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Activity and Essential Oil Content in Butterfly Pea Flower Herbal Tea (Clitoria ternatea) and Siam Orange Peel Extract (Citrus nobilis) Encapsulated

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A B S T R A C T

This study aims to determine the antioxidant activity and essential oil content in a mixture of butterfly pea flower herbal tea and encapsulated siam orange peel extract with the best characteristics. The design used in this study was a completely randomized design (CRD) with five treatments and three replications. The treatments given in this study were A (without mixing encapsulated siam orange peel extract), B (mixing encapsulated siam orange peel extract 1%), C (mixing encapsulated Siamese orange peel extract 2%), D (mixing encapsulated siam orange peel extract 3%), E (mixing encapsulated siam orange peel extract 4%). The research data were analyzed statistically using ANOVA and continued with Duncan's New Multiple Range Test (DNMRT) at the 5% level. The results showed that the ratio of mixing encapsulated siam orange peel extract had a significantly different effect on water content, pH value, anthocyanin content, and antioxidant activity. The more the encapsulated siam orange peel extract is mixed, the higher the water content, the lower the pH value, the lower the anthocyanin content, the lower the antioxidant activity, and the higher the essential oil content as limonene, which is 3.90%.

Contribution to Sustainable Development Goals (SDGs):
SDG 3: Good Health and Well-being
SDG 9: Industry, Innovation and Infrastructure
SDG 12: Responsible Consumption and Production
SDG 15: Life on Land

1. INTRODUCTION

1.1. Research Background

Herbal tea is a drink made from leaves or flowers of plants that are processed or processed as in making tea. According to [1]Herbal tea is usually made from plants' flowers, seeds, leaves, and roots and can be consumed as a practical, healthy drink to maintain health. In addition, herbal tea can enhance the taste of each ingredient used without reducing its efficacy [2]. One type of plant that can be used as an herbal tea ingredient is the butterfly pea flower.

Butterfly pea flower (*Clitoria ternatea*) is a climbing shrub. Single flowers appear from the leaf axils and are shaped like butterflies. The flower petals are helpful as antioxidants, antidiabetics, antiobesity, anticancer, anti-inflammatories, and antibiotics, and they protect liver tissue. Various bioactive components are found in butterfly pea flowers, both lipophilic and hydrophilic. Among the bioactive components are flavonol glycosides, anthocyanins, flavones, phenolic acids, terpenoid and alkaloid compounds, and cyclic peptide or cyclotide compounds [3]. Flavonoids are potential antioxidants, so flavonoids are the compounds that contribute the most antiradical activity to butterfly pea flowers. Antioxidants can delay, slow down, or inhibit oxidation reactions and fight free radicals [4]. Free radicals are highly

reactive molecules because they have one or more unpaired electrons. Free radicals can attack any compound and have implications for the emergence of various diseases such as heart disease, cancer, arteriosclerosis, and symptoms of aging [5].

Besides butterfly pea flowers, orange peel can also be a source of natural antioxidants because it contains phenolic compounds, carotenoids, and ascorbic acid [6]. According to [7], the outer skin of the siam orange contains 6% essential oil with a composition of 90% limonene, 5% citral, and small amounts of citronellal, alpha-terpineol, linalyl, and geranyl acetate. The inside of the Siamese orange peel contains not essential oils but bitter flavonoid glycosides, coumarin derivatives, and pectin. Orange peel also contains essential oils that can be calming [8].

One of the compounds of essential oil is limonene. Limonene is one type of limonoid, a group that is chemically in the same group as triterpene and is found in plants from the Rutaceae family. Limonene ($C_{26}H_{30}O_8$) is a chemical component in essential oils in the form of terpenes, and this compound has a distinctive citrus scent and aroma [9]. The bitter taste found in orange juice after extraction is caused by limonene [10].

The appeal and functionality of butterfly pea flower tea can be enhanced by adding other ingredients or herbs, including encapsulated siam orange peel extract. Orange peels have antioxidant content that functions very well for health. The content in Siamese orange peel can provide aroma; siam orange peel can also provide flavor to butterfly pea flower tea in the form of limonene compounds.

Limonene compounds in orange peel can be prepared using the encapsulation method. The encapsulation of this active ingredient aims to coat the flavor by binding essential oils and can reduce damage to the material during drying. Encapsulation is one way to coat liquid or solid materials using certain coating materials or encapsulants to get better results as desired [11].

