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The Effect of the Proportion of Basil Leaf: Kenikir Leaf and Drying Time on the Physiochemical and Organoleptic of Herbal Tea Bag

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A B S T R A C T

Tea is a processed drink that is widely popular in the world. Tea contains many benefits, such as its antioxidant content, which fights free radicals. Kenikir leaves are a plant that has exceptionally high antioxidant activity. Basil leaves are an herbal plant with a distinctive fragrant aroma from its essential oils and many health benefits. This research aims to determine the effect of the proportion of basil leaves and kenikir leaves and the drying time on tea bags' physicochemical and organoleptic content. This research used a completely randomized design (CRD) with a factorial pattern with two factors and three replications. Factor I is the proportion of basil leaves: kenikir leaves (25:75,50:50,75:25), and factor II is the drying time (120 minutes, 150 minutes, 180 minutes). The data obtained were analyzed statistically using analysis of variance (ANOVA) followed by the Duncan Multiple Range Test (DMRT) at the 5% level. The best research results were obtained in the proportion of basil leaves and kenikir leaves of 25:75 with a drying time of 120 minutes producing tea bags with characteristics of water content of 7.79%, ash content of 6.2%, product antioxidant activity of 88.99%, the antioxidant activity of the brewed water was 73.31%, total phenols were 15.29 mg/GAE/g, flavonoids were 10.33 mgQE/g, and the color values L*, a*, b* were 45.97 respectively; 6.10; 21.70. With a color organoleptic characteristic value of 4.48 (Yellow); aroma of 3.52 (somewhat unpleasant); and taste of 3.48 (Slightly Bitter).

1. INTRODUCTION

1.1. Research Background

Increasing demands for activities and work indirectly make it difficult for Indonesians to live healthy lives, especially in urban areas. Increasing the amount of fast food consumed, lack of exercise time, and stress due to work are lifestyles that are difficult to avoid. These activities can weaken a person's immune system or body resistance. Therefore, the function of the immune system is an important part and must always be maintained so that the body's immune system remains robust and optimal [1].

Functional drinks are currently becoming a trend among all ages, along with increasing awareness of healthy living and consuming healthy products. This significantly impacts the rising supply and demand for functional food products [2]. One of the functional drinks that is popular with Indonesian people is tea. Some tea consumers also consider drinking tea as a lifestyle. Tea processing has received much attention in the development of Indonesian tea cultivation, so domestic and foreign consumers like the dry tea produced [3].

Based on the ingredients it is made from, tea can be divided into two groups: herbal tea and non-herbal tea. Herbal tea combines plant flowers, leaves, roots, stems, or seeds. Meanwhile, non-herbal tea is made from the tea plant (*Camellia sinensis L.*) [4]. The trend of using biological plant diversity for herbal medicine in Indonesia is increasing, so there is a need for breakthroughs in creating products in the form of functional drinks based on innovation and creation to differentiate products

sold on the market. One of them is tea made from basil leaves and kenikir leaves.

Kenikir leaves are known by the Latin name *Cosmos caudatus Kunth*. It is a shrub from the Asteraceae family whose habitat is Central America, which has a tropical climate. The kenikir plant can also be found in Southeast Asia, Malaysia, Thailand and Indonesia. Kenikir contains many bioactive compounds, such as qurcetin, chlorogenic acid and polyphenol, which act as antioxidants. Kenikir leaves have quite a high antioxidant content and have several benefits such as treating diabetes, high blood pressure, osteoporosis, antimicrobial, and cancer prevention [5]. In research conducted by Pangeran [6], it was stated that the kenikir plant has quite high antioxidant activity, around 79%.

Basil (*Ocinum basillicum*) is a type of vegetable that contains vitamins and minerals such as vitamin A, phosphorus, and calcium. Besides vitamins and minerals, basil also contains flavonoids, which act as antioxidants that can fight free radicals. The content of these chemical compounds makes basil antioxidant, antimicrobial, and therapeutic, such as anti-inflammatory, antipyretic, and analgesic [7]. Basil contains essential oils, which give it a distinctive aroma. Basil leaf essential oil contains citral, camphor and methyl cinnamate essential oils. Citral is a mixture of two acyclic monoterpenes: geranial (citral A or trans citral) and neral (cis citral or citral B), which gives basil its characteristic citrus aroma [8]. Besides citral essential oil, eugenol produces a clove-like aroma, and eugenol produces a lemon-like aroma [9].

The drying process is one of the processes used to make herbal tea. This drying process aims to remove the water content contained in the ingredients so that the food ingredients can last longer. According to Winarno [10], the longer the drying time, the more water evaporates, so the water content in the material decreases. The more water content in the material, the longer the drying process will take. However, suppose the drying temperature is too high and the time is longer. In that case, it can change the characteristics and chemical components of the material, such as decreasing antioxidant activity, flavonoids, and phenol content [11].

