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THE POTENCY OF AVOCADO SEEDS (PERSEA AMERICANA MILL.) AS A SOURCE OF ANTIOXIDANT TEA

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Abstract: *The processing of avocado into avocado juice will produce organic waste, namely avocado skin and seeds. This potential of organic waste from avocado seeds can be exploited by turning them into tea products. This study employed avocado seed as a source of antioxidants which was made into processed products, namely tea. This research was intended to discover the influence of temperature with avocado seeds on antioxidant as well as the quality of resulting tea products, and to determine the best conditions for the drying process of avocado seed tea. This investigation was arranged at Integrated Lab of Politeknik Indonesia Venezuela and Laboratory of Banda Aceh Industrial Research and Standardization Center. The experimentation was adopted factorial completely randomized design pattern composing of 2 (two) parameters. First parameter was avocado seed drying temperature comprising of 3 (three) degrees, they were S1 (50°C), S2 (60°C), S3 (70°C). Second parameter represented the drying time of avocado seeds which comprised of 3 (three) degrees, they were L1 (2 hours), L2 (2.5 hours) and L3 (3 hours). Analysis carried out in the research was water, ash value, phenolic content, antioxidant, and sensory (colour, taste, and flavour). From the research, it was shown that the drying temperature was influenced by the moisture content, ash content and antioxidant activity of avocado seed tea, while the drying time and the treatments of those parameters made an impact on total phenol. The best quality avocado seed tea was obtained from a drying temperature 50°C along with length of drying 2 hours.*

Key words: *antioxidants, avocado seeds, organic waste, phenols, tea.*

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1. Introduction

Indonesia as a tropical country has a lot of natural resources. One of them is the avocado plant, where avocado is one type of plant that easily thrives in Indonesia, and is a fruit that is popular with the community. Avocado contains nutrients, enzymes and antioxidants and is high in fat [23]. The demand for avocado fruit supply is increasing along with the increase in the number of fresh fruit juice beverage businesses in various regions. This business produces organic waste, especially the skin and seeds of the avocado. Avocado waste can be processed into various kinds of processed food products. The research results which had been conducted utilizing avocado seed waste are dodol starch products which are an alternative for kidney treatment [11]. Avocado seeds can also be processed into flour to be used for cookies and sponge cake types [17], [29].

Avocado seed waste can also be used as instant drink with the addition of maltodextrin and avocado seed extract for functional drinks with ginger [5], [25]. The results of the phytochemical shining research on simplicia and ethanol extract of avocado seeds indicated polyphenol, flavonoid, triterpenoid, quinone, saponin, tannin and monoterpenoid and sesquiterpenoid are antioxidant contained on avocado seeds [32]. The components contained in avocado seeds are almost the same as the components contained in tea leaves. The peak potential of avocado leaves, as an antioxidant-rich herbal tea drink was attained in the optimum conditions for making the highest antioxidant tea which were obtained on drying temperature 50°C as well as length drying 50 minutes [2].

The results from the research showed that the antioxidant activity of tea made from avocado leaf on various techniques and drying times obtained the best conditions with 2 hours drying, by means of the oven drying method [26]. Based on this background, the researcher wants to study further by utilizing avocado seed waste into a tea product that will provide benefits to the wider community. This research was intended to discover the influence of temperature with avocado seeds on antioxidant as well as the quality of resulting tea products, and to determine the best conditions for the drying process of avocado seed tea.

2. Materials and Methods

2.1. Materials

Avocado seeds obtained from juice traders in the Lambaro region of Aceh Besar were used for this research. The materials used for the analysis consisted of DPPH, methanol, distilled water, Folin-Ciocalteu reagent, 20% Na_2CO_3.

The equipment used in this study consisted of equipment for making products and equipment for analysis. Equipment for making products includes knives, pans, cutting boards, spoons, measuring glass, analytical weigher, and laboratory ovens. Instrumentation used for examination composed of a measuring flask, test tube, aluminum foil, analytical balance and a spectrophotometer.

