Journal Basic Science and Technology 12 (1) (2023) pp. 1-11

Published by: IOCSCIENCE

Journal Basic Science and Technology

Journal homepage: www.iocscience.org/ejournal/index.php/JBST

Characteristics and Antioxidant Activity of Dried Purwoceng (Pimpinella Alpina Molk) as Functional Food to Increase Body Immune

Kavadya Syska[1], Asti Dewi Nurhayati[2], Ropiudin[3]

[1]Food Technology Study Program, Faculty of Science and Technology, Universitas Nahdlatul Ulama Purwokerto, Indonesia

[2,3]Agricultural Engineering Study Program, Faculty of Agriculture, Universitas Jenderal Soedirman, Indonesia

ARTICLE INFO

Article history:

Received Jan 29, 2023
Revised Feb 17, 2023
Accepted Feb 28, 2023

Keywords:

Antioxidant
Drying
Purwoceng
Functional Food
Body immune

ABSTRACT

Purwoceng (*Pimpinella Alpina* Molk.) is a native plant of Indonesia. This plant contains potential antioxidants in the form of alkaloids, glycosides, coumarins, triterpenoids-steroids, and saponins. These bioactive compounds are useful as aphrodisiacs, diuretics, and tonics (capable of increasing the body's immune system). Purwoceng-based functional drinks will go through a drying process. This process will result in a decrease in antioxidants in purwoceng. To reduce the loss of antioxidants contained in purwoceng, proper drying is the main key in producing purwoceng-based functional beverage products. The aims of this study were: (1) to determine the characteristics and antioxidant activity of purwoceng during drying to produce functional drinks to increase the body's immune system. and (2) obtaining a drying formula for dried purwoceng products to produce functional drinks to increase the body's immune system. This research method is experimental. This research was divided into four stages, namely: (1) determination of the formulation temperature for drying purwoceng, (2) physico-chemical testing after drying, (3) reducing the dimensions of dried purwoceng, and (4) physico-chemical testing after changing the dimensions of dried purwoceng. . The experimental design used in this study was a factorial Completely Randomized Design (CRD) with 2 factors. The first factor is the drying temperature of purwoceng, while the second factor is whole and counting. Both factors consist of 3 levels with 3 replications so that there are a total of 27 experimental combination units. Observational data were analyzed by analysis of variance (F test) and if they were significantly different, it was continued with the DMRT test at an accuracy level of 5%. The results showed that the best moisture content was the water content of dry purwoceng drying with the lowest value at a temperature of 70℃ (T4) with a value of whole pieces (P0) 27.95 and chopped pieces (P1) with a value of 26.53. The best pH for drying purwoceng tea is at a temperature of 70℃ (T4) with whole pieces (P0) getting a value of 6.85, while chopped pieces (P1) get a value of 6.77. The best yield in purwoceng drying is the least yield at 70℃ (T4). The best antioxidant test results are those that have the highest value at a temperature of 70℃ (T4). The best test for phenol content is with the highest value at a temperature of 70 (T4). The organoleptic test on dried purwoceng steeping with crystalline coconut sugar got the best values, including: color test with a value of 5, fragance test with a value of 5, and taste test with a value of 4.84.

This is an open access article under the CC BY-NC license.

Corresponding Author:

Kavadya Syska,
Food Technology Study Program, Faculty of Science and Technology,
Universitas Nahdlatul Ulama Purwokerto,
Jl. Sultan Agung No. 42, Purwokerto, Central Java, INDONESIA
Email: syska.kavadya@gmail.com

1. INTRODUCTION

Health is a very important aspect for humans. Efforts to maintain health are to increase body immunity, such as the current Covid-19 pandemic (Nopiyanto, *et al*., 2020). Proper nutritional intake can help prevent COVID-19 infection (Prawiradilaga, 2020). The body's immune system is needed to ward off free radicals that can interfere with the health of the human body. Increasing the body's immune system can be met with functional food in the form of antioxidant-rich drinks (Galanakis, 2017).

Functional food is food that is naturally or has been processed containing one or more compounds that have certain physiological functions that are beneficial to health and are consumed as food and drink with sensory characteristics in the form of appearance, color, texture, and taste that can be accepted by the public consumers (Galanakis, 2017; Bagchi & Nair, 2017; Isabel *et al*., 2019; Rani & Yadav, 2018).