Ref. [12] supports the drying time factor. Heating can accelerate the oxidation of antioxidants, decreasing the material's antioxidant activity. Meanwhile, temperatures that are too low and drying times that are too short can result in the resulting product being easily damaged due to the high water content. Research by Dewi [11] examined the effect of temperature and drying time on making pohpohan leaf tea. The longer the drying, the less antioxidant activity, total phenols, and flavonoid levels.

This research aims to analyze the effect of the proportion of basil leaf and kenikir leaf and drying time on the physicochemical and organoleptic of herbal tea and to determine the best treatment out of all treatments.

1.2. Literature Review

Tea is a drink that originates from China. It is a very famous drink and is widely known throughout the world. For thousands of years, tea has been proven to have sound effects on health. The benefits include maintaining brain function, healthy teeth and mouth, reducing diabetes, cholesterol, and blood pressure, reducing weight, supporting the digestive tract, and maintaining healthy bones and joints. And can be used for beauty purposes. One known type of tea is green tea, which comes from the Camellia sinensis L. plant [13].

Herbal tea is a brew of leaves, stems, flowers, fruit or roots from various types of plants. What's unique is that herbal tea is not made from the tea plant (*Camellia sinensis*) like conventional tea products [14]. Herbal tea has advantages in terms of product variety compared to traditional tea. Also, herbal tea has various medical properties useful in maintaining body health [15].

Basil (*Ocimum basilicum*) is a plant composed of various phenolic compounds, including cirsimaritin, cirsilineol, apigenin, isotimucin, tannin, and rosmarinic acid. In addition, large amounts of eugenol, the main constituent of essential oils, are present in basil [16]. Apart from being an excellent source of macro minerals (calcium, phosphorus, and magnesium), basil leaves contain β-carotene and vitamin C. The non-nutritional contents of basil leaves consist of essential oils, boron, anethole, arginine and flavonoid compounds. Grotenoids contributed 19.77 ± 0.01% of the composition of basil leaves, total phenolics 2.09 ± 0.10%, and total flavonoids 1.87 ± 0.02% [17].

According to Noor et al [18] kenikir originates from the American plains and spreads to areas with tropical climates. Kenikir can also be found in many countries, including Malaysia and Indonesia. Based on research from Rasdi et al [19], kenikir leaves contain several chemical compounds: alkaloids, flavonoids, saponins, tannins, and terpenoids. Other research reveals that the extraction process using ethanol solvent has obtained antibacterial compounds such as alkaloids, flavonoids, saponins and tannins [20]. Flavonoids are one of the important secondary metabolites in plants. About 5–10% of plant secondary metabolites are flavonoids. In plants, flavonoids give color, flavor to seeds, flowers, fruit, and aroma.

In the drying process, drying time and temperature influence the quality of the tea produced. Winarno [10] states that drying time and temperature significantly affect antioxidant activity. According to Taib et al. [21], drying time and temperature affect the levels of functional compounds in fig leaves, which can be damaged or reduced. Drying too long can cause the tea to become brittle quickly and the smell and quality to decrease. On the other hand, if the time is too fast, the dried tea will not dry enough, so it cannot be stored for too long.

1.3. Research Objective

This research aims to analyze the effect of the proportion of basil leaf: kenikir leaf (25:75, 50:50, 75:25) and drying time (120 minutes, 150 minutes, and 180 minutes) on the physicochemical properties and organoleptic of herbal tea and to determine the best formulation out of all treatments.

2. MATERIALS AND METHODS

2.1. Materials and Tools

The materials used consist raw materials and analysis materials. The materials used in making basil and kenikir leaf tea bags were basil leaves and kenikir leaves obtained from the Soponyono Rungkut traditional market, Surabaya. The analysis materials used include herbal tea powder, distilled water, quercetin standard, ascorbic acid standard, methanol, ethanol, tannic acid, 2,2-diphenyl-1-picrylhydrazyl (DPPH), Folin-Ciocalteu reagent, Na_2CO_3, $NaNO_2$, NaOH, AlCl3, gallic acid, aluminum foil, and Whatman No. 1 filter paper.

Tea-making tools include knives, cutting boards, baking dishes, food processors, spoons, and scales. Equipment used in testing includes ovens, furnaces, UV-Vis spectrophotometers, desiccators, analytical balances, hotplates, vortex, porcelain cups, measuring cups, tongs, stirrers, stopwatches, test tubes, pipettes, and weighing bottles.

2.2. Research Design and Analysis

This research used a completely randomized design (CRD) with a factorial pattern with two factors and three replications. Factor I is the proportion of basil leaves: kenikir leaves (25:75,50:50,75:25), and factor II is the drying time (120 minutes, 150 minutes, 180 minutes). The observation variable data was tested statistically using analysis of variance at α=5% using the DMRT follow-up test. The method used to determine the best treatment is the de Garmo effectiveness test.