The experimentation was adopted factorial completely randomized design pattern composing of 2 (two) parameters. First parameter was avocado seed drying temperature comprising of 3 (three) degrees, they were S1 (50°C), S2 (60°C), S3 (70°C). Second parameter represented the drying time of avocado seeds which

comprised of 3 (three) degrees, they were L1 (2 hours), L2 (2.5 hours) and L3 (3 hours). There were 3x3 (nine) treatment combinations on this research. Furthermore, this experiment employed three replicates, thus it acquired 27 experimental units. The analyses performed were determination of water content, ash, antioxidant activity, analysis of total phenol by means of the Folin Ciocalteu method, organoleptic tests (color, taste, aroma and texture).

2.2. Sample Preparation

Avocado seeds were cleaned from the husk and washed to make them clean. Avocado seeds were thinly sliced using a 2 mm knife. Then they were dried at room temperature (±5 minutes) followed by their drying using an oven dryer at the temperature and drying time according to the experimental treatment. The dried avocado seed tea was mashed in a blender then the tea was put in tea bags weighing 2 grams per bag.

2.3. Water Content

The 1-2 grams sample was weighed and placed into a porcelain cup whose weight was pondered. The sample was inserted in oven at 105-110 °C temperature for 2 hours.

Then, the sample was cooled in a desiccator for 10 minutes then weighed and put back into the oven for 1 hour. Then, samples were put into desiccator for 10 minutes and it were reweighed. Samples were reheated in the oven and they were pondered until their weight was constant. Then, the samples were computed their water value [4].

2.4. Ash Content

Beforehand, the weight of muffle furnace and the weight of the sample were specified. The samples which have been dried were placed into a furnace at 600 °C. The ashing process is run up to all substance changed their color to be gray and then the samples were weighed 4].

2.5. Antioxidant Activity

100 mg of the extract was weighed, then dissolved with distilled water until 100 mL in a volumetric flask and then it was obtained 1 mg/mL concentration. From the main liquor, dilution was performed by adding distilled water with a predetermined ratio, so that samples were had by concentrations of 100, 150, 200, 250, 300 µg/mL. To ensure the antioxidant activity by each concentration, 0.2 mL of sample solution was taken by a micropipette and put into a vial, then 3.8 mL of 50 M DPPH solution was appended. The compounds were blended and left it for 30 minutes in the dark place; the absorbance was determined by using a UV-Vis spectrophotometer at the maximum wavelength [12], [19].

2.6. Total Phenols (Folin Ciocalteu Method)

100 mg of extract was weighed then it dissolved to 10 mL with distilled water to obtain 10 mg/mL concentration. From its concentration, 1 mL was pipetted and diluted with distilled water to 10 mL and the extract concentration was 1 mg/mL. Then 0.2 mL of extract was pipetted, 15.8 mL of distilled water and 1 mL of Folin Ciocalteu reagent were included and then everything was shaken together. It was let to stand for 8 minutes and then 3 mL of

10% Na2CO3 was included to solutions. The solution was allowed to stand for 2 hours at room temperature. The absorption was decided by employing a UV-Vis spectrophotometer at 765 nm wavelength. It was rehashed by three times so that the phenol content gained was obtained as mg gallic acid equivalent/g fresh sample [20].

2.7. Organoleptic (Color, Taste, Aroma)

The testing instrument for organoleptic investigation was panelists who have been enrolled and prepared to execute particular errands of organoleptic assessment. Each of the panelists assessed the items based on their enjoying levels [3].

2.8. Data Analysis

The results were statistically processed using the analysis of variance (ANOVA) with the SPSS 2010 software.

3. Results and Discussion

3.1. Samples

The obtained results are presented in 4 graphs (the effect of drying temperature and drying time on the water content of avocado seed tea, the effect of drying temperature on the ash content of avocado seed tea, the effect of drying temperature and drying time on total phenol of avocado seed tea, the effect of drying temperature and drying time on the antioxidant activity of avocado seed tea), and 3 tables (the interaction between drying temperature and drying time on the color, the interaction between drying temperature and drying time on the taste, the interaction between drying temperature and drying time on the aroma).

