The Effect of Temperature and Roasting Time on The Characteristics of Sedau Robusta Coffee Powder (*Coffea canephora*)

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Abstract. The research aim was to determine the effect of temperature and roasting time on the characteristics of robusta coffee powder from Sedau village. The experiment was arranged with Completely Randomized Design of 2 factors and 3 replications. The factors were the roasting temperature of 190°C and 200°C, and the roasting time of 15 and 20 minutes. The parameters observed were physical characteristics (color), chemical characteristics i.e. pH, moisture content, ash content, caffeine content, coffee extract content and antioxidant activity, and also organoleptic characteristics of flavor and taste. Data was analyzed with analyses of variance at 5% significant level using Co-Stat software. *Post hoc* test was done with the Honestly Significant Difference test at the 5% level of significance. The result showed that the roasting temperature of 190 ^{0}C and roasting time of 10 minutes (S_1W_1 = 190°C for10 min) with the highest color value of L* is 29.18 and °Hue is 56.85; the pH is 5.44; ash content is 5.80%; water moisture content is 3.54%; the caffeine content is 1.0%; the coffee extract content is 23.93% and the value of antioxidant activity is 86.65%.

Keywords: robusta coffee, roasting, antioxidant, caffeine.

1. Introduction

Coffee fruit goes through a long process before being enjoyed. The coffee processing is divided into two stages, namely primary and secondary coffee processing. Secondary coffee processing included roasting, cooling and grinding processes. In this stage, roasting is the key to the powder coffee production process [17], because it plays an important role in the formation of coffee flavor and contributes 30% of the quality attributes of powder coffee. Coffee quality is also influenced by cultivation techniques and post-harvest coffee cherries.

Sedau Village, West Lombok Regency is one of the production centers for robusta coffee. This type of coffee has been cultivated by the villagers hereditary and the coffee cherries are processed in the traditional way that is drying directly in the home

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page. Besides that, local people also blend coffee beans with rice and then roast it traditionally, using an earthenware pan. Therefore, the taste of coffee produced by the robusta type in this region is less favorable from sensory aspects such as color, taste and aroma. The process of forming the distinctive flavor of robusta coffee is determined by 75% of post-harvest and processing techniques, especially in the roasting process which affected the taste and aroma of the coffee when brewed and 25% is determined by the conditions of the production area such as soil conditions, altitude and cultivation techniques which can produce different characteristics [23].

The characteristic of coffee was influenced by the roasting method. Local people roasted coffee beans using the traditional method that was manual roasting using an earthenware pan by stirring the coffee beans until they reached the desired level of maturity. This roasting method had the disadvantage of not being able to control the heat received by the coffee beans properly so that maturity is not perfect. The result of this roasting produced roasted coffee beans with a physical appearance of a darker color, a burnt aroma and a very bitter taste. This processing method did not meet standards for cafe consumption. Therefore, the Indonesian National Standard did not recommend this processing method. Meanwhile, roasting using a drum roaster was able to control the roasting process so that this technique was accepted to sensory aspects that were preferred to consumers.

The color, taste and aroma of coffee which are attributes of coffee quality could be developed through the roasting process. The coffee roasting process is the process of forming taste, color and aroma in brewed coffee through a pyrolysis process from carbohydrates in coffee beans (hemicellulose, cellulose, and lignin) which would be degraded at a temperature of around 200°C-260°C into simpler compounds [20]. These simple compounds are compounds from the furan, carbonyl, phenol and reducing sugar groups [12].

Roasting process for cafe consumption is generally done at a temperature of 190ºC-210ºC [15]. Roasting using a high temperature method and a long time can reduce the moisture content of coffee beans from 11% to 3.2% during 14 minutes of roasting [7]. Meanwhile, roasting coffee for 10 minutes at a temperature of 200ºC produced the best quality coffee with a moisture content of 1.34% [20], whereas [4] stated that the best temperature and roasting time is 190ºC for 10 minutes. The research results of [9] show that Robusta coffee with a moisture content of 12% can be roasted well at a temperature of 190ºC within 10 minutes.

Roasting temperature and time were the keys to the roasting process. Roasting with a drum roaster can control the temperature and roasting time to remain stable so as to obtain the desired results of roasted coffee beans. However, local people didn't know much about the application of drum roasters and there was not much information about using the right temperature and roasting time for natural process coffee beans with a drum roaster. Therefore, research to determine the effect of temperature and roasting time for robusta coffee with a drum roaster on the characteristics of coffee powder was urged to be carried out. This research aim was to determine the appropriate temperature and roasting time on the characteristics of Sedau Robusta powder coffee.