2.3. Research Implementation

2.3.1. Making of dried basil leaf and dried kenikir leaf

Five hundred grams of fresh basil leaves and kenikir leaves are sorted and washed in running water. Cut the leaves into small pieces. Then, withering was carried out for 18 hours. After that, the leaves are dried in a cabinet dryer for a predetermined time (120 minutes, 150 minutes, 180 minutes) at a temperature of 65. After drying, the leaves are blended and then sieved.

2.3.2. Making herbal tea bag

The dried tea leaves are then put into a tea bag in the amount of 2 grams in a predetermined proportion, namely basil leaves: kenikir leaves (25:75; 50:50; 75:25)

2.3.3. Making tea brewing

Brewing tea from all treatments is 2 grams with 100 ml of boiling water, with a tea brewing time of 5 minutes.

2.4. Analytical methods

2.4.1. Analysis of Ginger and Spices Extract

Analysis parameters include the antioxidant activity of the DPPH method, total phenols, total flavonoids, colour analysis, and organoleptic scoring.

2.4.2. Chemical Analysis

Analysis parameters include water content, ash content, total phenol, total flavonoid and antioxidant activity using DPPH.

2.4.3. Physical Analysis

Analysis parameters are colour analysis (L*, a*, b*) of tea brewing

2.4.4. Organoleptic sensory observation

The organoleptic test used in this research was a quality scoring test on nine samples of kenikir leaf tea bags: basil leaves. Organoleptic tests were carried out with 25 untrained panellists to determine the quality scoring test to assess the quality of basil leaf and kenikir leaf tea bags. The test parameters used are aroma, color and taste.

3. RESULT AND DISCUSSION

3.1. Chemical Analysis

Chemical analysis of instant spiced coffee includes water content, ash content, antioxidant activity and total phenols.

3.1.1. Water Content

The analysis of variance showed no significant interaction ($p \geq 0.05$) between the proportion of basil leaves, kenikir leaves and the drying time on the water content of the tea bags. The water content value of tea bags with the proportion of basil leaves and kenikir leaves can be seen in **Table 1.**

Table 1. Average Value of Water Content Herbal Tea With the Proportion of Basil leaf : Kenikir leaf

Proportion Basil leaf: kenikir leaf	Water content (%)± $\overline{SD}$	DMRT 5%
25:75	7.03±0.175[a]	-
50:50	7.34±0.171[b]	0.3323
75:25	7.63±0.167[c]	0.3490

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

The average water content of tea bags is based on the proportion of basil leaves: kenikir leaves range from 7.03 – 7.63%. The research results showed that the higher proportion of basil leaves and the smaller the proportion of kenikir leaves increased the water content of the tea bag product. This is due to the characteristics of basil leaves, which differ from kenikir leaves. Kenikir leaves have finger-shaped leaves divided into 5 strands on one petiole, which causes the water in the leaves to evaporate more quickly because the evaporation area is smaller [22]. Meanwhile, basil leaves have a single oval or egg-shaped leaf with a size of around 15–50 × 5–25 mm, which causes evaporation to take longer [23].

Besides the surface area, fresh ingredients' water content also affects the product's water content. Basil leaves have a more significant water content than kenikir leaves. Fresh basil leaves have a higher water content than kenikir leaves, namely 88.85%, while the water content of fresh kenikir leaves is 84.33%. The water content of the material is also influenced by the composition of the water contained in the material. Matrix tissue physically binds free water in materials such as membranes, capillaries and other leaf parts [24]. Apart from the proportion of leaves, the drying time also affects the water content of the tea bag.

Table 2. Average Value of Water Content Herbal Tea with the Influence of Drying Time

Drying time	Water content (%)± $\overline{SD}$	DMRT 5%
120 minutes	8.01±0.253[c]	0.3490
150 minutes	7.37±0.111[b]	0.3323
180 minutes	6.62±0.151[a]	-

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

The research results from **Table 2.** show that the longer the drying, the lower the water content. This is because the longer the tea leaves are dried, the longer the material is exposed to heat,

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causing the bound and free water in the material to come out or evaporate [25]. Evaporation of water in this product occurs due to the difference between the water in a material and the water vapor in the air. Because the water vapor pressure in the material is generally higher than the air pressure, water mass transfer occurs from the material to the air [26].

During drying, mass transfer occurs from the material to the air in the form of water vapor, or drying occurs on the material's surface. After that, the water vapor pressure on the material's surface will decrease. After temperature increases in all parts of the material, water moves by diffusion from the material to its surface, and evaporation occurs repeatedly on the surface. Finally, after the water content in the material decreases, the water vapor pressure will decrease until it reaches equilibrium with the surrounding air. SNI dried green tea bags in packaging 4324:2014 have a maximum value of 10%, so the water content of basil leaf tea bags: kenikir leaves with a drying time of 120 minutes, 150 minutes and 180 minutes a water content that is still included in the specified water content category.