Based on the description above, the author conducted a study on mixing encapsulated siam orange peel extract and butterfly pea flower powder as herbal tea with encapsulated siam orange peel extract concentrations of 1%, 2%, 3%, and 4% to see the antioxidant activity and essential oil content in herbal tea. According to Ref. [12], adding encapsulated orange peel extract above 4% will produce a bitter taste.

1.3. Research Objective

This study aims to investigate the effects of adding encapsulated Siam orange peel extract (*Citrus nobilis*) to butterfly pea flower (*Clitoria ternatea*) herbal tea on its antioxidant activity and essential oil content.

2. MATERIALS AND METHODS

2.1 Preparation of the sample

2.1.1 Making Butterfly Pea Flower Powder

Fresh butterfly pea flowers were purchased from the Hydroponic Binara on Jalan Ampang Karang Ganting, Kuranji, Padang City, West Sumatra, and Siamese orange peels were obtained from a squeezed orange drink outlet on Jalan Bandar Purus, Padang City, West Sumatra.

Sort and wash the butterfly pea flowers with running water, separate the crown from the flower stalk, and wilt at room temperature, 25 °C, for 18 hours. Drying was carried out at a temperature of 60 °C for 5 hours using a food dehydrator, and then the size was reduced using a blender at speed 1 for ± 3 minutes.

2.1.2 Making Encapsulated Siam Orange Peel Extract

Cleaned from the skin that is still attached until only the flavedo part remains, then washed with running water to clean dust or dirt that sticks to the surface of the orange peel. The clean siam orange peel is cut into pieces of 1-3 cm and placed on the floor lined with paper to air for 24 hours at room temperature.

2.1.2.1 Extraction of Siam Orange Peel by Distillation Method

Orange peels were cut into small pieces, air-dried, weighed as much as 3000 grams, and put into the kettle. Then, add water until all samples are submerged in water. After that, the tool for distilling essential oils. The distillate is collected, and the water phase and orange peel oil are separated using only a cloth. The oil obtained is stored in a dark glass bottle and tightly closed

2.1.2..2 Drying

A total of 10 grams of maltodextrin was dissolved in 200 mL of water. The homogenization process was carried out at a speed of 600 rpm at a temperature of 50 ° C for 1 hour until a homogeneous maltodextrin solution was formed. The emulsion was made using the maltodextrin solution. A total of 200 mL of maltodextrin solution was mixed with 5 grams of orange peel essential oil and 5.6 grams of Tween 80, then homogenized at 700 rpm at room temperature for 30 minutes. The last stage is when the emulsion is left to obtain a stable condition before drying using a spray dryer.

2.1.2.3 Making Butterfly Pea Flower Herbal Tea by Mixing Encapsulated Siam Orange Peel Extract

The materials used in the study were prepared, namely butterfly pea flower tea. Mixed with encapsulated siam orange peel extract (0%, 1%, 2%, 3%, and 4%), 2 grams of the total weight of the formulation was taken. Wrapped with a bag sachet with dimensions of 5.5 x 7.5 cm. Herbal tea bags are ready for analysis.

2.2. Research Design

This study was designed using a Completely Randomized Design (CRD) with 5 treatments and 3 replications. The treatment was a comparison of the mixing of encapsulated siam orange peel extract at various concentration levels with three replications each. Observation data obtained during the study were analyzed for variance using the F test and continued with Duncan's New Multiple Range Test (DNMRT) at the 5% level if the observation results were significantly different.

The treatments that will be given are:

Treatment A = Without mixing encapsulated siam orange peel extract

Treatment B = Mixing encapsulated siam orange peel extract 1%

Treatment C = Mixing encapsulated siam orange peel extract 2%

Treatment D = Mixing encapsulated siam orange peel extract 3%

Treatment E = Mixing encapsulated siam orange peel extract 4%

2.3 Observation

2.3.1 Water Content [13]

The aluminum dish is dried in an oven for 10 minutes, cooled in a desiccator for another 10 minutes, and weighed (A). Weigh 3 grams of the sample into the dish. Place the dish containing the sample in the oven for the first 5 hours; if the weight is not constant, continue heating in the oven for 1 to 2 hours, avoiding direct contact between the dish and the oven walls. Remove the dish and its contents, cool in a desiccator, and weigh it (W2).

$$\text{Water Content (\%)} = \frac{W1-(W2-A)}{W1} \times 100\%$$

Description:

A : weight of the empty aluminum dish (g)

W1 : weight of the sample + aluminum dish (g)

W2 : weight of the sample + aluminum dish after drying (g)

2.3.2 pH Value [13]

Determination of pH (using a calibrated pH meter) is as follows: Measure the sample temperature, then turn on the pH meter and allow it to stabilize. Rinse the pH meter electrode with distilled or deionized water, then dry it with tissue. Immerse the electrode into the diluted sample, adjust the pH meter, and let it stay until the reading stabilizes, then record the sample's pH.