Japanese scientists emphasize three basic functions in functional food, namely in the form of food (not capsules, tablets or powder) and made from basic ingredients derived from nature, then can be consumed between meals, and have several benefits when consumed (Decker *et al*., 2010a; Decker *et al*., 2010b). The expected benefits include preventing disease, increasing endurance, regulating body rhythm conditions, recovering, and slowing down the aging process (Rani & Yadav, 2018; Decker *et al*., 2010a; Decker *et al*., 2010b).).

Antioxidants are a group of compounds that can reduce free radicals so that they are very useful for breaking free radical reactions (Decker *et al*., 2010a). Free radicals are chemical molecules that have one or unpaired electrons (Decker *et al*., 2010b). Free radicals contained in the body are reactive (Decker *et al*., 2010a). Free radicals in the body can undergo oxidation reactions by binding to the electrons of cell molecules that can be harmful to the body (Decker *et al*., 2010b). Superoxide radicals, peroxyl, hydroxyl, superhydroxy radicals, alkoxyl, and nitrogen dioxy are examples of free radicals (Decker *et al*., 2010a; Decker *et al*., 2010b).

The need for antioxidants in the body must still be met, one of which is through intake from outside the body (Winarti *et al*, 2018). Sources of antioxidants that are widely used are from plants, because plants have secondary metabolite compounds that can be used as antioxidants (Decker *et al*., 2010a; Saputri & Susiani, 2018).

Antioxidants are compounds that occur naturally in almost all foodstuffs (Decker *et al*., 2010b). This compound serves to protect food from damage due to the oxidation reaction of fat or oil which makes food taste and smell rancid (Decker *et al*., 2010a). Antioxidants are agents that can limit the effects of oxidation reactions in the body (Winarti, 2018). The effects given by antioxidants to the body can be directly, namely by reducing free radicals in the body, and indirectly, namely by preventing the formation of radical effects (Winarti *et al*., 2016).

One of Indonesia's native plants that can be used as functional food is purwoceng (Pimpinella Alpina Molk.) (Nuryadin & Nabiil, 2018; Satyaningtijas *et al*, 2016). Purwoceng contains natural antioxidants, namely: coumarins, saponins, sterols, alkaloids, oligosaccharides, stigmasterol, marmachin, 4-hydroxy coumarin, umbeliforon, and psoralen (Qodri *et al*., 2013; Widayat & Soetarto, 2012). Antioxidant activity consists of several mechanisms, namely preventing chain reactions, preventing the formation of peroxides, preventing the uptake of hydrogen atoms, reducing, and capturing radicals (Widayat & Soetarto, 2012; Pratama & Danarto, 2018; Decker *et al*., 2010a; Decker *et al*., 2010b).

Purwoceng (Pimpinella Alpina Molk.) is a medicinal plant native to Indonesia that lives endemic to the highlands (Nuryadin & Nabiil, 2018; Satyaningtijas *et al*., 2016). This plant is often found in mountainous areas such as the Dieng Plateau and Mount Lawu in Central Java, Mount Pangrango and Mount Galunggung in West Java, as well as in the Tengger and Iyang Mountains in East Java (Nuryadin & Nabiil, 2018; Widayat & Soetarto, 2012). The plant has medicinal properties as an aphrodisiac, diuretic, and tonic (Satyaningtijas *et al*., 2016; Qodri *et al*., 2013; Pratama & Danarto, 2018).

Based on the reason, the characteristics and antioxidant activity of dried purwoceng as functional food to increase the body's immune system is considered effective in producing functional food products based on native Indonesian products. Basic information about the characteristics and activities of dried purwoceng is needed for processing purwoceng-based functional foods.

2. RESEARCH METHOD

2.1. Materials and Equipment

The materials used are: Purwoceng which is produced in the village of Distancesari, Wonosobo Regency, Central Java, distilled water, methanol p.a. (merck), gallic acid p.a (merck), folin–ciocalteu reagent, sodiumcarbonate p.a. (merck), DPPH p.a. (merck), and 96% ethanol. The tools used include: column chromatography, Whatman No. filter paper. 1, evaporating dish, digital balance, measuring flask, drip plate, measuring pipette, micro-pipette, spatula, aluminum foil, desiccator, Erlenmeyer flask, watch glass, vial, measuring cup, separating funnel, test tube, UV–Vis spectrophotometer set (Apak *et al*., 2018).

