AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

Characteristics of Kawa Daun with Differences in the Drying Time and Thickness of Arabica Coffee Leaves

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ARTICLE INFO

Article History:
Received: 2 August 2023
Final Revision: 1 September 2023
Accepted: 1 September 2023
Online Publication: 3 September 2023

KEYWORDS

Microwave, Arabica Coffee Leaves, Kawa Daun

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A B S T R A C T

Kawa daun is a beverage that is typical of West Sumatra and is created from dried coffee leaves. The purpose of this study is to ascertain the water content of kawa daun powder, pH value, total dissolved solids, the hedonic test for steeping kawa daun during drying using a microwave, the thickness of the pile of Arabica coffee leaves, and the preferred brew of kawa daun tea among the panelists. This study used a completely randomized design (CRD) factorial pattern with 2 factors. Factor A drying time for 3, 7, and 11 minutes. Factor B number of piles of leaves 2, 4, 6, 8, and 10 leaves. The resulting coffee leaf powder and kawa daun brew were then tested using hedonic tests for color, aroma, and taste as well as water content, pH value, and total dissolved solids. The panelists' chosen and favorite kawa daun drink composition was dried with 10 piles of leaves for 11 minutes. The properties of coffee leaf powder include a water content of 4.11%, a pH value of 6.4, 1.3 °Brix of total dissolved solids, and hedonic scores of 4.95 (very like), 4.40 (like), and 4.80 (very like) for color, scent, and taste.

1. INTRODUCTION

1.1. Research Background

Kawa Daun is a beverage that is typical of West Sumatra and is created from dried coffee leaves. The kawa daun beverage is served in a coconut shell supported by bamboo that serves as a glass and resembles tea thanks to the darker color of the steeping water. The Minang people were familiar with the coffee plant long before the Dutch arrived and that the leaves of the coffee plant were more valuable than the fruit. Kawa Daun has been around for a while in Sumatra [1].

Drying is used to transform coffee leaves into the beverage kawa daun. There are three ways to prepare kawa daun, namely the boiling method (original method), smoking method, and combustion method (toast method) [2]. Due to the uncontrolled drying process, including drying time and temperature, traditional drying results in non-uniform product quality. Additionally, the conventional drying method requires a lot of time, therefore extra work is required to produce high-quality kawa daun items. Microwave dryers are one of the dryers that are frequently used today since they can produce heat quickly.

Drying with a microwave is recommended for results in fast and effective drying [3]. The ability to generate heat very quickly has the potential to save energy because the heat is generated directly from within the material without the need for heating the external environment of the material [4]. The way a microwave oven works is by sending microwave radiation waves into water, which is present in many foods, where they are absorbed by the food ingredients. This causes heat, which causes the cell walls of the ingredients to break, allowing the contents to escape [5].

1.2. Literature Review)

Research related to leaf drying with the used drying of robusta coffee leaves In Arief's research, the optimal time that can be used to dry one robusta coffee leaf is obtained, which is 2 minutes [6]. Other research related to leaf drying using microwave conducted research on drying coriander leaves needed 290 seconds at a power of 900 W [7]. Drying lemon myrtle leaves using a microwave at power levels of 720, 960, and 1200 W (for

8, 7, and 6 minutes). Drying at 960 W for 7 minutes produced the best results [8]. Following that, [9] dried bay leaves using three distinct techniques: air drying (23°C) took 4 days, air drying in an oven (40°C) took 3–4 days, and drying in a microwave (300 W) took 130 seconds but showed the highest antioxidant levels. Therefore, microwave drying was chosen for the best drying of bay leaves.

According to a prior study, drying using a microwave is advised since it produces better chemical content in a shorter amount of time while also saving energy. To create kawa daun drinks of high quality so that they can be transformed into functional drinks, the method of processing Arabica coffee leaves needs to be thoroughly examined.

1.3. Research Objective

This study aims to determine the water content of kawa daun powder, pH value, total dissolved solids, and the hedonic test for steeping kawa daun during drying using a microwave and the thickness of the pile of Arabica coffee leaves and knowing the panelist's preferred brew of kawa daun tea. This study used a completely randomized design (CRD) factorial pattern with 2 factors. Factor A: drying time for 3, 7, and 11 minutes. Factor B: number of piles of leaves 2, 4, 6, 8, and 10 leaves.