2. Materials and Methods

2.1. Materials

The tools used in this research are grain moisture meter (MC-7825G), pH instrument (SCHOTT lustr), 40 mesh sieve (CBN), Chromameter (MSEZ User Manual), glass funnel (Pyrex), separating funnel (Pyrex), exicator, Erlenmeyer (Pyrex), beaker glass (AGC Iwaki), glass, measuring cup (isolab), Kjeldahl flask, measuring flask, volumetric flask (Iwaki), refrigerator, grinder (FEIMA N600), roaster (WE600i), Oven Drying (MEMMERT), Spectrophotometer UV Vis (LABO,7809). The main ingredient used is robusta coffee cherries from Sedau village which are obtained from coffee collectors in the Sedau area, then the supporting materials are mineral water with a temperature of 90ºC, Aquadest, standard caffeine solvent, standard buffer solvent pH 4 and 7, DPPH solvent, chloroform solvent, methanol solvent and Na_2CO_3 solvent.

2.2. Method

The method used in this research is an experimental method carried out in UKM KIAT Gora Wirausaha and the Laboratory Food Processing, Faculty of Food Technology and Agroindustry, Mataram University.

Preparation of Materials
Robusta coffee cherries are obtained from various coffee collectors in the Sedau area and surrounding areas. The coffee cherries are picked when fully ripe and then processed using a natural process method that is processing the coffee cherries by drying them directly in the sun using a drying hood. The natural process or natural method begins with washing the coffee cherries by soaking them in clean water. Besides that, this soaking also sorts the coffee fruit between good (superior) and defective (imperior). Good coffee cherries will sink when soaked, and vice versa. After being washed clean, the coffee cherries are then dried directly in the sun for ± 3 weeks until the coffee cherries are ready to be peeled. Next, the dry coffee fruit is peeled off the horn skin to obtain coffee beans.

Making Roasted Coffee
Drying coffee beans aims to obtain coffee beans with a moisture content of less than 12.5% according to SNI before roasting. The moisture content of the coffee beans used in this research was 11%. Then, coffee beans (green beans) are sorted to separate inferior coffee beans (damaged beans) and superior (good beans) so that it will be easier to standardize the quality of the roasted coffee produced, and weighed according to the capacity of the roasting machine used. After that, coffee beans are roasted using a "William Edison (WE600i)" type roasting machine with a capacity of 1 kg. Roasting begins by turning on the motor that rotates the machine tube and then turning on the stove on the roasting machine. Next, warm up the machine until the drum temperature reaches 200ºC. Next, the coffee beans are put into a roasting tube.

Then run the machine according to the research treatment that is using temperatures of 190ºC and 200ºC with a time of 10, 15 and 20 minutes.

After the roasting process is complete, the roasted coffee is immediately cooled. This cooling machine is part of the roaster with an automatic working mechanism. This cooling aims to ensure that the roasted coffee beans do not run into over roasting. The cooling process is carried out for ± 3 minutes. Roasted coffee beans are packaged before use. The packaging used is a plastic aluminum foil standing pouch with zip lock adhesive. This packaging can store roasted coffee beans well. Roasted coffee beans are very vulnerable to air because it can cause an oxidation reaction, so they require good packaging. Packaging is also one of the keys to storing food.

Making Powder Coffee

Grinding coffee beans using an N600 type coffee grinder. The particle size used is medium size. Then, sifting is carried out using 40 mesh sieves to obtain uniform powder coffee granules.

Making Brewed Coffee

Weighing 10 g of coffee powder in a container or cup, then brewing coffee powder directly with a ratio of coffee powder and water of 1:10 with a water temperature ranging between 90ºC-97ºC.

Parameters

The parameters observed include color, acidity degree (pH), moisture content, ash content, caffeine content, coffee extract content, antioxidant activity and organoleptic (aroma and taste).

Research Design

The research design used in this research is a Completely Randomized Design (CRD) with 2 factors, that are the roasting temperature factor and the roasting time factor which consists of 6 treatment levels, namely S_1W_1 (190ºC:10 min); S_1W_2 (190ºC:15 min); S_1W_3 (190ºC:20 min); S_2W_1 (200ºC:10 min); S_2W_2 (200ºC:15 min) and S_2W_3 (200ºC:20 min). Each treatment was repeated 3 times to obtain 18 experimental units. The research data were analyzed using analysis of variance with a real level of 5% using Co-Stat software. If there is a real difference, a further test is carried out using the Honestly Significant Difference (HSD) test.

3. Results and Discussion

3.1. Color

Color is the first quality attribute in determining food products because it was an important component in product acceptance and consumer appeal. The color of coffee changes from green or light brown to cinnamon brown, and then slowly blackens with

an oily surface [18]. The color of coffee was an important indicator for controlling the grade and quality of the roasting process.