3.1.2. Ash Content

The results of the variance analysis showed that the proportion of leaves and drying time did not have a significant interaction ($p \geq 0.05$) with the ash content of the tea bags. The average value of ash content with the proportion of basil leaves and kenikir leaves can be seen in **Table 3.**

The ash content in tea bags is related to the water content in the tea product. The higher the water content, the lower the ash content. This is because during the drying process the water content in the product will evaporate and leaf minerals will remain in the material (Etika and Giyatmi, 2019) [28]. This is confirmed by research from Fitriana et al [25] in making keji shard leaf herbal tea that the longer the drying, the higher the ash content of the tea. The increase in ash content based on drying time is caused by the decreasing water content in the product.

Table 3. Average Value of Ash Content Herbal Tea With the Proportion of Basil leaf: Kenikir leaf

Proportion Basil leaves: kenikir leaves	Ash content (%)± $\overline{SD}$	DMRT 5%
25:75	7.62 ± 0.234^{c}	-
50:50	7.48 ± 0.213^{b}	0.4389
75:25	7.28 ± 0.196^{a}	0.4611

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

The higher proportion of kenikir leaves and the smaller the proportion of basil leaves in the tea bag, the greater the ash content. This is due to the high mineral content in basil leaves, such as iron (Fe), Manganese (Mn), Zinc (Zn), Cadmium (Cd), Cuprum (Cu), Calcium (Ca) and others [27] and the minerals in kenikir leaves contain the minerals calcium, phosphorus, magnesium, iron and zinc [5]. In the analysis of fresh material, basil leaves had a higher ash content than kenikir leaves. Namely, 1.6% and kenikir leaves 1.26%. However, the greater the proportion of kenikir leaves in tea products, the greater the ash content. This is related to the drying time, which also influences the tea bag's water content, which is associated with the tea's ash content. The ash content value based on drying time can be seen in **Table 4**. The average ash content of basil leaf and kenikir leaf tea bags with long drying treatment ranged from 6.63 – 8.46%. The largest value in the drying treatment for 180 minutes is 8.63%. Meanwhile, the lowest value had a drying time of 120 minutes.

Table 4. Average Value of Ash Content Herbal tea With the Influence of Drying Time

Drying time	Ash content (%)± $\overline{SD}$	DMRT 5%
120 minutes	6.50 ± 0.113^{a}	-
150 minutes	7.48 ± 0.226^{b}	0.4172
180 minutes	8.41 ± 0.304^{c}	0.4383

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

3.1.3. Antioxidant Activity

The average value of antioxidant activity of basil leaf tea bags: kenikir leaves can be seen in **Table 5.**

Table 5. Average Value of Antioxidant Activity Herbal Tea Basil leaf : Kenikir leaf

Treatment		Antioxidant activity (%)	DMRT (5%)
Proportion of Basil leaves : kenikir leaves	Drying time (minutes)		
25:75	120	13.84±0.13^{d}	0.7688
	150	15.01±0.18^{e}	0.7643
	180	17.72±0.12^{h}	0.6716
50:50	120	11.74±0.12^{b}	0.7643
	150	13.61±0.09^{d}	0.7394
	180	15.90±0.19^{g}	0.7055
75:25	120	11.31±0.10^{a}	0.7598
	150	13.21±0.02^{c}	0.7258
	180	15.43±0.07^{f}	-

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

The analysis of variance showed a significant interaction ($p \leq 0.05$) between the treatment of the proportion of basil leaves: kenikir leaves and drying time on the antioxidant activity of tea bags. The average antioxidant activity value of basil and kenikir leaf tea ranges from 79.93 – 89.99%. The higher the proportion of basil leaves, the smaller the proportion of kenikir leaves; the longer the drying time, the more the antioxidant activity will be reduced. This is because basil leaves have lower antioxidant activity than kenikir leaves, 82.28%, while kenikir leaves have 87.74%. Kenikir leaves have bioactive components acting as antioxidants, namely alkaloids, triterpenoids, flavonoids, phenolics, quinones, quercetin and tannins [29]. Meanwhile, basil leaves contain bioactive components of alkaloids, tannins, flavonoids, phenolics and terpenoids [30]. The bioactive components in basil leaves quickly evaporate when exposed to heating treatment due to the volatile nature of the compounds [31].

Apart from the proportion of ingredients that influence the antioxidant activity levels of tea, the drying time also influences the antioxidant activity. The longer the drying, the less antioxidant activity there is. In research conducted by Dewi et al. [11], it is stated that higher temperatures and more prolonged heating will cause damage to metabolite compounds, which act as antioxidants and reduce antioxidant activity due to enzymatic

oxidation of polyphenol compounds. According to Muawanah et al. [12] antioxidant activity is also influenced by the content of phenolic and flavonoid compounds contained in tea bags. The higher the phenolic and flavonoid compounds, the higher the antioxidant activity.