2. MATERIALS AND METHODS

2.1. Preparation of Sample

Arabica coffee leaves (Coffea cannephora) are obtained from the Agricultural Technology Assessment Center (BPTP) Solok, West Sumatra. The old leaves or the seventh leaf from the shoots are picked, sorted to prevent any damaged leaves from being left behind when fresh leaves are collected, then cleaned by washing under running water and prepared for the next step.

2.2. Drying coffee leaves in a microwave

Prepare coffee leaves for drying, then thoroughly wash them under running water, drain them, and weigh them first. Then, according to the treatment duration of 3, 7, 11, and the number of leaf piles that it has, 2, 4, 6, 8, or 10, place it in the oven or microwave. The treated leaves were then weighed and kept at 25 °C to maintain a constant weight. The equilibrium water content is then determined by weighing the final weight.

2.3. Reduced Size of Dried Leaves

It was done by dry leaves to reduce their size to make them consistent in size. By blending the dry leaves, one can reduce their size. The powder is then sieve-filtered till it passes a 20-mesh sieve.

2.4. Brewing Kawa Daun

The process of making kawa daun drink is done by hot soaking. 200 ml of water is cooked until it boils, then 2 g of kawa leaves are added and allowed to boil for 5 minutes.

2.5. Research Design

The research method used is the experimental method (experiment). The design used at this stage was a factorial Completely Randomized Design (CRD) which had 2 factors, namely, factor 1 (F1) drying time (3, 7, and 11 minutes) and factor 2 (F2) number of piles of leaves (2, 4, 6, 8, and 10 strands) with 3 replications to obtain 45 experimental units.

2.6. Observation

Observations were made on the coffee leaf powder, namely the water content, the steeping of kawa daun including, the pH value, total dissolved solids, and the hedonic test (test of preference level) on the parameters of color, scent, and taste.

2.6.1. Moisture content

An empty aluminum cup that has been cleaned is dried in an oven at ±105ºC for one hour, then cooled in a desiccator for 15 minutes and weighed. Two grams of sample was put into the cup and then baked in the oven at 105 ºC for one hour. The sample is then cooled in a desiccator and weighed. Drying was repeated until it reached a constant weight [10]. Water content is calculated by the formula:

% water content = ((W1+W2)-W3)/ W2 x100%

Information :
W1 = weight of empty aluminum cup (g)
W2 = sample weight (g)
W3 = weight of the cup and sample after drying (g)

2.6.2. pH value

The pH-meter temperature regulator is set at the measured temperature once the sample temperature is measured. The pH meter is turned on and given 15 to 30 minutes to stabilize. If using distilled water, dry the electrodes with paper towels after rinsing them with aliquots of sample water. Setting the pH measurement, the electrode is submerged in the sample fluid. Up until a stable reading is acquired, the electrode is submerged. It is noted what the sample's pH is [10]

2.6.3. Total disolved solid

An Abbe refractometer was used to analyze the total dissolved solids in the steeped kawa daun sample. The results of brewing kawa leaf powder with a ratio of components (grams) and air (mL) 1: 100 at room temperature and calibrating with 95% alcohol were measured for their total dissolved solids content. The refractometer's reading is represented in °Brix (% Brix) [11].

2.6.4. Organoleptic Test

A study on the organoleptic properties of kawa daun was conducted. Samples are displayed in a consistent format. For each treatment, 20 panelists participated in an organoleptic test that included a preference (hedonic) test for the color, scent, and flavor of kawa daun tea items. This experiment was done to see how much the panelists preferred the kawa daun beverage. The hedonic scale test, which uses five numerical scales from highly detest (1) to dislike (2) to ordinary (3) to like (4) to very like (5), is the one that is employed.

3. RESULT AND DISCUSSION

3.1. Water Content of Kawa Leaf Powder

For both dry and fresh products, moisture content is a crucial factor in assessing the quality of the food ingredients [12].

 https://doi.org/10.29165/ajarcde.v7i3.311

According to research findings, Arabica coffee leaf powder has a water content of 3.34 to 7.05% and complies with SNI 3945:2016 for green tea, with a maximum of 8%.