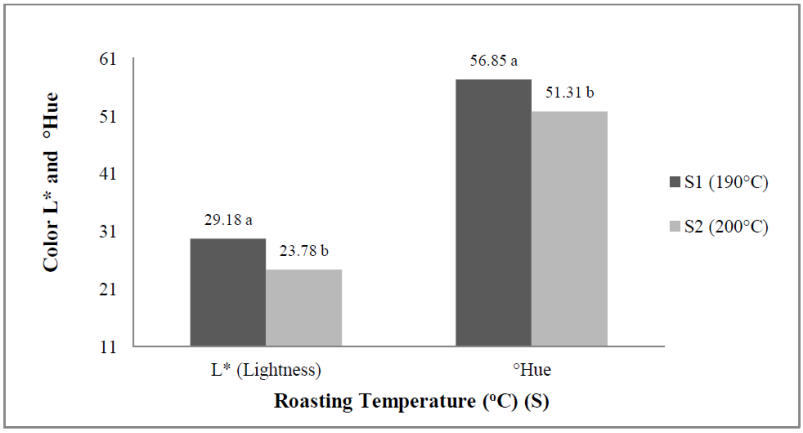

Fig. 1. The Influence of Roasting Temperature (S) on the Color L* and °Hue of Robusta Sedau Coffee Powder

Fig. 1 showed that the roasting temperature (S) treatment had a significantly different effect on the L* and °Hue values. The L* value ranged from 23.78-29.18, with a higher L* value obtained at the 190°C (S_1) compared to the 200°C (S_2). This shows that the use of high roasting temperatures causes a decrease in the brightness level of coffee powder. This result is in accordance with research by [1] who obtained the highest L* value at 190°C roasting and the lowest L* value at 210°C roasting. The decreased brightness level is caused by the Maillard reaction, which is a non-enzymatic browning reaction between reducing groups and primary amine groups so that the reaction produces a brown material [32].

Furthermore, the °Hue value ranges from 51.31-56.85 with a higher °Hue value obtained at the roasting temperature treatment of 190°C (S_1) is 56.85; while the °Hue value at the treatment temperature of 200°C (S_2) is 51.31. This shows that the higher the roast level causes the °Hue value to decrease. The °Hue value is an attribute that indicates the degree of visual color that is visible and is referred to as chromatic color which is denoted by a* and b*[2].

The °Hue value was obtained by calculating the inverse tangent of comparing the b* value with the a* value, thus obtaining an average °Hue value for a roasting temperature of 190°C is 56.85 while for a temperature of 200°C is 51.39. Roasting at a temperature of 190°C produces an °Hue value of 56.85, equivalent to yellow red (YR) with an °Hue value range between 54-90 [2], Next, the color is converted using a color analysis and colorimeter application program to produce the actual image color of Irish coffee. Meanwhile, using a temperature of 200°C produces an °Hue value in the amount of 51.39 which is equivalent to the color red (R) with an °Hue value range between 18-54 [2], then the color is converted to produce a brown bramble color. The

color image of powder coffee obtained based on the color analysis and colorimeter application program can be seen in Fig. 2.

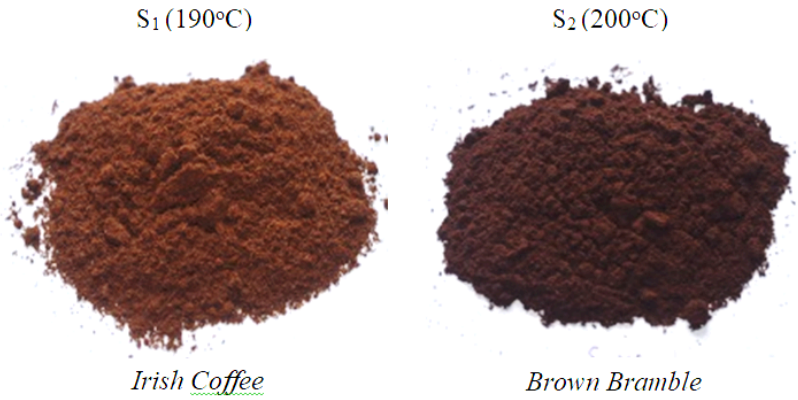

Fig. 2. The Appearance of Color Based on L*a*b* Value in Sedau Robusta Coffee powder

Fig. 2 showed that the average roasting temperature treatment had different colors. Roasting at a temperature of 190°C (S_1) obtained higher L* and °Hue values with a medium roast level and obtained a color in the form of Irish coffee with a brown appearance that was not too dark. Meanwhile, roasting at a temperature of 200°C obtained lower L* and °Hue values with a dark roast level and obtained a brown bramble color with a dark brown appearance. The color change occurred due to the Maillard reaction which degraded carbohydrates and proteins during heat treatment [21].

3.2. Degree of Acidity (pH)

Coffee generally has acidic properties because the average pH ranges from 4-6. However, different varieties of coffee have different acid contents. The roasting process affected the pH value depending on the roasting temperature used, the type of roasting and the cooking method used. The pH value obtained was affected by the roasting process, which was the use of roasting temperature, type of roasting and cooking method.