2.2. Research Procedures

This research is an empirical study consisting of five procedures: (1) determination of the formulation of drying temperature of purwoceng, (2) physico-chemical testing after drying, (3) reduction of the dimensions of dried purwoceng, (4) physico-chemical testing after dimensional changes. dried purwoceng, and (5) organoleptic testing (Mujumdar & Xiao, 2019; Apak *et al*., 2018; Meilgaard *et al*., 2016).

a. Determination of Purwoceng Drying Temperature Formulation

Determination of purwoceng formulation was carried out on sun drying and cabinet drying to obtain the optimum drying temperature range that could produce dry purwoceng. The drying temperature of the cabinet that will be tested in this study is 30, 50, and 70oC (Mujumdar & Xiao, 2019).

b. Physico-Chemical Testing after Drying

Physico-chemical tests after drying included yield, moisture content, total phenol, total antioxidant, reducing power, and free radical scavenging capacity (2-Diphenyl-1-Picrylhydrazyl / DPPH) (Decker *et al*., 2010a; Mujumdar & Xiao, 2019 ; Apak *et al*., 2018).

c. Dried Purwoceng Dimensions Size Reduction

Size reduction of dried purwoceng dimensions in 2 types, namely whole and chopped. The intact dimensions adjust to the original dimensions of the purwoceng. The dimensions of the chopped by dividing the whole purwoceng into 4 equal parts.

c. Physico-Chemical Testing after Changes in Dimensions of Dried Purwoceng

Physico-Chemical Testing after changing the dimensions of dry Purwoceng consisted of yield, water content, anthocyanin content, total phenol, antioxidant activity testing using the Radical DPPH Scavenging Activity Method, and reducing power (Apak *et al*., 2018).

d. Organoleptic Test

Organoleptic tests were carried out by scoring each variable, namely: fragance, rancidity, texture, taste, and preference (Hollowood *et al*., 2018; Zhong & Wang, 2019). Organoleptic analysis criteria are carried out using a scale or score approach associated with certain descriptions of product quality attributes (Hollowood *et al*., 2018; Meilgaard *et al*., 2016).

2.3. Experimental Design

This study used a factorial Completely Randomized Design (CRD) with 2 factors. The first factor is the drying temperature of purwoceng, while the second factor is whole and counting. Both factors consisted of 3 levels (30, 50, and 70^{o}C drying temperature) with 3 replicates of the experiment. Observational data were analyzed by analysis of variance (F test) (Zhong & Wang, 2019). and if it is significantly different, then proceed with the DMRT test at an accuracy level of 5% (Alkarkhi & Alqaraghuli, 2019).

Table 1. Combination of Treatments in Research

U	P	T1	T2	T3	Description
U1	P0	P0T1U1	P0T2U1	P0T3U1	P0= whole Purwoceng; P1=
	P1	P1T1U1	P1T2U1	P1T3U1	Purwoceng is chopped; T1= Drying
U2	P0	P0T1U2	P0T2U2	P0T3U2	Temperature 30^{o}C; T2= Drying
	P1	P1T1U2	P1T2U2	P1T3U2	Temperature 50^{o}C; T3= Drying
U3	P0	P0T1U3	P0T2U3	P0T3U3	Temperature 70^{o}C; U1= 1st test; U2=
	P1	P1T1U3	P1T2U3	P1T3U3	2nd test; U3= 3rd test

2.4. Research Variables

The variables in this study that were measured were: drying temperature 30, 50, and 70^{o}C, yield, water content, total phenol, total antioxidant, reducing power, DPPH, dried purwoceng dimensions, fragance, rancidity, texture, taste, and preference (Mujumdar & Xiao, 2019; Apak *et al*., 2018; Meilgaard *et al*., 2016).

3. RESULTS AND DISCUSSIONS

3.1. Water Content

Drying is the process of removing moisture from agricultural materials and products to produce high quality and durable products for storage (Ibrahim & Zamfirescu, 2016). During the drying, two processes occur, namely the process of heat transfer from the drying air to the material, and the process of transferring water vapor mass from the surface of the material to the surrounding air (Mujumdar, 2014; Mujumdar & Xiao, 2019).

Water is part of the components contained in food. According to Mujumdar & Xiao (2019), the water content in a food can affect the structure, appearance, and taste of the food. The shelf life of food is determined by the water content in the material. According to Ohtake *et al*. (2020) high water content in foodstuffs can cause rapid growth of bacteria, molds, and yeasts. Purwoceng tea analysis data can be seen in Figure 1.