Table 1. Average Water Content of Kawa Daun Powder

Drying Time (Factor A)	Water Content(%) ± SD Number of Leaf Piles (Factor B)				
	T1 (2 Strand)	T2 (4 Strand)	T3 (6 Strand)	T4 (8 Strand)	T5 (10 Strand)
S1 (3 Minutes)	$5,80 \pm 0,14^{Ae}$	$6,03 \pm 0,08^{Ad}$	$6,29 \pm 0,21^{Ac}$	$6,61 \pm 0,15^{Ab}$	$7,05 \pm 0,07^{Aa}$
S2 (7 Minutes)	$4,05 \pm 0,08^{Be}$	$4,20 \pm 0,17^{Bd}$	$4,54 \pm 0,09^{Bc}$	$4,92 \pm 0,10^{Bb}$	$5,17 \pm 0,22^{Ba}$
S3 (11 Minutes)	$3,34 \pm 0,15^{Ce}$	$3,61 \pm 0,19^{Cd}$	$3,80 \pm 0,13^{Cc}$	$3,94 \pm 0,06^{Cb}$	$4,11 \pm 0,13^{Ca}$

Note: Numbers followed by the same letter on the same line or row, are not significantly different at the 5% level according to the DMRT (uppercase letters are read vertically and lowercase letters are read horizontally)

The range for the interaction between drying time and the quantity of leaf stacks on the water content in coffee leaf powder was 3.24–7.05%, according to Table 1. The S1T5 treatment had the highest water content, with an average value of 7.05% after 3 minutes of drying with 10 piles of Arabica coffee leaves, and the S3T1 treatment had the lowest water content after 11 minutes of drying with only 2 piles of Arabica coffee leaves. produces an average water content value of 3.34%. The analysis of variance results revealed a significant effect of the drying time factor, the number of piles of leaves, and their interaction at the level of = 5%.

The percentage of water content is directly proportional to the number of piles of leaves, i.e., the more piles of leaves, the greater the resulting water content, while the percentage of water content is inversely proportional to the drying time, i.e., the longer the drying time, the lower the water content. This is because the longer the drying process lasts, the more heat the material receives, increasing the amount of water evaporated from the food and decreasing its water content. In contrast, the thicker the material, the longer it will take for the heat to be distributed to it, resulting in less moisture evaporating than materials with fewer piles [13]. Figure 1 shows a comparison of the water content of various kawa daun powders.

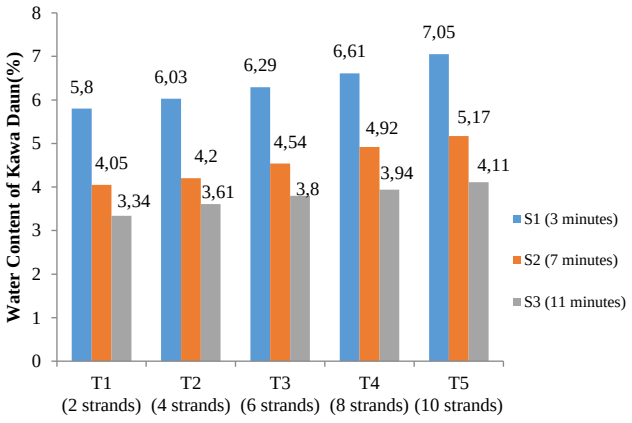

Fig 1. Water Content of Kawa Daun

Based on Figure 1, it is evident that the water content decreases with increased drying time but increases with increased leaf stacks. The findings of this study are consistent with Jalil's research, which found that pedada leaf powder dries in 5 to 9 minutes and has an average moisture content of 21.0 to 3.12%. This indicates that as drying time increases, the water content of the leaf powder gradually decreases and becomes greater [14]. According to Arief's research, drying Robusta coffee leaves in the microwave took a long time and decreased the water content, which ranged from 4.33 to 3.28% in total drying time [6].

According to the research, the quantity of leaf piles has an impact on the water content as well; the more piles of leaves there are, the higher the water content that results. This occurs when less moisture evaporates from thicker materials than from those with fewer piles because thicker materials take longer to transfer heat to them. According to research by Yando and Paramita, the water content of cassava slices increases with increasing thickness [15]. The thickness of the material being dried affects how long the drying process takes; the thinner the material being dried, the quicker the drying time [16].