3.1.4. Total Phenol

According to the analysis of variance result, there was a significant interaction ($p \leq 0.05$) between the proportion of basil leaf: kenikir leaf and drying time on the total phenols in the herbal tea bag. The average total phenolic value of basil leaf teabags: kenikir leaves with drying time can be seen in **Table 6**.

Table 1. Average Value of Total Phenol Herbal Tea Basil leaf: Kenikir leaf

Treatment		Total phenol (mg GAE/g)	DMRT (5%)
Proportion of Basil leaves: kenikir leaves	Drying time (minutes)		
25:75	120	15.29±0.189^{i}	0.3086
	150	13.08±0.118^{f}	0.2968
	180	11.78±0.125^{d}	0.2831
50:50	120	14.48±0.244^{h}	0.3049
	150	12.40±0.244^{e}	0.3013
	180	9.91±0.162^{b}	0.2913
75:25	120	13.52±0.087^{g}	0.3049
	150	11.08±0.019^{c}	0.2913
	180	8.65±0.063^{a}	-

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

Table 6 shows that the proportion of basil leaves to kenikir leaves and the drying time significantly influences tea bags' average total phenol value. The analysis results show that the higher proportion of kenikir and the smaller the proportion of basil leaves, the higher the total value of phenols in the tea bags. Meanwhile, the longer the drying time is, the smaller the total phenol value in the tea bag will be. The average total phenolic value of tea bags ranges from 15.29 – 8.65 mg GAE/g.

The amount of total phenol is influenced by the materials used in material testing. The total phenol value in fresh kenikir leaves is greater than fresh basil leaves, namely 17.95 mg GAE/gr. Meanwhile, basil leaves were 9.80 mg GAE/g. This was also proven in previous research, which tested the phenolic content of materials, namely basil leaves and kenikir leaves. Based on research conducted by Latiff et al. [32], kenikir plants contained 19.441 mg GAE/g phenols in this study. Meanwhile, in research by Ref. [33], basil plants contained total phenols of 9.09 mg GAE/g.

Apart from the total phenol content in basil and kenikir, which affects the total phenol content of teabags, the drying time also affects the total phenol content. The longer drying time will reduce the total phenol value in the tea bag. The temperature used in this research was 65°C. However, several studies have shown that herbal tea has the optimal temperature and time to produce optimal total phenols. According to Permata [34], drying treatment can reduce phenol content; the longer and higher the temperature, the more the total phenol content will decrease. The total phenol content is directly proportional to antioxidant activity, so the higher the temperature and the longer the food is dried, the lower the antioxidant activity.

3.1.5. Total Flavonoids

Based on the analysis of variance, it shows that the proportion of basil leaves and kenikir leaves and the drying time do not provide a real interaction with the flavonoid content of basil leaf tea and kenikir leaves. The flavonoid value of tea bags based on the proportion of basil leaves kenikir leaves can be seen in **Table 7.**

Table 7. Average Value of Total Flavonoids Herbal Tea With the Proportion of Basil Leaf: Kenikir leaf

Proportion Basil leaf: kenikir leaf	Total Flavonoid (mgQE/g) ± $\overline{SD}$	DMRT 5%
25:75	8.89 ± 0.093^{c}	0.3546
50:50	8.66 ± 0.179^{b}	0.3425
75:25	7.62 ± 0.240^{a}	-

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

Table 7 shows that the more kenikir leaves added and the fewer basil leaves, the higher the flavonoid content, namely 8.89 mgQE/g. Meanwhile, the higher the proportion of basil leaves, the smaller the flavonoid content, namely 7.62 mgQE/g. This is because the flavonoid content of kenikir leaves is higher than basil leaves. The fresh material analysis showed that kenikir leaves had a greater flavonoid content than basil leaves, namely 13.14 mgQE/g. while in fresh basil leaves it was 4.24 mgQE/g. Kenikir leaves contain flavonoids with derivatives such as quercetin, kampferol, myricetin 3-O-xyloside, quercetin 3-O-arabinofuranoside, and routine. With a flavonoid content of 51.3 ± 4.1 mg/100 g of fresh leaves [35].