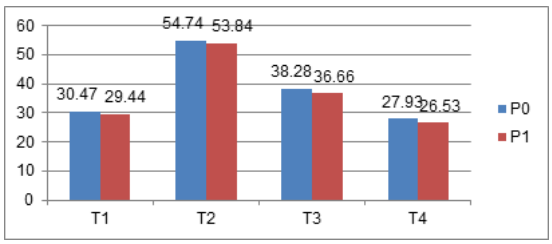


Figure 1. Analysis of water content

The results of the water content analysis showed that purwoceng drying with variations in drying temperature was in accordance with the SNI 3836:2013 standard, namely dry tea containing a maximum water content of 8%. The best water content is the water content of dried purwoceng

with the lowest value at a temperature of 70℃ (T3) with a value of whole pieces (P0) 27.95 and chopped pieces (P1) with a value of 26.53. Based on the results obtained, the higher the drying temperature, the water content of the material decreases, this is due to the longer the heat received by the material, the more water vapor in the food material comes out. Drying using direct sunlight is the most economical and easiest drying process, but in terms of quality, an artificial dryer (oven) will provide a better product (Syska & Ropiudin, 2020). Ultraviolet rays from the sun also cause damage to the chemical content of the dried material (Winangsih, 2013).

The results of the ANOVA test showed that the analysis of water content in purwoceng drying with three variations of temperature on the shape of the pieces had a significant effect (α = 0.05). The drying process will reduce the water content and water activity so as to extend the shelf life. High temperature on drying.

3.2. pH Analysis

Testing pH or acidity levels is used to determine the acidity of a product or material. The pH value of a food product is an important factor related to the shelf life of the product because it determines the growth rate of spoilage microorganisms during storage. The lower the pH value, the more durable the product will be and generally foodstuffs have a pH of 3.0 to 8.0 and usually microorganisms can grow at a pH of 5.0-8.0. The pH analysis of functional tea and spice drinks was carried out based on SNI-01-2891-1992. Increasing the pH of food products has an effect on the antioxidant activity of tea. pH analysis can be seen in Figure 2.

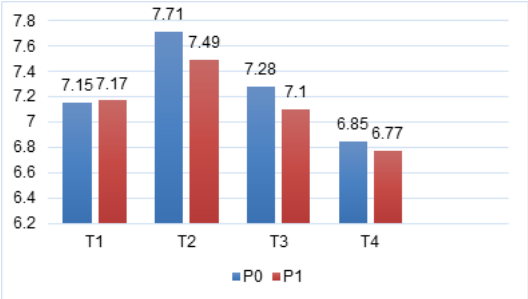


Figure 2. pH Analysis

According to Sayekti, *et al*. (2016) during the withering process, there are chemical changes such as reduced solids content, reduced starch and gum, increased sugar content, reduced protein, increased amino acids, and the breakdown of protein into amino acids. The lower the pH content, the higher the total acid. The results of ANOVA analysis showed that there was a significant difference ($p<0.05$) from drying puwoceng with variations in drying temperature and shape of purwoceng slices on the brewing pH. Based on the results obtained, the best pH for drying purwoceng tea is at a temperature of 70℃ (T4) with whole pieces (P0) getting a value of 6.85, while chopped pieces (P1) get a value of 6.77, this is due to the higher the drying temperature, the higher the drying temperature. the acid content in the material decreases.

3.3. Yield

Extraction is the process of separating the active component from other active components in a food ingredient using a solvent. The aim is to obtain parts of the material that contain the active components. The method used is meserasi, because the method is easy to do and uses simple tools. Dry purwoceng extraction was carried out with one type of solvent with variations in temperature and two treatments. The selection of variations in brewing temperature and treatment aims to determine the yield and active components of dried purwoceng which are still unknown.

The extraction results from one type of solvent with variations in brewing temperature and variations in the combination of dry purwoceng will produce different extract yields. Yield value is used to determine the economic value of a product or material. The higher the yield value, the

more effective the utilization and the higher the economic value. Calculation of yield by dividing the final weight of the resulting extract by the number of initial samples of the extract. The extract yield value can be seen in Figure 3.

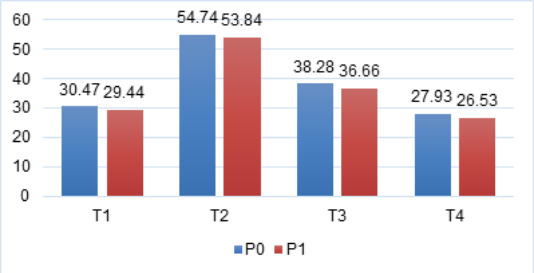


Figure 3. Yield

The results of the ANOVA test showed that the yield of purwoceng drying with variations in temperature and cutting effects was significantly different ($p<0.05$). The highest yield of purwoceng drying at 50℃ (T2) yielded 54.74 whole pieces, while the lowest yield was chopped pieces with a temperature of 100℃ yielding 26.53. The best yield on purwoceng drying is the least yield.