3.2. Water Content

From observations, the water content of avocado seed tea ranged from 3.94 to 14.93% with an by and large normal of 9.07%. The results of variance appeared that the drying temperature and length of drying made an extremely tremendous difference ($P<0.01$) on water content of the avocado seed tea powder and the the collaboration between two treatments indicated an apparent effect ($P>0.05$) on the moisture of avocado seed tea powder (Figure 1).

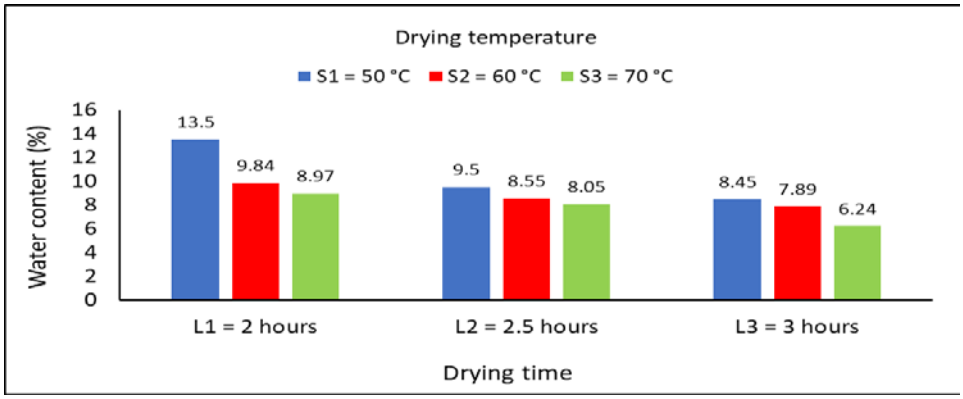

Fig. 1. *Impact of drying temperature and length of drying on the water content of avocado seed tea*

The graph above demonstrated that the highest water content of avocado seed tea powder was found in the treatment temperature 50°C along with length of drying 2 hours (S1L1), which was 13.5% which was essentially diverse from other parameters, while the lowest water content of avocado seed tea powder was found at a 70°C drying temperature treatment with 3 hours drying time (S3L3) which is 6.24%, which was not significantly different from the 70°C drying temperature treatment with 2.5 hours drying time (S3L2) yet it essentially diverse from other parameters.

The higher drying temperature and drying time, the lower the water content of the avocado seed tea powder due to the amount of water that was evaporated from the material surface. If the drying process lasts longer and more heat is applied to the material, the amount of evaporated water from the foodstuff increases and thus the water content is lower [9]. The moisture content of dry tea was at a maximum of 8.0% (w/w) [6]. The results of the research which are in accordance with the Indonesian National Standard are the S3L3 treatment, namely 6.24% and S3L2, namely 7.89%, while other treatments had not met the requirements for ready-to-consume dry tea because the water content value of avocado seed tea powder exceeds 8% (w/b) [6].

The high water content of avocado seed tea powder will easily be damaged due to the ongoing growth of microorganisms. Therefore, the proper drying process is important. Each given temperature increase and length of drying will have an impact on the transfer of water to the material, with the result that optimal water value of the dried substance can be obtained [24].

3.3. Ash Content

The ash content of the resulting avocado seed tea ranged from 2.29 to 3.27% with an average of 2.78%. The variance results illustrated that drying temperature gave a critical impact ($P<0.05$) towards ash of the avocado seed tea. The treatment of drying time and the collaborations between drying temperature and length drying made no tremendous difference ($P>0.05$) towards ash value of avocado seed tea. Avocado seed tea powder ranged from 2.69% to 2.95%. The lowest ash content of avocado seed tea powder was obtained at a drying temperature of 50°C, namely 2.69%, while the highest ash content with a value of 2.95% was obtained at a drying temperature of 70°C.

Research result demonstrated that the higher the drying temperature, the higher ash content obtained.

A higher drying temperature would raise ash content due to an increase in temperature accordingly in a drying process did not result in the destruction of food nutrients, especially minerals [16]. The value of the ash content obtained from this study had met the standard of packaged dry tea, namely 8.0% [6].