2.3.3 Anthocyanin Content [14]

Add 1 gram of sample and dilute it using 96% alcohol, then homogenize it. Next, add a pH one solution and a pH 4.5 solution. The sample was placed in a pH one solution for 15 minutes, while the one in a pH 4.5 solution was incubated for 5 minutes. Measure the absorbance of the sample placed in a cuvette at two wavelengths, 510 nm, and 700 nm, using a spectrophotometer. Once the absorbance values are obtained, the anthocyanin content can be calculated using the formula:

$$\text{Anthocyanin Content} = \frac{A \times FP \times BM \times 100}{\varepsilon \times b}$$

Description:

A : Absorbance value of the sample

FP : Dilution factor

MW : Molecular weight (550 g/mol)

Ɛ : Molar extinction coefficient

B : Cuvette path length (1 cm)

2.3.4 Antioxidant Activity [15]

Add 1 gram of sample to 10 mL of methanol in a test tube, then homogenize by vortexing and sonicating for 15 minutes. Dilute the homogenized sample by adding 1 mL of the solution and 9 mL of methanol, then place it in a test tube. Homogenize the sample again until it becomes clear. Once homogeneous, pipette 2 mL of the sample, add 1 mL of DPPH, and place it in a test tube. Next, keep the sample in a dark place for 15 minutes. Measure the sample with a spectrophotometer at a set wavelength of 517 nm. Record and calculate the results using the following formula:

$$\text{Antioxidant Activity \%} = \frac{abs.blanko-abs.sampel}{abs.blanko} \times 100\%$$

2.3.5. Analysis of Essential Compounds Using GC-MS [16]

Place 1 gram of tea powder into a test tube containing 4 mL of ethanol solvent, then vortex for 1 minute. Next, please place it in an ultrasonic bath for 30 minutes. After that, the sample was filtered using a syringe filter. The obtained filtrate is then used for GC-MS testing. Helium is the carrier gas at a constant flow rate of 1 mL/min, injecting one µL, with an injector temperature of 280°C. The column temperature program is set to 70°C (for 5 minutes) – 270°C (for 15 minutes) with a temperature increase of 10°C/min. GC-MS conditions: ion source temperature of 250°C, interface temperature of 300°C, and solvent cut time of 3 minutes. The GC-MS device identifies bioactive compounds, visible as chromatogram peaks for data identification and mass spectrometry (MS) results, viewed from the mass spectrum with each bioactive compound's molecular weight.

3. RESULT AND DISCUSSION

3.1 *Raw Material Analysis*

Observations made on raw materials are water content, pH value, anthocyanin content, and antioxidant activity. The results obtained from the analysis of each raw material can be seen in Table 2.

Table 2. Raw Material Analysis

Analysis	Butterfly Pea Flower Powder Value ± SD	Encapsulated Siam Orange Peel Extract Value ± SD
Water content (%)	5.44 ± 0.38	7.22 ± 0.51
pH value	6.07 ± 0.02	5.46 ± 0.01
Anthocyanin content	28.22 ± 0.00	-
Antioxidant activity (%)	46.68 ± 0.14 (10 ppm)	31.69 ± 0.27 (1 ppm)

Note: (-) no lest performed

Based on the data in Table 2. The analysis results of the water content of dried butterfly pea flowers with an average of 5,44% and encapsulation of siam orange peel extract with an average of 7,22%. According to SNI 03-3836-2013, the quality requirement for dry water content is 8%. Dried butterfly pea flowers and encapsulated orange peel extract have met the existing water content standards.

The pH value is an indicator of the acid-base of a solution. The results of the analysis of raw materials in the butterfly pea flower extract obtained a pH value of 6.07; with this pH, the color produced is greenish blue. The pH value of the butterfly pea flower extract obtained is higher than the results of [1 7] research, where the results of the pH value of the butterfly pea flower extract obtained were in the range of 3.3 - 5.1, which produced a blue extract. In the encapsulated siam orange peel extract, the value obtained was 5.46, which was also higher than

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the research conducted by [18] for the pH value of the kaffir lime peel extract, namely 4.03.