Fig. 3 shows that the pH value of Sedau Robusta coffee powder ranged between 5.44-5.99 with the highest value obtained in the 200°C interaction treatment for 20 minutes (S_2W_3) of 5.99, while the lowest value was obtained in the 190°C treatment for 10 minutes (S_1W_1) of 5.44. The results of this research showed that increasing temperature and roasting time tended to produce high pH values, causing the acidity level to decrease. This was due to the degradation of coffee compounds such as protein, polysaccharides, trigonelline and chlorogenic acid when high temperatures were used in the roasting process. Therefore, Sedau Robusta coffee powder produced a slightly sour taste with a dominant bitter taste. The results of this research were

parallel with research [34] which found that the pH of coffee powder increased with increasing roasting temperature, and changes in the pH value of coffee powder tended to increase towards neutral pH.

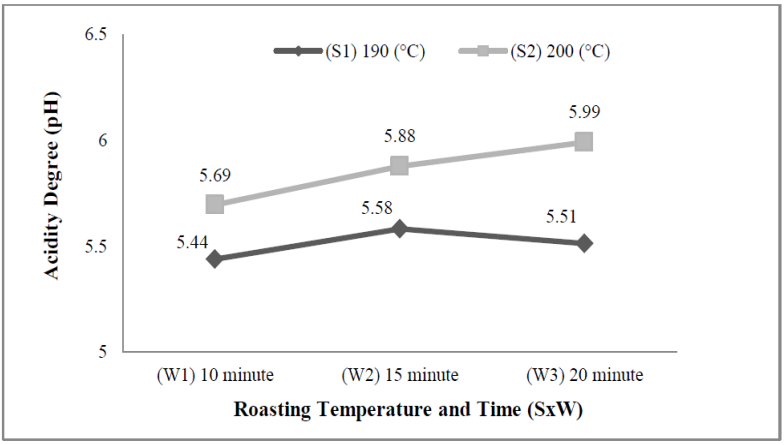

Fig 3. The Influence of Interaction of Roasting Temperature and Roasting Time (SxW) on the Acidity Degree (pH) of Robusta Sedau Coffee Powder

The results of the research showed that the pH value of 5.44-5.99 did not meet SNI with a maximum pH requirement for powder coffee of 4; however this result was in accordance with research by [8] which obtained a range of pH values for Robusta coffee between 5.5-6.5. This was supported by [1] that coffee suitable for consumption had a pH value of more than 4 and less than 6.

3.3. Ash Content

Ash is the residue from complete combustion of organic compounds which produces the inorganic solid anhydrite. Ash content testing aims to seduce the useful mineral content, levels of heavy metal contamination and inorganic material contamination during the production process. The principle of determining ash content uses the dry ashing method, namely by oxidizing organic substances at high temperatures and then weighing the substances left behind after the combustion process [3].

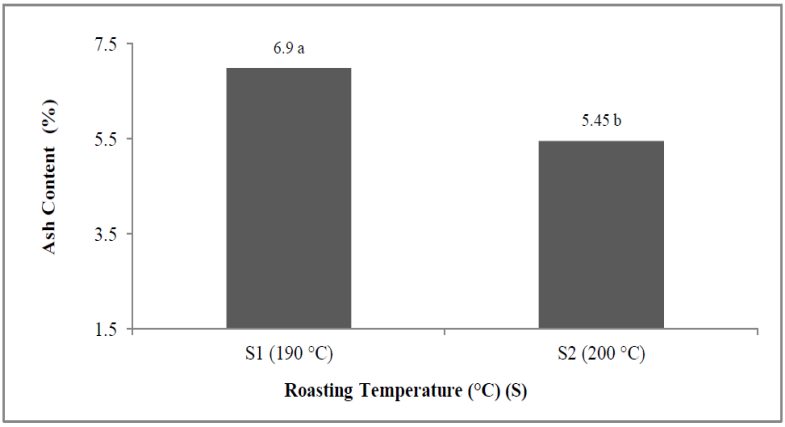

Fig. 4. The Influence of Roasting Temperature (S) on the Ash Content of Robusta Sedau Coffee Powder

Fig. 4 showed that the roasting temperature (S) treatment produced ash content values of 5.45% and 6.99%. The roasting temperature treatment of 190ºC (S_1) obtained a higher ash content value of 6.99% than the 200ºC temperature treatment (S_2) of 5.45%. This showed that high roasting temperatures cause the ash content to decrease. This was due to the increased brittleness of the material during the roasting process so that the ash mineral content dissolved in acid which causes the ash content to decrease [19].