3.2. pH and Total Dissolved Solid of Kawa Daun

The basis for utilizing a pH meter to determine acidity (pH) is the potentiometric measurement of hydrogen ions. A product's acidity increases with decreasing pH, while its level of alkalinity increases with increasing pH. Total dissolved solids is a measurement of the amount of material dissolved in water [17]. Table 2 shows that the average pH range for kawa daun infusion is between 5.2 and 6.6. The S1T5 treatment, which dried 10 piles of leaves in 3 minutes on average, had a pH value of 5.2 0.10, while the S3T1 treatment, which dried 2 piles of leaves in 11 minutes on average, had a pH value of 6.6 ± 0.10.

According to the findings, the pH value will be higher (more alkaline) the longer it takes to dry, whereas the pH value will be lower (more acidic) the longer it takes to dry. The analysis of variance results revealed that the number of leaf piles, the drying time factor, and their interaction all had a significant impact at the level of 5%. Figure 2 shows a comparison of the pH level of the kawa daun infusion. Table 2 displays the average pH and total dissolved solids of kawa daun.

According to Table 2, the pH value rises the longer the drying process lasts, but the pH value (acid) decreases as the number of leaf piles grows. This is because the material receives more heat as the drying process goes on, increasing the amount of acid that is evaporating from Arabica coffee leaves and raising the pH level (which is close to neutral). The material will also take longer, which leads to less acid content evaporating in comparison to leaves that have fewer piles, causing the pH to rise.

Table 2. Average pH Value and Total

Treatment	pH Value ± SD	Total Dissolved Solid ± SD
S1T1	5.6 ± 0.06^{Ca}	0.5 ± 0.06^{Ca}
S1T2	5.5 ± 0.06^{Ca}	0.7 ± 0.15^{Cb}
S1T3	5.5 ± 0.06^{Cb}	0.7 ± 0.06^{Cc}
S1T4	5.4 ± 0.10^{Cb}	0.8 ± 0.12^{Cc}
S1T5	5.2 ± 0.10^{Cc}	0.9 ± 0.12^{Cd}
S2T1	6.0 ± 0.06^{Ba}	0.7 ± 0.06^{Ba}
S2T2	5.9 ± 0.10^{Ba}	0.8 ± 0.06^{Bb}
S2T3	5.8 ± 0.06^{Bb}	1.0 ± 0.06^{Bc}
S2T4	5.7 ± 0.06^{Bb}	1.0 ± 0.12^{Bc}
S2T5	5.7 ± 0.06^{Bc}	1.1 ± 0.06^{Bd}
S3T1	6.6 ± 0.10^{Aa}	0.8 ± 0.06^{Aa}
S3T2	6.6 ± 0.06^{Aa}	1.0 ± 0.10^{Ab}
S3T3	6.5 ± 0.06^{Ab}	1.0 ± 0.06^{Ac}
S3T4	6.4 ± 0.06^{Ab}	1.1 ± 0.12^{Ac}
S3T5	6.4 ± 0.10^{Ac}	1.3 ± 0.06^{Ad}

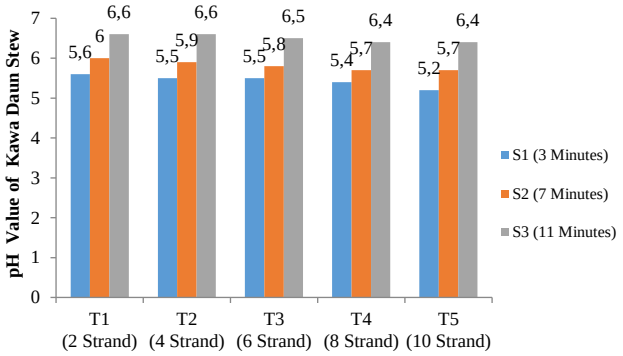

Fig 2. Comparison of pH Value Kawa Daun Steeping

The pH value of the research's findings ranged from 5.2 to 6.6, with the highest results on the kawa daun beverage coming in at pH 6.63. These findings were equivalent to those of Defri's research *et al*. [18]. According to Defri Research *et al*., longer drying times result in higher, more neutral pH-like pH values. This is because heating readily destroys the chlorogenic acid found in coffee leaves, increasing the pH value [18].

