the cold feeling of methyl salicylate at the beginning, but after that, the skin will feel warm [19].

5) Overall Product

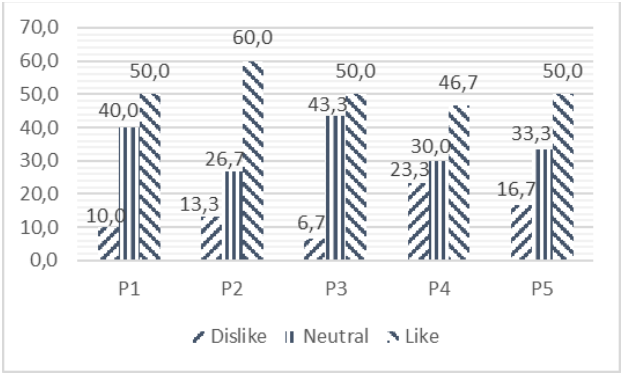

Figure 13. Comparison of Hedonic Tests to Overall Level of Aromatherapy Massage Oil (Percentage)

Based on Figure 5, it is known that the P2 product sample has the highest preference value of 60%. The P2 sample product itself is aromatherapy massage oil with the addition of more lime essential oil than the addition of tuberose flower essential oil. When paying attention to the overall aspects of aromatherapy massage oil, the value of the difference in the percentage of preferences is not significantly different.This explains that most of the panelists like the five aromatherapy massage oil products. This result is reinforced by the Friedman test results yielding 0.927 significance, where the results explain that the change in the composition of the added essential oil has no effect on the panelists' preference for the overall product yield. One factor is the superiority of essential oils added to massage oils, such as lime, which is good and safe for sensitive skin and does not cause irritation [16].

C. The Best Formulation of Aromatherapy Massage Oil

After conducting physical tests and testing the preferred parameters of the five aromatherapy massage oil formulations, the next step is to conduct an analysis to determine the best aromatherapy massage oil formulations. Determination of the formulation is based on two things, namely the average value of the panelists' preference parameters and the compatibility of the aromatherapy massage oil physical test results with the relevant literature. The determination of the first formulation is based on the average values of the preference parameters, where the preference value shown by the panelists consists of 7 values, ranging from strongly disliked to strongly liked.

TABLE 2. Recapitulation of the Average Value of Aromatherapy Massage Oil Parameters

Product Code	Average					Average value
	Color	Aroma	Viscocity	Warmth	Overall	
P1	5.1	4.7	4.37	4.03	4.6	4.56
P2	5.1	4.3	4.17	4.17	4.6	4.47
P3	4.83	4.4	4.27	4	4.67	4.43
P4	4.73	3.9	4.07	3.93	4.43	4.21
P5	4.57	4.1	4.33	4.07	4.27	4.27

Source: Primary Data of Writer (2020)

Table 2 shows that the five aromatherapy massage oil product formulations obtain an average value of 4. This explains that in general the aromatherapy massage oil formulation gets a neutral response. However, the aromatherapy massage oil formulation P1 shows an average value of close to 5, which is 4.56 and is the highest average value among other aromatherapy massage oil product formulations. Therefore, based on the average value of the overall parameters, P1 product can be an option for an ideal aromatherapy massage oil formulation.

This finding is in harmony with the results of determining aromatherapy massage oil formulations by using the average value of all parameters for each formulation. The physical test demonstrates the average values of the first and second tests for each formulation. Here is the recapitulation of the physical test results, which include the pH value, viscosity, specific gravity, refractive index, and the color of aromatherapy massage oil.