The kind of ingredients, length of drying and temperature as well as ashing method can affect the ash content value. Avocado seeds have a higher mineral content than other fruit seeds by 0.54%, thereby increasing the mineral content of functional drinks [4].

3.4. Phenolic Content

From the analysis, the total phenol of avocado seed tea ranged from 0.68 (GAE) mg/g to 0.88 (GAE) mg/g which was obtained was 0.77 (GAE) mg/g. The outcome from variance total phenol showed that drying temperature factor (S) had no significant influence (P>0.05), whereas length of drying (L) and the collaboration between the various temperature and length of drying (SL) gave an exceptionally tremendous impact to the total phenol of avocado seed tea (P <0.01). Figure 3 demonstrated the influence of the collaboration between drying temperature and drying time towards avocado seed tea total phenol.

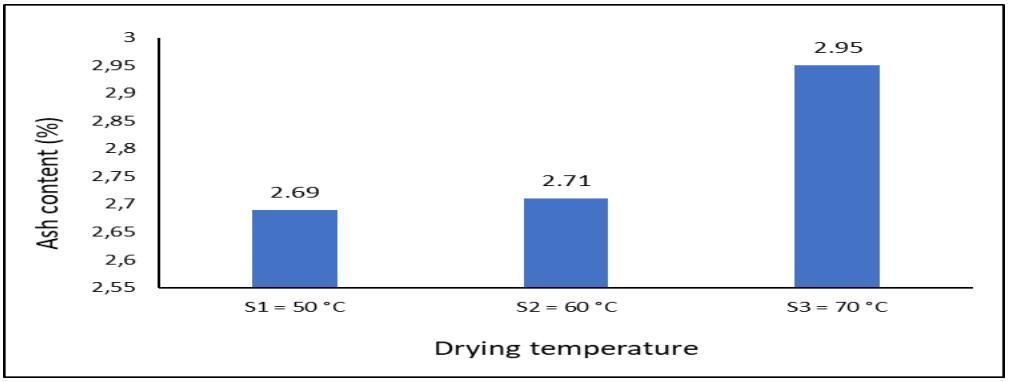

Fig. 2. *Impact of drying temperature on the ash level of avocado seed tea*

The results of the LSD test (Figure 3) showed that the highest total phenol was obtained 50°C drying temperature and of 2 hours drying time (0.88 (GAE) mg/g) which was altogether distinctive than other parameters. The lowest total phenol was gained by 70 °C drying temperature of and 3 hours drying time which was 0.68 (GAE) mg/g. The low total phenol content was caused by the drying temperature treatment.

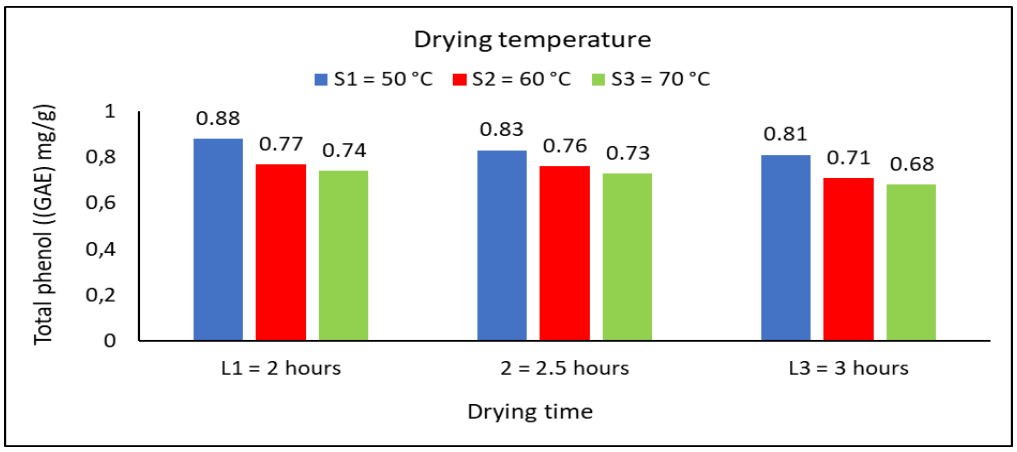

Fig.3. *Impact of drying temperature and drying time on total phenol of avocado seed tea*

The outcome demonstrated that the increase of drying temperature caused a decrease in total phenol in avocado seed tea. A higher drying temperature results in an increase in the inactivation process of the polyphenol oxidase enzyme, so that the enzyme activity would be lower and the damage to the polyphenol compound will be less significant, but if the drying temperature exceeds the optimum temperature, the stability of the polyphenol compound will be interfered thus it can cause a diminish within in the substance of polyphenol from the ingredients [30].