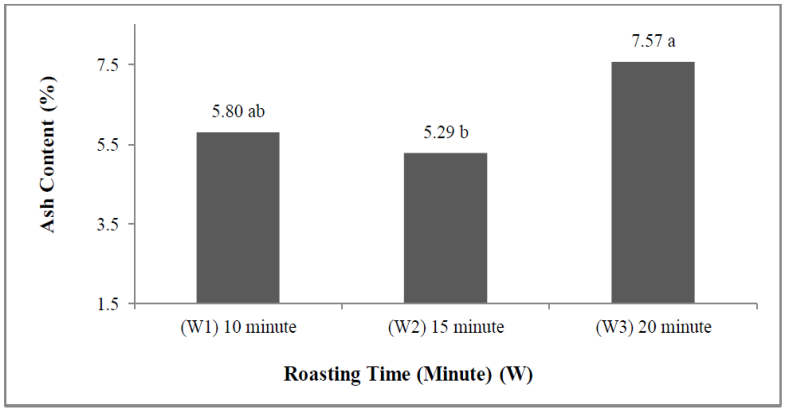

Fig. 5. The Influence of Roasting Time (W) on the Ash Content of Robusta Sedau Coffee Powder

Fig. 5 showed that the roasting time (W) treatment produced ash content between 5.29% -7.57% with the highest value obtained in the 20 minute roasting time (W_3) treatment of 7.57%, while the lowest value was in the 15 minute treatment. (W_2) of 5.29. Using a longer roasting time produced high ash content values. However, the roasting time treatment graph was unstable, marked by a decrease in the ash content value. The ash content value decreased in 10 minute treatment (W_1) to 15 minutes (W_2), then ran into a significant increase in 20 minute treatment (W_3). In general, the roasting time treatment caused an increase in ash content as indicated by an increase in values that were significantly different from 15 minute (W_2) to 20 minute (W_3) treatment, while the 10 minute (W_1) treatment did not experience a significant difference compared to the other treatments. The results of this research showed that the longer the roasting process causes the greater of ash content value. These results are in accordance with research by [9] that the length of roasting affected on ash content produced with a roasting time is 16-22 minutes with an ash content value of 6.95%-11.45%.

The maximum limit for ash content of powder coffee based on SNI 01-3542-2004 was 5% w/w. This showed that the roasting temperature (S) and time (W) treatment did not meet SNI because the ash content produced is above the SNI limit. The high and low levels of ash indicated the amount of minerals contained in food. This indicated that a high ash content value means it had high mineral content and vice versa [10]. However, if the ash content in coffee was more than 5% w/w so it was indicated that it contained strange substances (impurities) [4].

3.4. Moisture content

Moisture content is one of the factors determining the quality of a food ingredient because it is closely related to shelf life to prevent unwanted physical and chemical changes. According to [14], water in a food ingredient can influence the appearance, texture and taste as well as determine the freshness and durability of the ingredient.

Fig. 6 showed the moisture content values range between 3.03% - 3.54% with the highest value obtained in 10 minute roasting time treatment (W1) with a value of 3.54%, while the lowest value was obtained in the 15 minute treatment (W2) with a value of 3.03%. Using a longer roasting time causes a decrease in the moisture content value. However, the treatment graph was unstable. In general, this roasting time treatment causes a decrease in moisture content which is marked by a decrease in values that were significantly different from 10 minute (W_1) to 15 minute (W_2) treatment, while the 20 minute treatment (W_3) did not run into a significant difference compared to the other treatments. This showed that the length of roasting had an effect on reducing moisture content. This result was parallel with the statement by [22] which stated that the longer the roasting process caused the moisture content of coffee beans to decrease. This was because when the roasting process lasted longer, the roasting temperature increased so that the moisture of the coffee beans evaporated [20].

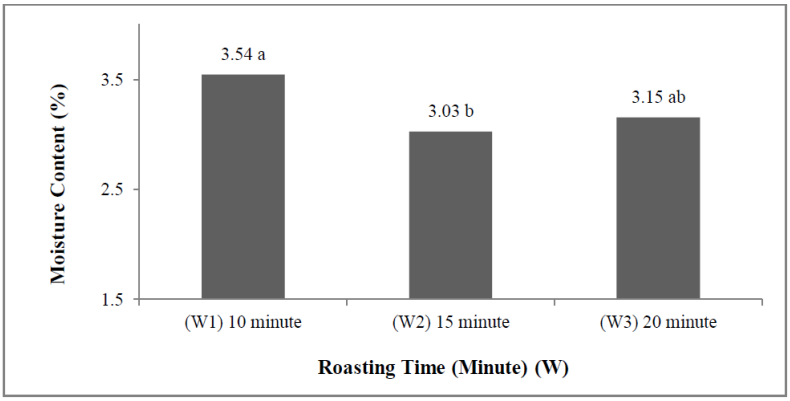

Fig. 6. The Influence of Roasting Time (W) on the Moisture Content of Robusta Sedau Coffee Powder

The research results showed that the moisture content value of Sedau Robusta coffee powder met SNI requirements. The maximum moisture content limit for powder coffee based on SNI 01-3542-2004 is 7% w/w [30].