The anthocyanin content in the butterfly pea flower extract was 28.22 mg/100mL, which is higher than the results of previous research conducted by [19], which was 27.18 mg/100mL. The results were slightly different due to several factors, such as flower varieties, drying temperature, and the solvent used.

The results of the analysis of the antioxidant activity of the raw materials of dried butterfly pea flower powder and encapsulated orange peel extract, respectively, namely 46.68% and 31.69% with different concentrations, namely 10 ppm and 1 ppm. Antioxidant analysis of the raw materials of butterfly pea flower herbal tea with adding a mixture of encapsulated siam orange peel extract using DPPH. The results of the antioxidant activity of butterfly pea flowers averaged 46.68%, which is not much different from previous research conducted by [20], which obtained the antioxidant activity of butterfly pea flowers with an average of 47.64%.

3.2 Chemical Analysis of Herbal Tea

3.2.1 Water Content

The results of the water content analysis are presented in Table 3.

Table 3. Water Content of Butterfly Pea Flower Herbal Tea with Encapsulated Siam Orange Peel Extract

Treatment Encapsulated Siam Orange Peel Extract	Water Content (%) Average ± SD
A (0 %)	5.44 ± 0.35 a
B (1 %)	6.00 ± 0.48 ab
C (2 %)	6.56 ± 0.51 bc
D (3 %)	7.11 ± 0.69 cd
E (4 %)	7.33 ± 0.41 d
CV	81.6%

Description: SD = Standard Deviation. CV = Coefficient of Diversity. Numbers in the same column are followed by lowercase letters; those that are not the same are significantly different according to (DNMRT) AT THE 5% level.

The highest water content was in treatment E, 7.33%, and the lowest was in treatment A, which was 5.44%. The more encapsulated siam orange peel extract mixed showed an increasing water content. This is because, based on observations of raw materials, encapsulated siam orange peel extract has a higher water content than butterfly pea flowers. According to Ref. [21], the typical water content of products produced by spray dryers is 2-6%. The relatively high content in the resulting product is thought to be due to the coating material used and the viscosity of the emulsion [22]. In addition, the water content is also influenced by the essential oils used.

The water content of the tea obtained follows the SNI 03-3836-2013 standard for packaged dry tea, namely a water content with a maximum value of 8%, while the water content produced in this study ranged from 5.44% -7.33%.

3.2.2 pH Value

The pH values produced from the brewed water for each treatment can be seen in Table 4.

Table 4. pH Value of Mixed Herbal Tea of Butterfly Pea Flower with Encapsulated Siam Orange Peel Extract

Treatment Encapsulated Siam Orange Peel Extract	pH Value Average ± SD
E (4 %)	5.63 ± 0.02 a
D (3 %)	5.77 ± 0.02 b
C (2 %)	5.94 ± 0.02 c
B (1 %)	6.03 ± 0.02 d
A (0 %)	6.07 ± 0.02 e
CV	61,1%

Description: SD = Standard Devitioni. CV = Coefficient of Diversity. Numbers in the same column are followed by lowercase letters; those that are not the same are significantly different according to (DNMRT) at 5% level.

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Based on Table 4, it is known that the pH obtained from the infusion of butterfly pea flower herbal tea with a mixture of encapsulated siam orange peel extract ranges from pH 6.07-5.63. The lowest pH value was found in treatment E (mixing 4% encapsulated siam orange peel extract), which was 5.63, and the highest pH value was found in treatment A (without mixing encapsulated siam orange peel extract), which was 6.07. The analysis of variance (ANOVA) showed that the treatment comparison of the encapsulated siam orange peel extract in butterfly pea flower herbal tea was significantly different from the pH value of the herbal tea infusion.

The pH value of the infusion of butterfly pea flower herbal tea with a mixture of encapsulated siam orange peel extract decreased along with the amount of encapsulated orange peel extract mixture. This is thought to be because orange peel contains citric acid. According to Ref. [23], siam orange peel contains 1.4% citric acid. Then, the presence of coating materials used in encapsulating orange peel extract does not affect the pH of the orange peel itself. According to [24], maltodextrin coating material does not cause pH changes because both of these materials have a neutral pH range of 5-7. In addition, this tea is brewed using mineral water that has a pH of 7.00, which is following the Regulation of the Minister of Health 492 of 2010 concerning the Requirements for Drinking Water Quality, which is permitted, namely pH 6.5 - 8.5 (Permenkes in [25]).