Figure 3 showed that the total phenol content decreased when increasing oven temperature and oven time. The decrease in total phenolic compounds due to oven drying and drying could damage some phenolic compounds, so that the higher the drying temperature, the lower the phenolic content. The total phenol content was directly proportional to the antioxidant activity. It was proven that the higher the drying temperature, the lower the antioxidant activity [13], [21].

3.5. Antioxidant Activity

The antioxidant activity was decided by the radical scavenging method using the DPPH radical. The measurement of antioxidant action by this method is based on the capacity of a test compound to decrease intensity of the DPPH radical color at 515 nm [22]. The parameter used for antioxidant activity with this DPPH radical scavenging method is the IC value of 50, namely the concentration of the test compound (extract/fraction) required to reduce the intensity of the DPPH radical color by 50% [31].

The results of the LSD test (Figure 4) appeared that the highest IC_{50} value was gained at a parameter of 70°C of drying temperature and 3 hours of drying time (114.25 ppm) which was essentially distinctive from others. The lowest total IC_{50} was acquired by 50°C drying temperature and 2 hours drying time, namely 55.27 ppm. The IC value of 50 was obtained from a linear regression equation which states the relationship between the concentration of the test extract and the percent of radical scavenging. The smaller the IC_{50} value, the more active the extract/fraction (test compound) was as an antioxidant. The smaller IC_{50} value, indicated a higher antioxidant ability to ward off free radicals. Materials that have an IC_{50} value of <50 ppm have very strong antioxidant properties [18].

The results demonstrated that the higher the drying temperature, the higher IC_{50} value. A high IC_{50} value exhibits a low antioxidant capability, when a low IC_{50} value exhibits a high antioxidant ability. The higher the IC_{50} value, the lower the antioxidant activity got. The antioxidant activity will decrease if the drying temperature achieve a peak. It is due to the higher warming temperature induces the auxiliary metabolites that served as antioxidants (flavonoid compounds) to be breakdown. The higher the drying temperature, the lower the antioxidant thus it can damage the antioxidant activity of the sample [9], [27], [28].