Caffeine breaks down into xanthine during the smoking/drying process, which is what gives kawa daun its acidic taste. The process by which caffeine in coffee leaves is destroyed In the beginning, xanthine is present in much smaller amounts (0.07–0.22 mg g–1).-1) as opposed to caffeine (5.7–7.1 mg g-1). The removal of three methyl groups, which causes xanthine to be formed, is what slows down the substance's decomposition. Then, by the use of uric acid, allantoin, and allantoate, xanthine is broken down by traditional purine catabolic routes into CO_2 and NH_3. Caffeine has a pKa of 0.8, while xanthine has a pKa of 7.7. In general, the higher a compound's pKa value, the higher its pH. As a result, the pH of the kawa daun kawa daun beverage will rise when caffeine is converted to xanthine, which has a higher pKa than caffeine [18].

The S1T5 treatment, drying in 3 minutes with 10 piles of leaves and an average of 0.5 0.10 °brix, had the lowest analysis of total dissolved solids steeped in kawa daun (Table 2), whereas the S3T1 treatment, drying in 11 minutes with 2 piles of leaves and an average of 1.3 0.06 °brix, had the highest. The analysis of variance results revealed a significant difference between the drying time factor and the number of piles of leaves at the level of 5%, but the interaction between the drying time factor and the number of piles of leaves did not differ significantly at this level. Figure 3 shows a comparison of total dissolved solids steeped in kawa daun.

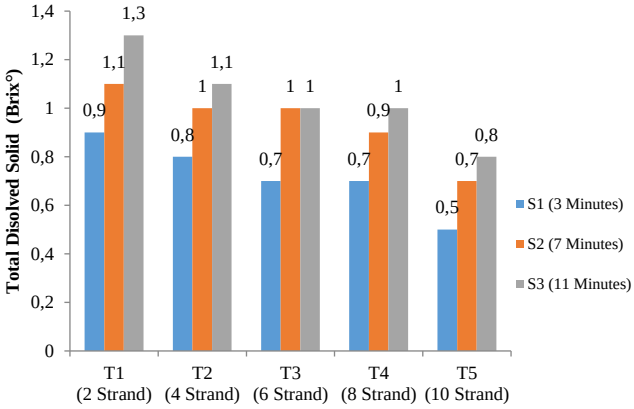

Fig 3. Comparison of Total Dissolved Solid Kawa Daun Steeping

According to the research findings, the total dissolved solids in the kawa daun infusion ranged from 0.5 to 1.3 °Brix. This outcome is inferior to Arief's research results, which range from 1.87 to 2.07 for the total dissolved solids of kawa daun infusion [6]. According to [19], the increase in °Brix was brought on by the material's water content evaporating, and the more water that evaporates, the more dissolved solids will be present. Due to heating, which caused the sugar to dissolve in the material and raise the total dissolved solids, the amount of total dissolved solids grew along with the drying period of the coffee leaves. According to [20], reducing sugars, non-reducing sugars, organic acids, pectin, and protein are all included in the total dissolved solids concentration of a substance.

3.3. Organoleptic Test (Hedonic)

The S3T5 treatment, drying for 11 minutes with 10 piles of leaves, had the greatest average hedonic test results for the color, scent, and taste of steeping kawa daun, scoring 4.95 (very like), 4.40 (like), and 4.80 (very like). With a color score of 3.1 (quite like), scent score of 3.1 (rather like), and taste score of 3.2 (rather like), the 3-minute drying S1T1 treatment with 2 heaps of leaves received the lowest score. The findings of the hedonic tests for color, fragrance, and taste statistically have an impact of = 5%. The average table of hedonic test results on the color, aroma, and taste of steeping kawa daun can be seen in Table 3 and the Organoleptic Radar can be seen in Figure 4.

Color is one of the sensory properties found in food products and is an important component in determining the level of acceptance of food products. color is used as a benchmark for quality attributes, identity, and consumer attractiveness. Color will affect consumers to accept or reject the food product. Based on the results of the hedonic test, the color of the steeped kawa daun that the panelists liked the most was the S3T5 treatment, namely drying for 11 minutes with 10 piles of leaves. Figure 5 displays the hue of the kawa daun steeping for all treatments.

https://doi.org/10.29165/ajarcde.v7i3.311

Table 3. Average Hedonic Test Result of Color, Aroma, and Taste of Stewing Kawa Daun