3.5. Caffeine Content

Caffeine is the largest component in coffee. Caffeine plays a role in the body as a psychological effect in the form of increasing energy and stimulating the psychomotor work system so that the body remains awake by preventing drowsiness. Furthermore, caffeine provides a distinctive taste that is popular with many people. Caffeine levels did not run into significant differences in the roasting temperature (S), roasting time (W) and the interaction between both (SxW), so that the HSD test was not carried out. Analysis of temperature treatment and roasting time on the caffeine content of Sedau Robusta coffee powder can be seen in Table 1.

The caffeine content produced in this research ranged from 0.98%-1.02% with the highest value obtained in the 10 minute treatment (W_1) with a value of 1.02%, while the lowest value was obtained in the 20 minute treatment (W_3) with value 0.98%. Table 1 showed that the treatment temperature of 190ºC has a value of 0.99% while the temperature of 200ºC had a value of 1.00% with a difference of 0.01%. This showed that the higher the roasting temperature, the higher the caffeine levels. This was due to the decomposition of chemical components during the roasting process, especially the content of non-liquid substances such as caffeine, fat and total acids so that the mineral percentage increases.

Table 1. The effect of roasting temperature (s) and roasting time (w) on caffeine content of sedau robusta coffee powder.

Treatment	The Average of Caffeine Content (%)
S_1 (Roasting Temperature 190ºC)	0.99
S_2 (Roasting Temperature 200ºC)	1.00
HSD (5%)	-
W_1 (Roasting Time 10 Minute)	1.02
W_2 (Roasting Time 15 Minute)	0.99
W_3 (Roasting Time 20 Minute)	0.98
HSD (5%)	-

Meanwhile, the roasting time (W) treatment had the lower caffeine content along with the longer of roasting time (W). However, temperature (S) and roasting time (W) did not have a significantly different effect on caffeine contents. There was no effect on roasting temperature, possibly because the roasting temperature treatment used was too short [31], namely only two levels, so the effect was not clearly visible. This is supported by the theory of [29], that caffeine is stable to heating so it does not have a significantly different effect.

The results of the analysis of caffeine content are below the maximum SNI limit that was 2% w/w. The maximum limit for caffeine content in coffee powder is based on SNI 01-3542-2004, namely first quality was 0.9-2% w/w, and second quality was 0.45-2% w/w [30]. This showed that the caffeine content value of the coffee powder produced in this study met the SNI for coffee powder because the average caffeine content produced is below quality requirements I. Caffeine content was affected by various factors, one of which is the type of coffee. Robusta coffee had higher caffeine levels than Arabica coffee [7].

3.6. Coffee Extract Content

Coffee extract is a water-soluble fraction of coffee powder which is composed of organic and inorganic chemical compounds such as sugar, acid, caffeine, chlorogenic acid, melanoidin, trigonelline and minerals. The solubility level of coffee extract is determined by the particle size. The extract content value shows the amount of dregs left after extraction.

Based on the results of observations and the results of analysis of variance in the treatment of roasting temperature (S), roasting time (W) and the interaction between both (SxW) did not have a significantly different effect on the content of the coffee extract produced, so no further 5% HSD test was carried out. The average analysis and results of the 5% HSD further test on temperature treatment and roasting time on the extract content of Sedau robusta coffee powder can be seen in Table 2.

Table 2. Observation results of roasting temperature (s) and roasting time (w) treatment on sedau robusta coffee powder of coffee extract content

Treatment	Coffee Extract Content (%)
S_1 (Temperature 190ºC)	23.93
S_2 (Temperature 200ºC)	23.80
HSD (5%)	-
W_1 (Time 10 Minutes)	24.52
W_2 (Time 15 Minutes)	23.98
W_3 (Time 20 Minutes)	23.09
HSD (5%)	-

Table 2 showed that a roasting temperature of 190ºC (S_1) has a higher coffee extract content value of 23.93% compared to a roasting temperature of 200ºC (S_2) with a value of 23.80%. Furthermore, the roasting time (W) treatment resulted in higher coffee extract content values in 10 minute treatment (W_1) compared to the 15 minute (W_2) and 20 minute (W_3) treatments. This shows that increasing temperature and roasting time caused a decrease in coffee extract content. This was because the extract content value is affected by the roast level. where the higher of roast level caused the more complex organic compounds to break down thermally into simple organic compounds so that the coffee powder with a dark roast level was more soluble than at a lower roast level. The results of this research were in accordance with research by [6] who found that the highest value of coffee extract content at the medium roast level and the lowest value of coffee extract content at the dark roast level.

The value of the coffee extract content produced in this research met SNI for coffee powder in requirement 1 with coffee extract content ranging from 20–36% w/w [30]. The results of coffee juice content can be affected by various factors that are particle size. Surface area and extraction. If the smaller particle size of coffee powder, the higher the value of the coffee extract. This was because the small particle size caused the surface area to increase. So that the amount of dissolved solids increased [28].