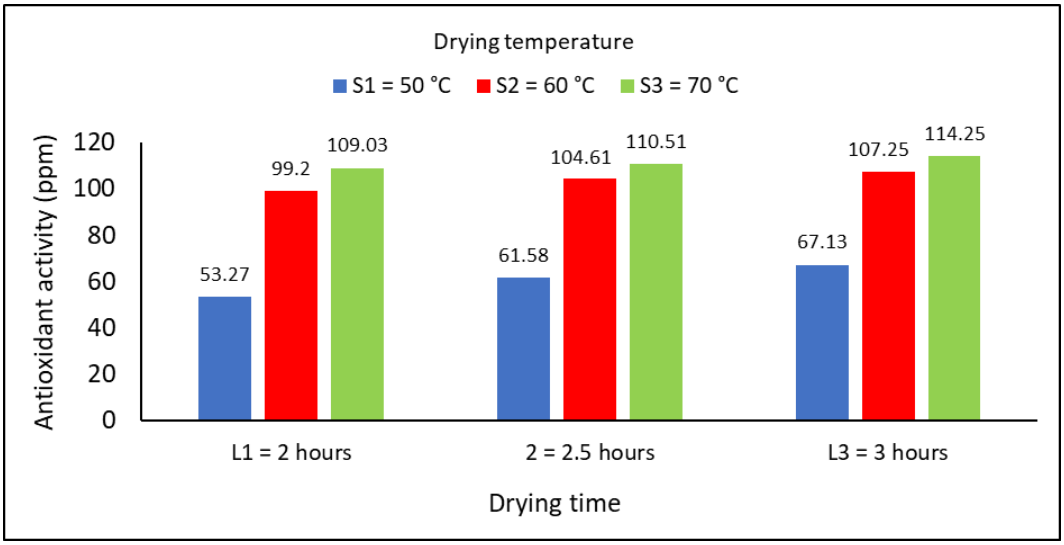

Fig.4. *Impact of drying temperature and drying time towards antioxidant activity of avocado seed tea*

3.6. Color

From the observations, it was obtained that the panelists' preference for the color of the avocado seed tea powder ranged from 3.08 to 3.96 (acceptance was somewhat like-for-like). The average organoleptic value for the color of the whole avocado seed tea powder was 3.37 (acceptance rate was somewhat favorable). The results of various organoleptic values of the color of avocado seed tea powder showed that the treatment of drying temperature, length of drying and collaboration of the two treatments made no had no critical impact ($P>0.05$) toward the color of avocado seed tea powder. This was due to the fact that the color of the avocado seed tea powder produced was not too significant, so the level of acceptance of the panelists regarding the color of steeping water from the avocado seed tea powder did not cause obviously distinct between treatments. The collaboration among those parameters on avocado seed tea powder the color was presented in the Table 1.

Table 1

The interaction between drying temperature and drying time on color

Drying temperature (S)	**Drying time (L)**		
	L_1 = 2 hours	**L_2 = 2.5 hours**	**L_3 = 3 hours**
S_1 = 50 °C	2.93 ± 0.25^{ns}	3.41 ± 0.75^{ns}	3.49 ± 0.23^{ns}
S_2 = 60 °C	3.25 ± 0.33^{ns}	3.33 ± 0.14^{ns}	3.53 ± 0.32^{ns}
S_3 = 70 °C	3.47 ± 0.05^{ns}	3.29 ± 0.22^{ns}	3.59 ± 0.34^{ns}

* ns = no significant effect

Table 1 showed that the color of avocado seed tea powder in the drying treatment of avocado seed slices which are dried at 60 and 70°C by 3 hours (S2L3 and S3L3) drying was preferred by panelists, as compared to the ones for which drying temperatures of 50°C for 3 hours were applied. The treatment 50, 60 and 70°C for 2 hours and 2.5 hours were still acceptable to the panelists even though the values obtained from all treatments did not show a significant difference. This was because the color of the tea produced was almost the same so that it did not affect the level of sensitivity of the panelists to the color of the avocado seed tea powder. In the research it was shown that the color of avocado seed powder was orange. Panelists preferred the S2L3 and S3L3 treatments because the avocado seed tea powder was slightly orange in color as compared to other treatments which were pale orange in color. The orange color of avocado seed tea powder was caused by the presence of polyphenol compounds in avocado seeds which are the most components within the handle of generating the orange. Avocado seed extract dyes, apart from being used as a natural orange dye in food, also have an antioxidant function [8], [10].

3.7. Taste

The panelists' preference value for the flavor of avocado seed tea powder ranged from 2.65 to 3.12 (rather like acceptance). The average organoleptic value on the taste of the whole avocado seed tea powder was 2.74. The results of various organoleptic values of the flavor of avocado seed tea powder demonstrated that the treatment of all parameters did not cause obviously distinct ($P>0.05$) towards avocado seed tea powder taste. It was because the dehydration temperature range and drying time were not significant to the panelists' acceptance level of the taste of avocado seed tea powder. The interaction between drying temperature and dehydration time towards taste of avocado seed tea powder was presented in Table 2.