This is also following research conducted by Afifah et al. [36]; fresh kenikir leaves contain flavonoids of 12,197 mgQE/g. Meanwhile, in research by Nguyen et al. [30], the flavonoid content in fresh basil leaves was 5.77 mgQE/g. Apart from the flavonoid content in fresh leaves, the drying time also affects the flavonoid content of tea bags. The average value of the flavonoid content of herbal tea bags with drying time can be seen in **Table 8.**

Table 8. Average Value of Total Flavonoids Herbal Tea With the Influence of Drying Time

Drying time	Total Flavonoid (mgQE/g) ± $\overline{SD}$	DMRT 5%
120 minutes	9.91 ± 0.149^{c}	0.3546
150 minutes	8.12 ± 0.116^{b}	0.3725
180 minutes	7.14 ± 0.247^{a}	-

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

Based on **Table 8.** shows that the longer the drying, the more flavonoid content in tea bags will decrease. The highest flavonoid content value was obtained in the drying treatment for 120 minutes, namely 9.91 mgQE/g. Meanwhile, the lowest value was received in the most prolonged drying treatment, 180 minutes, with a flavonoid content of 7.14 mgQE/g. Drying time has a significant effect on the flavonoid content of tea bags. The longer the leaves receive heat treatment, the more the flavonoid compound content will decrease or be damaged. Flavonoids are a type of polyphenol whose basic structure is phenol. These

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compounds are easily oxidized and sensitive to heat treatment, so the drying temperature affects the flavonoid content [37]. Research by Ref. [11] found that the longer the drying time for pohpohan leaf herbal tea, the lower the total content of phenols, flavonoids, and antioxidant activity.

3.2. Physical Analysis

Physical analysis of herbal tea from basil leaf: kenikir leaf is colour analysis of L*, a*,b*. The L value indicates brightness with a value range of 0 (dark) and 100 for white (brightness) (Vargas et al., 2003). Meanwhile, color a* is a color assessment parameter (red-green) with a value range of 0 to 60 in red and 0 to -60 in green. The color parameter b* is used for yellow and blue with a range of yellow with a color range of 0 to 60 and blue with a value range of 0 to -60. The results of color analysis L*, a*, b* of basil leaf tea: kenikir leaves can be seen in the table.

Table 9. Average color values L*, a*, b* of tea brewing water

Treatment		L*	a*	b*
Proportion of Basil leaves : kenikir leaves	**Drying time (minutes)**			
25:75	120	45.97 ± 0.2517^{d}	6.07 ± 0.1528^{a}	21.70 ± 0.2000^{d}
	150	45. 00 ± 0.2000^{b}	6.67 ± 0.1528^{b}	21.1 ± 0.1000^{f}
	180	44.40 ± 0.1000^{a}	9.53 ± 0.1528^{f}	17.07 ± 0.2517^{b}
50:50	120	46.00 ± 0.2646^{d}	7.13 ± 0.1528^{c}	20.03 ±0.2082^{e}
	150	45.93 ± 0.4933^{c}	7.40 ± 0.2000^{d}	19.17 ± 0.1528^{d}
	180	45.50 ± 0.2000^{c}	8.90 ± 0.1000^{e}	17.50 ± 0.2000^{c}
75:25	120	46.30 ± 0.2000^{d}	7.30 ± 0.2000^{cd}	19.40 ± 0.1000^{d}
	150	46.07 ± 0.2517^{d}	9.10 ± 0.1000^{e}	16.00 ± 0.2000^{a}
	180	44.87 ± 0.1528^{b}	9.80 ± 0.1000^{g}	15.93 ± 0.1528^{a}

Note: Average values accompanied by the different letters indicate significant differences at p≤0,05

The average L* value of brewing basil leaf tea: kenikir leaves ranges from 44.40 ± 0.100 – 46.30 ± 0.200 **Table 9.** Shows that the higher proportion of basil leaves and the smaller the proportion of kenikir leaves, and the longer the drying, the lower the the brightness value or the color will get darker. This brewed tea has a greenish-yellow to brownish color, this is due to the chlorophyll content of the kenikir and basil leaves themselves. However, the longer the drying, the darker the color of the brewing water will be due to the destruction of the chlorophyll color component in the material. Kenikir leaves and basil leaves contain the color pigment chlorophyll which, when exposed to too much heat, will change to a brownish color. Compounds derived from chlorophyll in tea brewing water are teharubigin and tehaflavin, which can produce a brown color the more they contain [38].

The average a* value of brewing basil leaf tea: kenikir leaves ranges from 6.10 ± 0.100 – 9.80 ± 0.100. **Table 9 shows t**he higher the proportion of basil leaves and the smaller the proportion of kenikir leaves and the drying time, the redder the color of the brewed tea will be. This red or brown color is caused by the chlorophyll content in basil leaves and kenikir leaves, which oxidize due to exposure to heat for too long and eventually turn brown [39]. The reaction that occurs is that chlorophyll reacts with epimerization during heating and turns into the compound pheophytin, which when further oxidized, the green color will change to reddish brown [40].