The pH resulting from the infusion of each formulation of butterfly pea flower herbal tea mixed with encapsulated siam orange peel extract still meets the pH requirements for food products, as stated by Ref. [26] that in general food ingredients have a pH ranging from 3,0 to 8,0.

3.2.3 Anthocyanin Content

The results of the average anthocyanin content can be seen in Table 5. The results of the variance analysis show that the addition of an encapsulated siam orange peel extract mixture has a significantly different effect at the 5% level on the anthocyanin content of the resulting butterfly pea herbal tea. Table 5 above shows the anthocyanin content in butterfly pea herbal tea with a mixture of encapsulated siam orange peel extract ranging from 28.22 to 27.16 mg/100m. Based on the results above, it can be seen that the more encapsulated orange peel extract is added, the lower the anthocyanin content obtained. The stability of anthocyanin pigments is also influenced by several factors

such as concentration, temperature, light, the presence of pigmentation, and others [27].

Table 5. Anthocyanin Content of Mixed Herbal Tea of Butterfly Pea Flowers with Encapsulated Siam Orange Peel Extract

Treatment Encapsulated Siam Orange Peel Extract	Anthocyanin Content Average ± SD
E (4 %)	27.16 ± 0.10 a
D (3 %)	27.22 ± 0.00 a
C (2 %)	27.55 ± 0.17 b
B (1 %)	28.00 ± 0.26 c
A (0 %)	28.22 ± 0.00 c
CV	2.72%

Description: SD = Standard Deviation. CV = Coefficient of Diversity. Numbers in the same column are followed by lowercase letters; those that are not the same are significantly different according to (DNMRT) at 5% level.

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The presence of pH treatment influences the anthocyanins in a product, where the higher the pH value, the lower the anthocyanin level. According to Ref. [28], anthocyanins are more stable in acidic conditions, such as pH 3 to pH 5, than in alkaline or neutral conditions. When there is an increase in the pH value, the pigments of the butterfly pea flower will be degraded. Anthocyanin pigments consist of colors between red, violet, and blue, and they can change at any time due to changes in pH values ranging from 4 to 10. The pH of butterfly pea flowers above 6 will produce blue to greenish blue, and pH 5 will produce dark blue to purple [29]. The lower levels of anthocyanin in this butterfly pea flower herbal tea are also caused by the fact that the tea mixture, namely the encapsulation of siam orange peel extract added to the herbal tea, does not contain any anthocyanin compounds at all.

3.2.4 Antioxidant Activity

The results of the antioxidant activity test can be seen in Table 6.

Table 6. Antioxidant Activity of Mixed Herbal Tea of Butterfly Pea Flower with Encapsulated Siam Orange Peel Extract

Treatment Encapsulated Siam Orange Peel Extract	Antioxidant Activity (%) Average ± SD
E (4 %)	45.28 ± 0.13 a
D (3 %)	45.59 ± 0.14 b
C (2 %)	45.90 ± 0.00 c
B (1 %)	46.37 ± 0.00 d
A (0 %)	46.68 ± 0.14 e
CV	1.56%

Description: SD = Standard Deviation. CV= Coefficient of Diversity. Numbers in the same column are followed by lowercase letters; those that are not the same are significantly different according to (DNMRT) at 5% level.

Based on Table 6 above, the antioxidant activity of butterfly pea herbal tea with different concentrations shows an increase with each addition of encapsulated orange peel extract mixture. The average antioxidant test results ranged from 46.68% - 45.28%. The treatment with the highest antioxidant activity value was treatment A (without mixing encapsulated orange peel extract) at 46.68%. In comparison, the treatment with the lowest antioxidant activity was treatment E (mixing 4% encapsulated orange peel extract) at 45.28%. Based on [20] testing, butterfly pea flower extract had antioxidants of around 47.64%.

Antioxidants derived from anthocyanins function as absorbers or traps where these molecules can react to free radicals and neutralize free radicals. In addition, butterfly pea flowers have bioactive compounds such as kaempferol, myricetin, quercetin, phytosterol, and tocopherol, which compounds can play a role in producing antioxidants in butterfly pea flowers. The more anthocyanins added, the more antioxidants are produced [30]. Phytochemical analysis of siam orange peel shows the presence of essential oils, flavonoids, saponins, and triterpenoids, all of which function as antioxidants by preventing the formation of excessive free radicals. The more the addition of the essential oil mixture, the more the antioxidant activity decreases because the antioxidant activity in orange peel extract is lower than the antioxidant activity in butterfly pea flowers. Orange peel also shows antioxidant activity depending on the concentration of D-limonene, pinene, and other components. The antioxidant activity of this essential oil is produced from D-limonene, pinene, and several other components or flavonoids and phenolic compounds are present [31].