TABLE 3. Recapitulation of Physical Test Values for Each Aromatherapy Massage Oil Formulation

Physical Test	Criteria	P1	P2	P3	P4	P5
pH	4.5 – 6.5[1]	6	6	5	5	4.67
Viscosity (cP)	2.3 – 6.0[1]	9.93	10.32	11.12	11.49	11.59
Specific gravity (g/ml)	0.696 – 1.188[2]	0.92	0.92	0.92	0.92	0.92
Refractive index	1.455 – 1.503[2]	1.45	1.45	1.45	1.45	1.45
Color	Bright Yellow[2,3]	Yellow	Yellow	Yellow	Yellow	Yellow

Source: [1] = Gunawan (2019), [2] = Julianto (2016), [3] = Hidayati (2012)

Table 3 shows that overall the aromatherapy massage oil formulation complies with the physical test criteria performed, except for the viscosity test. In the viscosity test, the lowest value is shown in formulation P1, which explains that the aromatherapy massage oil has the closest level of viscosity criteria. Therefore, the aromatherapy massage oil formulation chosen is the P1 formulation, which is aromatherapy massage oil with the amount of tuberose essential oil of 0.2 ml and lime essential oil of 0.8 ml.

Based on the research results, it is known that the formulation of aromatherapy P1 massage oil is the chosen formulation which is then compared to the results of physical testing and antioxidant activity tests using DPPH method with aromatherapy massage oil which have been circulating on the market. The results of the comparison are shown in Table 4.

TABLE 4. Comparison of Physical and Chemical Testing Values of Selected Aromatherapy Massage Oil Formulations with Aromatherapy Massage Oil Formulations Circulating on the Market

Physical and Chemical Test	Criteria	P1	Competitor products
pH	4.5 – 6.5[1]	6	6
Viscosity (cP)	2.3 – 6.0[1]	9.93	8.55
Specific gravity (g/ml)	0.696 – 1.188[2]	0.92	0.87
Refractive index	1.455 – 1.503[2]	1.45	1.46
Color	Bright Yellow[2,3]	Yellow	Yellow
Antioxidant (%)	-	14.173	35.017

Source: [1] = Gunawan (2019), [2] = Julianto (2016), [3] = Hidayati (2012)

Referring to the information in Table 4, it is known that overall pH, viscosity, specific gravity, refractive index, and the same color have met the criteria for aromatherapy oil massage both on the P1 product formulation and competitors' products. Viscosity and specific gravity aromatherapy massage oil of competitors' products show lower value than P1. Lower viscosity shows that aromatherapy massage oil is not as thick as P1 aromatherapy massage oil. In terms of specific gravity, although the value of the specific gravity of the competitor's

product is lower, the value of the two products has met the criteria of good purity level. Antioxidant activity test results explain that P1 aromatherapy massage oil and competitors' products have antioxidant activity, but the antioxidant activity of P1 aromatherapy oil is indeed lower than that of competitors' products. This is because the material used for P1 aromatherapy massage oil is different from that of competing products in the market. This finding concludes that the P1 aromatherapy massage oil formulation is nearly similar to the aromatherapy massage oil of competing products which have been circulating in the market.

IV. CONCLUSION

The making of aromatherapy massage oil with varied addition of tuberose flower essential oil and lime essential oil affects the characteristics of physical properties, which include viscosity, specific gravity, refractive index, and color on the brightness value. However, in the consumer preference test, the addition of tuberose oil and lime essential oil does not make a significant difference or consumers tend to prefer each aromatherapy massage oil formulation with the addition of tuberose flower essential oil and lime essential oil. Aromatherapy massage oil which has the potential to produce the best massage oil is found in the aromatherapy massage oil formulation with the addition of 0.2 ml tuberose essential oil and 0.8 ml lime essential oil . This is based on the results of the consumer preferences test, showing the highest average value of preferences.

REFERENCES

[1] Badan Pusat Statistik. 2015. Statistik Indonesia. Jakarta.

[2] Reddy, L. J., R. D. Jalli, B. Jose, dan S. Gopu. 2012. Evaluation of Antibacterial and Atioxidant Activities of The Leaf Essential Oil and Leaf extract of Citrus Aurantifolia L. Asian Journal of Biochemical and Pharmaceutical Research 2:346-53

[3] [3] Guenther, E. 2011. Minyak Atsiri. Jilid 1 (Penerjemah) S. Ketaren. Jakarta : Universitas Indonesia.