Table 2

The collaboration between drying temperature and drying time on the taste

Drying temperature (S)	**Drying time (L)**		
	L_1 = 2 hours	**L_2 = 2.5 hours**	**L_3 = 3 hours**
S_1 = 50°C	2.68±0,17^{ns}	2.65±0.30^{ns}	2.81±0.14^{ns}
S_2 = 60°C	2.61±0,04^{ns}	2.65±0.21^{ns}	2.72±0.13^{ns}
S_3 = 70°C	2.68±0,28^{ns}	3,12±0.04^{ns}	2.75±0.14^{ns}

ns = no significant effect

The outcomes illustrated that the taste of avocado seed tea powder resulting from the drying treatment of avocado seed slices that were dried at 50 and 70°C with 2 hours drying time was preferred by the panelists as compared to the one upon which a temperature of 60°C for 2 hours was applied. The taste of avocado seed tea powder after drying the avocado seed slices at a temperature of 70°C for 2.5 hours was preferable rather than drying at a temperature of 50 and 60°C,

while drying the avocado seed slices using a temperature of 50°C for 3 hours is rather preferred by panelists as compared to using drying temperatures of 60 and 70°C. Of all the treatments, the panelists liked the taste of avocado seed tea with a drying process of 70°C and a drying time of 2.5 hours. This was because the resulting tea taste was more bitter than the tea resulting from other treatments. Avocado seeds have a slightly bitter taste. In addition, the drying temperature had no obviously distinct towards taste hedonic test. Panelists' evaluation was determined by the panelists' habit of consuming tea, so that the bitter taste obtained was still relatively ordinary, and the bitter taste of food was usually caused by tannins [14], [25].

3.8. Aroma

The value of panelists' preference for aroma of the avocado seed tea powder ranged from 2.72 to 3.44 (rather like acceptance) with the average was 3.08 (acceptance rate to somewhat favorable). The results of aroma of avocado seed tea powder demonstrated that all of parameters did not cause obviously distinct ($P>0.05$) towards aroma. It was because due of the obviousness, the drying temperature along with length of drying range were not significant towards the panelists' acceptance of the aroma of the avocado seed tea powder. The interaction among all of parameters toward avocado seed tea powder aroma were presented in Table 3.

Table 3

The interaction between drying temperature and drying time on aroma

Drying temperature (S)	**Drying time (L)**		
	L_1 = 2 hours	**L_2 = 2.5 hours**	**L_3 = 3 hours**
S_1 = 50°C	3.07 ± 0.17^{tn}	3.03 ± 0.30^{tn}	2.90 ± 0.14^{tn}
S_2 = 60°C	3.24 ± 0.04^{tn}	3.05 ± 0.21^{tn}	3.03 ± 0.13^{tn}
S_3 = 70°C	3.16 ± 0.28^{tn}	3.00 ± 0.04^{tn}	3.19 ± 0.14^{tn}

ns = no significant effect

Table 3 showed that the aroma of avocado seed tea powder resulting from the drying treatment of avocado seed slices which were dried at 60°C with a drying time of 2 hours was somewhat preferred by the panelists as compared to using a temperature of 50 and 70°C for 2 hours. The aroma of avocado seed tea by drying the avocado seed slices at 60°C for 2.5 hours was rather preferable than drying at 50 and 70°C, while drying the avocado seed slices using a temperature of 70°C for 3 hours was rather preferred by panelists as compared to using drying temperatures of 50 and 60°C.

Of all the treatments, the panelists liked the aroma of avocado seed tea powder by drying process of 60°C and 2 hours drying time. This was because the aroma of the tea produced has almost the same aroma so that the panelists find it difficult to distinguish the aroma. The research outcomes were not in accordance with other researches that explain drying time includes a noteworthy impact on aroma of tea produced [1].

The aroma-forming compounds of tea mainly consist of volatile and easy-to-reduce essential oils so that they are able to deliver a aromatic smell in tea. Besides that, tea also contains gallic acid compounds. When there is a drying process in tea, gallic acid will be oxidized to a thearubigin (TR) compound. Thearubigin compounds are responsible for the fragrant aroma that is present in tea brewing [7], [15].

4. Conclusions

Research shows that drying temperature has an effect on the moisture content, ash content and antioxidant activity of avocado seed tea, while the drying time factor and the interaction of those factors have had an effect on total phenol. For this reason, the best quality avocado seed tea was obtained at a drying temperature of 50°C with a drying time of 2 hours.

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