The average value of color b* in brewing basil leaf tea: kenikir leaves ranges from 15.93 ± 0.153 – 21.70 ± 0.200. From **Table 9.** It shows that the higher proportion of basil leaves and the smaller the proportion of kenikir leaves, the longer the drying time, the lower the b* value so that the color becomes more yellow. The longer the drying, the more the leaf chlorophyll's green colour will fade and produce a yellow color from flavonoids. This is proven by research by Suciati et al. [41] on testing mint leaf tea that drying temperatures that are too high cause degradation of chlorophyll into pheophytin, resulting in darker colored tea and flavonoid pigments which produce a yellow color in mint leaf herbal tea bags. The result of the parameter value b* is the same as the values L* and a*; the longer the drying time, the darker the water colour for tea brewing from kenikir leaves and basil leaves.

3.3. Organoleptic analysis

The results of the organoleptic analysis of tea bag brewing water can be seen in **Table 10.**

An organoleptic test determines the panelists' level of preference for a product. The organoleptic test used in this research was a quality scoring test on nine samples of kenikir leaf tea bags: basil leaves. Organoleptic tests were carried out with 25 untrained panelists to determine the quality scoring test to assess the quality of basil leaf and kenikir leaf tea bags. The test parameters used are aroma, color and taste. To carry out organoleptic tests, 2 grams of sample are brewed in hot water for 3 minutes.

3.3.1. Colour

Based on **Table 10**. Color of tea brewing water from basil leaf tea bags: kenikir leaves are bright yellow to brown. The scoring value for the color parameter assessment ranges from 3.16 – 4.48. With the color parameter, the smallest score is very brown and the largest value is pale yellow. The largest color scoring value was obtained in sample A1B1, namely 4.48, namely yellow with a proportion of basil leaves: kenikir leaves of (25:75) with a drying time of 120 minutes. Meanwhile, the lowest value in sample A3B3, with a proportion of basil and kenikir leaves of 75:25 with a drying time of 180 minutes, had a score of 3.16, which means slightly brown. The higher the proportion of kenikir leaves and the smaller the proportion of basil leaves, the smaller the scoring value obtained, but it is not significantly different.

The longer the drying time, the smaller the value obtained. This is because the longer it takes, the darker or browner the color of the tea brewing water will be. The color change to brown is

caused by damaged leaf pigment due to prolonged exposure to heat during drying. This is supported by research conducted by Yamin et al [42] on Chinese ketepeng leaf herbal tea products showing that the longer the drying time, the more pigments contained in the leaves will be damaged or reduced, such as leaf chlorophyll which will turn into pheophytin which causes the color to turn browner. Apart from chlorophyll degradation, the tannin content in the leaves also has an effect. The longer tannin is exposed to heat, it will change into the compound tehaflavin which has a yellow color and teharugubin which has a red color. However, if teharugubin oxidizes for too long, its content will increase and cause the brewing water to become dark in color [38]..

Table 10. Results of organoleptic assessment scoring color, aroma and taste of basil leaf herbal tea: kenikir leaf

Treatment		Color	Aroma	Taste
The proportion of Basil leaves : kenikir leaves	**Drying time (minutes)**			
25:75	120	4.48 ± 0.5099^{d}	3.52 ± 0.6532^{ab}	3.48 ± 0.7141^{a}
	150	3.72 ± 0.6137^{bc}	3.16 ± 0.8981^{a}	3.44 ± 0.7681^{a}
	180	3.44 ± 1.5099^{ab}	3.12 ± 1.0536^{a}	3.36 ± 0.6377^{a}
50:50	120	$4 \pm 0{,}5000c^{d}$	3.6 ± 0.8165^{ab}	3.52 ± 1.0050^{a}
	150	3.88 ± 0.6000^{bc}	3.48 ± 0.7703^{ab}	3.32 ± 0.9000^{a}
	180	3.4 ± 1.000^{ab}	3.24 ± 0.8794^{a}	3.72 ± 0.9363^{a}
75:25	120	3.92 ± 0.4933^{bc}	4.36 ± 0.7000^{c}	3.56 ± 0.8206^{a}
	150	3.4 ± 0.9609^{abc}	3.92 ± 0.9092^{b}	3.4 ± 1.0408^{a}
	180	3.16 ± 1.1790^{a}	3.32 ± 0.9000^{a}	3.76 ± 1.0116^{a}

Note: Color : 1= Very Brown. 2= Brown, 3=Slightly brown, 4= yellow, 5=Pale yellow ; Aroma : 1= Very Languid. 2= Slang, 3= Somewhat Slang 4= Not Slang, 5= Very Slang ; Taste : 1= Very Bitter. 2=Bitter, 3=Slightly Bitter, 4=Not Bitter, 5=Very Not Bitter

3.3.2. Aroma

Table 10. shows the quality assessment of the panelists' scoring of the aroma of basil leaf tea bags: kenikir leaves. The score ranges between 3.12 - 4.36. The highest value was obtained in sample A3B1, namely the proportion of basil leaves: kenikir leaves of 75:25 with a drying time of 120 minutes and a score of 4.36, which was not unpleasant. The lowest value was obtained by the A3B3 product sample, which was treated with a proportion of basil leaves: kenikir leaves of 25:75 with a drying time of 180 minutes of 3.12, which means it was a bit unpleasant. The pleasant smell of this tea drink comes from the kenikir leaves used. Kenikir leaves have essential oils such as beta ocimene, methatriene, beta caryophyllene, cyclohexadiene and germacrene [43].