Treatment	Color±SD	Scent±SD	Taste±SD
S1T1	3.10^{g}	3.10^{g}	3.20^{j}
S1T2	3.10^{g}	3.15^{fg}	3.30^{ij}
S1T3	3.15^{g}	3.15^{fg}	3.45^{hij}
S1T4	3.20^{g}	3.20^{efg}	3.55^{ghij}
S1T5	3.35^{fg}	3.25^{defg}	3.65^{ghi}
S2T1	3.45^{efg}	3.30^{defg}	3.75^{fgh}
S2T2	3.50^{efg}	3.40^{cdefg}	3.80^{fgh}
S2T3	3.75^{def}	3.45^{cdefg}	3.90^{efg}
S2T4	3.85^{de}	3.50^{cdefg}	4.10^{def}
S2T5	4.00^{d}	3.55^{cdef}	4.20^{cde}
S3T1	4.15^{cd}	3.60^{bcde}	4.40^{bcd}
S3T2	4.40^{bc}	3.65^{bcd}	4.55^{abc}
S3T3	4.60^{ab}	3.80^{bc}	4.65^{ab}
S3T4	4.75^{ab}	4.00^{b}	4.70^{ab}
S3T5	4.95^{a}	4.40^{a}	4.80^{a}

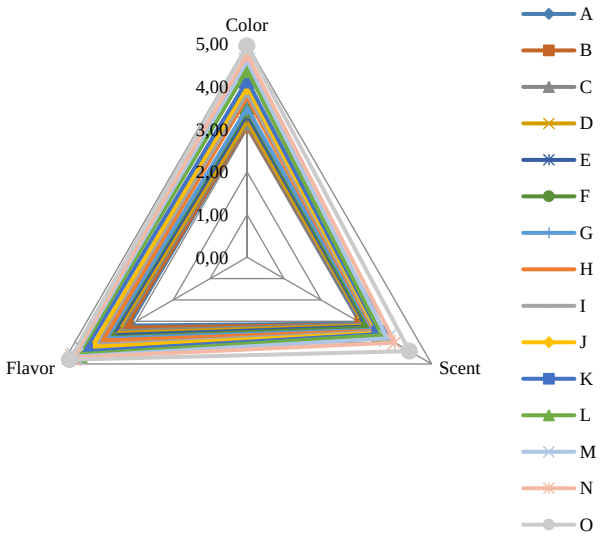

Fig 4. Organoleptic Radar Diagram

Fig 5. The Color of Kawa Daun Steeping

Aroma is an element of an object's odor that may be detected by the nose. Aroma is a sign of a food ingredient's acceptance as well as one of the criteria that determine a product's or food ingredient's quality. The panelists preferred the smell of the S3T5 treatment, which was dried for 11 minutes with 10 piles of leaves, based on the results of the hedonic test. This indicates that the aroma of steeping kawa daun was more appealing to the panelists as the microwave drying process went on. According to studies by Defri et al., the more time spent smoking, the stronger the kawa daun drink's signature aroma will be [18].

Coffee leaves contain flavor-precursor substances that are similar to those found in coffee beans but in much lower concentrations. These substances include phenolic and nonvolatile acids (acetaldehyde, propanone, alcohol, and vanillin aldehyde), carbonyl acid compounds (oxalosuccinic, acetoacetic, hydroxy pyruvate, ketones, caproic, oxalacetate, mesoxalate [18]. Another factor that affects the aroma of kawa daun drink is the process of grinding coffee leaves into the powder known as kawa daun in a blender is another element that influences the flavor of the kawa daun beverage. Kawa leaf powder contains a higher surface area than entire leaves, which facilitates easier dissolution of the aromatic components during the brewing process.

Taste is a crucial component of food goods and influences whether a consumer will ultimately accept or reject a food item. The panelists preferred the flavor of the S3T5 treatment, which was dried for 11 minutes with 10 piles of leaves, based on the findings of the hedonic test. This implies that the level of consumer choice is higher the longer the drying time and the more leaf piles there are.

4. CONCLUSION

The panelists' chosen and favorite kawa daun drink composition was dried with 10 piles of leaves for 11 minutes. Coffee leaf powder has the following properties: 4.11% water content, 6.4 pH, 1.3 °Brix total dissolved solids, 4.95 on the hedonic scale for color (quite similar), 4.40 on the scale for scent, and 4.80 on the scale for taste.

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