3.7. Antioxidant Activity

Antioxidants are very important for the body because they act as a barrier that functions as the first defense against free radicals and maintains the body's optimum condition. According to [33] explains that antioxidants are compounds that can inhibit oxidation reactions by binding free radicals and highly reactive molecules so that it can inhibit cell damage. Coffee is a source of antioxidants because it contains active polyphenol compounds which act as antioxidants. The phenolic compounds found in coffee will have to degradation during the roasting process.

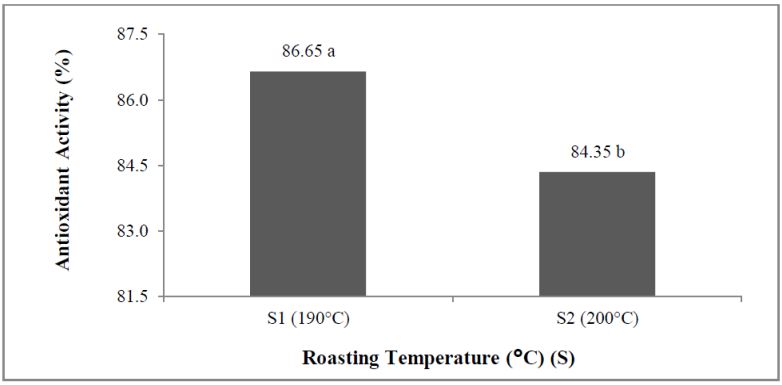

Fig. 7. The Influence of Roasting Temperature (S) on the Antioxidant Activity of Robusta Sedau Coffee Powder

Fig. 7 above showed that the antioxidants of Sedau Robusta coffee powder range between 84.35%-86.65% with a higher value obtained at the 190ºC (S_1) roasting temperature treatment of 86.65%. While the 200ºC (S_2) roasting temperature is 84.35%. This suggested that the higher the roasting process, the lower the antioxidant activity produced. Antioxidants decreased due to a degradation of phenolic components at high temperatures. Resulting in reduced antioxidant activity as the roasting temperature increases [25].

The results of this research obtained an antioxidant activity value of around 80%. and this value is included in the antioxidant number that can be said to be active. According to [24] stated that a food ingredient was being active as an antioxidant if the percentage of antioxidant activity was more than or equal to 50%. Meanwhile, an antioxidant with a concentration of 0% indicated that the sample had no antioxidants. while a concentration of 100% means that antioxidant testing needed to be continued by diluting the sample to determine the antioxidant concentration limit. The level of antioxidant value obtained can be affected by several aspects such as the height of the growing place. the roasting process and secondary metabolites produced by the coffee plant [11].

3.8. Sensories Attributes

Aroma

The aroma of coffee arises after going through the roasting and brewing process. The aroma of coffee smelled by the human senses is caused by the evaporation of the volatile compounds contained during the brewing process. According to [16] coffee beans contain volatile compounds that easily evaporate during roasting and brewing such as aldehydes, furfural, ketones, esters, formic acid and acetic acid.

Based on the results of observations and the results of variance analysis, it showed that the treatment of temperature (S), time (W) and the interaction between both

(SxW) did not showed significantly different effect on the aroma of the brew produced both through the scoring test and the hedonic test. The average analysis of HSD's results on temperature treatment and roasting time on the aroma and taste of brewed Robusta Sedau coffee powder can be seen in Table 3.

Table 3. Results of HSD test of 5% for Temperature (S) and Time (W) of Roasting on the Aroma and Taste of Stewed Robusta Sedau Coffee Powder.

Treatment	Aroma	
	Hedonic	**Scoring**
S_1(Roasting Temperature 190ºC)	3.37	3.18
S_2(Roasting Temperature 200ºC)	3.18	3.11
HSD (5%)	-	-
W_1 (Roasting Time 10 Minutes)	3.28	3.21
W_2 (Roasting Time 15 Minutes)	3.30	3.02
W_3 (Roasting Time 20 Minutes)	3.24	3.20
HSD (5%)	-	-

Table 3 showed that the temperature of 190ºC (S_1) had a higher value compared to the treatment temperature of 200ºC (S_2). Meanwhile, the roasting time (W) treatment was unstable in both scoring and hedonic tests. The highest aroma scoring value was obtained at 10 minute treatment (W1) while the lowest scoring value was obtained at minute treatment (W2) with the same average panelist acceptance index in the form of "it's rather strong coffee aroma". Likewise with the hedonic test, the roasting temperature treatment of 190ºC (S_1) obtained a higher aroma assessment than the treatment temperature of 200ºC (S_2) with the same panelist preference index of "it's rather like" the brewed Sedau Robusta coffee powder.