The greater the proportion of basil leaves and the smaller the proportion of kenikir leaves, the greater the scoring value given. This is because basil leaves have a distinctive fragrant aroma which comes from its essential oil, namely linalool, which has a soft sweet aroma. Apart from that, basil leaves also contain citral compounds, which have a citrus smell and limonene compounds, which have a lemon-like smell [9]. This causes the brewed tea to have a distinctive basil aroma. Apart from the aroma of basil, the catechin compounds in the tannins found in the leaves will be oxidized to teharubigin, producing a distinctive aroma in tea [24]. The length of heating also affects the aroma of tea bags. If drying takes too long, this can cause the tea's aroma to diminish because the volatile components in the leaves, such as essential oils, phenol, carvacol, cinesol evaporate when exposed to long periods of heat. This is also supported by research by Patin et al. [44] on making bitter-leaf tea, which states that the longer the drying, the less aroma the tea takes.

3.3.3. Taste

Based on **Table 10**. the quality scoring value of the tea taste parameters ranges from 3.32 – 3.76, which means it is not bitter. The highest value was obtained in sample A3B3 with a proportion of basil leaves: kenikir leaves of 75:25 with a drying time of 180 minutes and a value of 3.76, which means it is not bitter. Meanwhile, the lowest value in sample A2B2 was the proportion of basil leaves: kenikir leaves of 50:50 with a drying time of 150 minutes, namely 3.32, which means it is slightly bitter. The bitter taste of this tea drink comes from the catechin compound from kenikir leaves. The higher the catechin content in the leaves, the more bitter the tea brew tastes. However, if the drying takes longer, the catechin content will be reduced because catechin compounds are not heat resistant.

The longer the drying also affects the taste of the tea because the longer the drying, the less tannin content there is. This is proven by Sari et al. [26] 's research on the effect of drying time on fig-leaf tea products. The longer it takes to dry, the less bitter the fig leaf tea. The tannin content of food ingredients can determine the quality of the taste of the ingredients. The tannins in tea cause an astringent taste. In tea, tannin compounds can be used as a guiding factor in taste quality because tannins provide taste stability. Apart from the tannin content in tea, the content of phenolic compounds and flavonoids also affects the taste of tea. Yamin et al. [42] said that the phenol and flavonoid content is colourless, soluble in water, and can cause a bitter taste in brewed tea. The distinctive bitter taste of this tea also follows the quality requirements of SNI 4324:2014, which states that the quality of green tea dipped in tea brewing water must have a distinctive smell and taste of the tea product.

3.4. Determination of The Best Treatment

Determination of the best treatment method for tea bags with basil leaves: kenikir leaves using the De Garmo method and the best treatment was obtained in the proportion A1B1, namely with a proportion of basil leaves: kenikir leaves of 25:75 with a drying time of 120 minutes. This best proportion has product characteristics with a water content of 7.79%, ash content of 6.2%, product antioxidant activity of 88.99%, tea brewing water

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antioxidant activity of 73.31%, total phenols of 15.29 mg/ GAE/gr, flavonoids were 10.33 mgQE/g and color values L*, a*, b* were 45.97 respectively; 6.10; 21.70. With a color organoleptic characteristic value of 4.48 (yellow), an aroma of 3.52 (not unpleasant), and taste 3.48 (slightly bitter).

4. CONCLUSION

The treatment of the proportion of basil leaves: kenikir leaves and the drying time resulted in a significant interaction ($p \leq 0.05$) between the treatment of the proportion of basil leaves: kenikir leaves, and the drying time on antioxidant activity, total phenols, color test L*; a*;b*, and organoleptic tests for the attributes of color, aroma and taste, while for the parameters of water content, ash content, flavonoids and antioxidant activity of brewed water there was no significant interaction ($p \geq 0.05$). The treatment proportion of basil leaves: kenikir leaves was 25:75 with a drying time of 120 minutes. This best proportion has product characteristics with a water content of 7.79%, ash content of 6.2%, product antioxidant activity of 88.99%, tea brewing water antioxidant activity of 73.31%, total phenols of 15.29 mg/ GAE/gr, flavonoids were 10.33 mgQE/g and color values L,a,b were 45.97 respectively; 6.10 ; 21.70. With a colour organoleptic characteristic value of 4.48 (yellow), the aroma of 3.52 (not unpleasant), and taste of 3.48 (slightly bitter).

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