3.2.5 Analysis of Essential Compounds Using GC-MS

Analysis with GC-MS was conducted to determine the secondary metabolites contained in the best herbal tea, namely in treatment E, with the formulation of adding a mixture of encapsulated Siamese orange peel extract of as much as 4%. This analysis was intended to identify the secondary metabolite profile found in the best herbal tea treatment. Obtained 10 metabolites were identified and can be seen in Table 7.

Table 7. Secondary Metabolite Compounds from GC-MS Identification Result

Peak	% Area	Real-Time	Compounds Name
1	3.90	6.117	D-Limonene
2	0.68	10.630	Citronellal
3	0.48	11.524	Naphthalene
4	0.56	12.275	Citronellol
5	0.91	12.752	Geraniol
6	3.63	13.394	Cinnamaldehyde, (E)-

The results of GC-MS analysis are expressed in the form of peaks representing different compounds. The chromatogram results can be seen in Figure 3.

Based on the results of gas chromatography (GC), 6 peaks were obtained with different retention times according to the type of compound analyzed. The largest component in herbal tea mixed with 4% encapsulated orange peel extract in ethanol solvent is located at peak 8 with a retention area value of 47.78%, namely the oleic acid compound (*oleic acid*). *Oleic acid is acid*considered very stable against oxidation and can also enhance the activity of antioxidants and antipolymerization agents. When

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combined with antioxidants such as tocopherols, this oil can be mixed with other oils to prevent oxidation. The mixture*oleic acid* and this tocopherol is reported to have a better protective effect than a-tocopherol alone [32]. It has also been reported that isocaloric replacement of about 5% of the energy from saturated fatty acids with *oleic acid* reduces the risk of coronary heart disease by 20-40%, mainly through the reduction of low-density lipoprotein (LDL) cholesterol [33]). It is generally known that higher intake of oleic acid and limited intake of saturated fat are beneficial and can help protect against cardiovascular disease. Then at peak 7 with a retention area value of 26.14%, namely the n-Hexadecanoic acid compound. Based on Pubchem (an online site that contains the world's largest collection of chemical information from https://pubchem.ncbi.nlm.nih.gov/) this n-Hexadecanoic acid compound is a synonym for palmitic acid which is a group of saturated fatty acids.

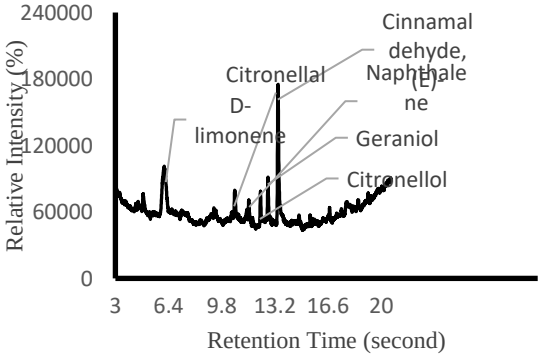

Figure 3. Chromatogram of Herbal Tea Treatment E

Based on retention time, the first compound to come out is the D-limonene compound at a retention time of 6.117 with a retention area of 3.90%. Retention time is the time interval required by the dissolved substance (component) to come out of the column and reach the detector. The more the longer the solute interacts with the polar stationary phase, the longer it takes for the solute to come out. So the retention time is greater [34].

Secondary metabolite compounds found in the peel of the Siamese orange are D-Limonene; Citronellal; Naphthalene; Citronellol; Geraniol; Cinnamaldehyde, (E) -; Octadecanoic acid; Glycidyl palmitate. In addition, secondary metabolite compounds found in butterfly pea flowers are n-Hexadeconoic acid; oleic acid. Meanwhile, carbohydrates, terpenoids, fatty acids, and flavonoids were found in [34] from the results of GC-MS analysis of butterfly pea flower extract.

4. CONCLUSION

Based on the research that has been done, it can be concluded that, the results of the study indicate that there is antioxidant activity and essential compound content in herbal tea mixed with butterfly pea flower and encapsulated siam orange peel extract. The more encapsulated Siamese orange peel extract is mixed, the higher the water content, the lower the pH value, the lower the anthocyanin content, the lower the antioxidant activity, and the higher the essential content as limonene, which is 3.90%.

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