These results indicated that the roasting temperature treatment of 190ºC (S_1) was the best treatment for roasting coffee beans as indicated by the highest aroma hedonic value obtained in brewing Sedau Robusta coffee powder. This was due to the distinctive and fragrant aroma of coffee powder that comes out of this treatment, so it was preferred by the panelists. Medium roast levels had more complex volatile compounds compared to dark roasts. This was parallel to the research of [9] which stated that a roasting temperature treatment of 190ºC for 10 minutes was the best treatment in the Robusta coffee roasting process.

Taste

Taste is one of the benchmarks in assessing the quality of brewed coffee drinks. According to [26], stated that the delicious of brewing coffee was not an aspect that is a benchmark for consumer acceptance but rather how rich the taste of the coffee was.

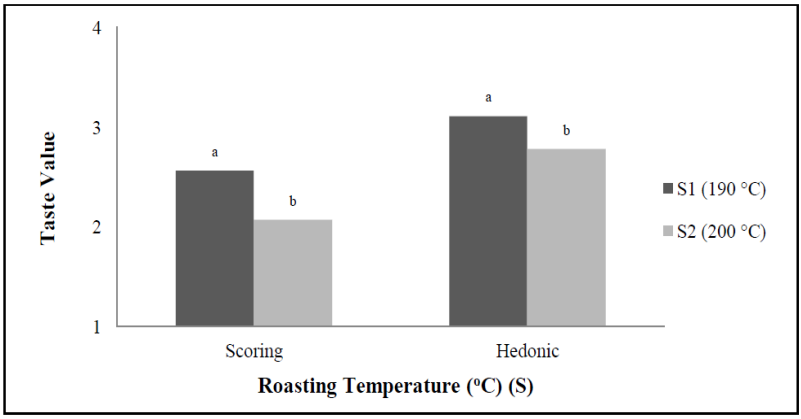

Fig. 8. Effect of Roasting Temperature Treatment on the Taste of Sedau Robusta Coffee Powder.

Fig. 8 showed that using a roasting temperature of 190°C (S_1) obtained a higher taste value than the treatment temperature of 200°C (S_2) in both the scoring test and hedonic test. A temperature of 190°C (S_1) obtained an average panelist assessment of "bitter taste approaching acidity". The taste of the brew in this treatment was preferred by panelists as indicated by obtaining a higher score, while the 200°C treatment (S_2) received an average panelist assessment in the form of a "bitter taste" which was not preferred by panelist. This shows that the best treatment to get a specialty taste is shown at a roasting temperature of 190°C. This result is supported by research of [4] that the roasting temperature treatment of 190°C for 10 minutes obtained an average panelist rating of "very like", because the treatment still contains complete flavor elements such as sweet, bitter and salty which is the most important element in the taste of robusta coffee powder.

Likewise, the hedonic test obtained a higher score in the 190°C temperature roasting treatment (S_1) with an average panelist assessment of "rather like", while the 200°C temperature treatment (S_2) obtained a lower value with a "dislike" rating index for the taste of brewing Sedau Robusta coffee powder. These results indicated that using a roasting temperature of 190°C (S_1) was the best treatment in determining the specialty taste of Sedau Robusta coffee powder. The results obtained in this research differed slightly from the results of research by [4] who obtained the best treatment according to the panelist's assessment of coffee brewing, that was a roasting temperature of 190°C for 10 minutes.

The quality of good coffee brewing was seen based on the concept of taste which can influence a person's multisensory impression. During the roasting process changes in composition occur through Maillard reactions, caramelization and pyrolysis [13]. A change in the composition of the Maillard and Strecker reactions caused caffeic acid to be released and the formation of lactones and other phenolic compound derivatives which affected the taste and aroma of coffee during the roasting

process [27]. Each coffee brew had a different taste that represents the identity of the coffee because each type of coffee had its own characteristics.

4. Conclusion

The interaction treatment of temperature and roasting time (SxW) had a significantly different effect only on pH parameters, while the roasting temperature (S) treatment had significant differences in color parameters, degree of acidity (pH), and ash content. antioxidant and organoleptic activity, while the roasting time treatment (W) were significant differences in the parameters of acidity degree (pH), ash content and moisture content, but were no significant differences in the parameters of caffeine content and coffee extract content.

The roasting temperature of 190ºC (S_1) and the roasting time of 10 minutes (W1) was produced coffee powder with the best characteristic of chemical, physical and organoleptic attributes such as L* and ºHue color values as much as 29.18 and 56.85; degree of acidity (pH) of 5.44; ash content of 5.29%; moisture content of 3.54%; antioxidant activity of 86.65% and organoleptic preference by panelists.

The ash content is reduced when the roasting temperature rises and the roasting time is longer. The caffeine content increased when the roasting temperature rise and reduced when the roasting time was longer. The moisture, caffeine content, and the coffee extract of the Sedau Robusta coffee powder met the Indonesian Food Standard (SNI), however the ash content did not meet the standard.

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