[4] [4] Kim T. H. 2015. Simultaneous determination of phenoxyethanol and its major meta-bolite, phenoxy acetic acid, in rat biological matrices by LC-MS / MS with polarity Switcing: Application to ADME studies. Talanta Vol. 144: 29-38.

[5] [5] Rowe, R. C., J Sheskey, P. dan E Quinn, M. 2009. Handbook of Pharmaceutical Excipients 6th Ed. Pharmaceutical Press. Chicago.

[6] [6] Price, S., dan L. Price. 2012. Aromatherapy for Health Professionals E-Book. Edisi 4. Elsevier Health Sciences.

[7] [7] Gunawan, I. 2019. Formulasi dan Pembuatan Obat Gosok (Linimentum) Minyak Jahe (Oleum Zingiberis) dan Minyak Sereh (Oleum Citronelae). Jurnal Analis Farmasi Vol 4(1).

[8] [8] Sutiah, K., S. Firdausi, dan W. S. Budi. 2008. Studi Kualitas Minyak Goreng dengan Parameter Viskositas dan Indeks Bias. Jurnal Berkala Fisika 11(2) : 53-58.

[9] [9] Handayani, R. 2015. Karakteristik Fisiko-Kimia Minyak Biji Bintaro (Cerbera manghas L) dan Potensinya sebagai Bahan Baku Pembuatan Biodiesel. Jurnal Akuatika Vol. 6 (2):177-186.

[10] [10] Nugrahini, A. D., A. L. Ristanti, dan Jumeri. 2017. Characterization of Essential Oils from Tuberose Flowers Waste (Polianthes tuberosa L.). Journal of Advanced Agricultural Technologies 4(1):53-56.

[11] [11] Ekowati, D., Abid, A. N., dan Merari, J. 2013. Uji Aktivitas Minyak Atsiri Kulit Buah Jeruk Nipis (Citrus Aurantifolia, Swingle) Dalam Sediaan Lotion Sebagai Repelan Terhadap Nyamuk Aedes Aegypti. Biomedika 6(1):1823.

[12] [12] Julianto, Tatang S. 2016. Minyak Atsiri Bunga di Indonesia Edisi 1 Cetakan 1. Yogyakarta: Deepublish.

[13] [13] Sinaga, A. 2019. Segmentasi Ruang Warna L*a*b. Jurnal Mantik Penusa 3(1):43- 46.

[14] [14] Hidayati. 2012. DISTILASI MINYAK ATSIRI DARI KULIT JERUK PONTIANAK DAN PEMANFAATANNYA DALAM PEMBUATAN SABUN AROMATERAPI. BIOPROPAL INDUSTRI 3(2):39-49.

[15] [15] Ali, B., Al-Wabel, N. A., Shams, S., Ahamad, A., Khan, S. A., dan Anwar, F. 2015. Essential Oils Used In Aromatherapy: A Systemic Review. Asian Pacific Journal of Tropical Biomedicine 5(8): 601-611.

[16] [16] Michalak, M. 2018. The use of carrier oils in aromatherapy massage and their effect on skin. Archives of Physiotherapy & Global Researches 22(3): 23-31.

[17] [17] Hongratanaworakit, T., Soontornmanokul, S., dan Wongareesanti, P. 2018. Development Of Aroma Massage Oil For Relieving Muscle Pain And Satisfaction Evaluation In Humans. Journal of Applied Pharmaceutical Science Vol 8(04): 126-130.

[18] [18] Mason, L., R. A. Moore, J. E. Edwards, H. J. McQuay, P. J. Wiffen. 2004. Systematic review of efficacy of topical rubefacients containing salicylates for the treatment of acute and chronic pain. BMJ 328 (7446): 995.

[19] [19] Aisiyah, S., R. Harjanti, V. Nopiyanti, Suhartinah, R. S. P. Pudiastuti. 2017. PEMBERDAYAAN MASYARAKAT DALAM PEMBUATAN BALSAM METIL SALISILAT UNTUK MENGATASI RASA NYERI SENDI DAN OTOT DI LINGKUNGAN MOJOSONGO SURAKARTA. Journal of Dedicators Community 1(1): 76-81.