3.4. Antioxidant

The antioxidant activity test of purwoceng leaves was carried out to determine the drying temperature on dried purwoceng leaves using the DPPH method. DPPH is an organic compound that contains less stable nitrogen, has free radical properties and is dark purple in color. According to Hasanah *et al*. (2017), DPPH dissolved with an antioxidant substance that can donate electrons will show a color change from purple to yellow due to the formation of a more stable DPPH-H compound. According to Ramlah (2017), a simple, inexpensive and time-consuming antioxidant testing method can use the DPPH method. The way DPPH works is based on the ability of antioxidant compounds found in foodstuffs to ward off free radicals, so that when DPPH interacts with antioxidants, a process of electron donation occurs and can stabilize free radical compounds.

The drying temperature was chosen to determine the amount of antioxidant content in dried purwoceng leaves in whole and chopped form using sunlight and an oven at 30 C, 50 C and 70 C. The choice of temperature is based on the antioxidant properties in the food. According to Putri and Ulfin (2015), the use of high temperatures can result in widening the distance between the molecules contained in the tea leaf solids so that water molecules will easily enter to penetrate the tea solids.

The antioxidant activity of dried purwoceng leaves showed that the inhibitory concentration (Figure 4) had various values with different optimization temperatures. Testing of antioxidant activity used a positive control in the form of ascorbic acid which is the most commonly used standard to test antioxidants. In addition, ascorbic acid is often used because ascorbic acid compounds are included in natural antioxidant compounds that are relatively safe and do not cause toxicity (Lung and Destiani, 2017). Whole dried purwoceng leaves which have the highest value are whole dried purwoceng leaves with a value of 88.74 which was carried out at a temperature of 100ºC. The temperature resulting from the optimization will be used to perform antioxidant testing on the formulas of the three types of tea.

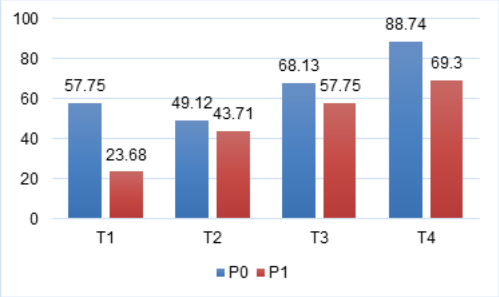


Figure 4. Antioxidant value

The results obtained from the concentration value of dried purwoceng leaves are directly proportional to the inhibition value. The higher the concentration, the higher the inhibition value of a material. According to Widyasanti *et al*. (2016), this shows that the amount of concentration means that the amount of antioxidants contained in an extract can counteract free radical activity, marked by a change in purple color from DPPH to yellow color as measured by a wavelength of 515-520 nm.

The concentration used to test dried purwoceng leaves was 100 ppm which was based on the cytotoxicity test of dried purwoceng leaves. The antioxidant content of whole dried purwoceng and chopped dried purwoceng can produce different antioxidant values. The highest antioxidant content was obtained from a combination of drying temperatures for dried purwoceng leaves. According to Mandarini (2014) the amount of free radicals that were inhibited could result in plant extracts having a high antioxidant role.

The results of the formula using ANOVA obtained p value > 0.5. Whole purwoceng leaves were able to inhibit DPPH radicals well, while chopped purwoceng leaves were able to inhibit DPPH radicals although the antioxidant activity value was lower than whole dried purwoceng leaves.

3.5. Total of Phenol

Testing of phytochemical compounds on dried purwoceng leaves was tested for total phenol using the Folin-Ciocalteu method. In the Folin-Ciocalteu method, it can determine the levels of total phenol using gallic acid as a standard because it contains hydroxy benzoic acid which is reactive to the Folin-Ciocalteu reagent, in the total phenol test the wavelength used in gallic acid solution as a standard for quantitative analysis is the maximum wavelength at a wavelength of 650-800 nm so that the obtained wavelength is 750m. According to Winarti *et al*. (2018) the color complex produced by the reaction of gallic acid with the Folin-Ciocalteu reagent is blue at a wavelength of 750 nm. Gallic acid contains 3 phenolic hydroxy groups which are oxidized when Folin-Ciocalteu reagent is added under alkaline conditions and form a molybdenum-tungsten complex. According to Apak, *et al*. (2018) Molybdemum ions (Mo6+) will be reduced to Mo5+ ions so that the reaction color changes from yellow to blue.

The phenol content of the sample was calculated using the line equation y = bx + a with the resulting sample absorbance value of 0.115. The results showed that the whole dried purwoceng leaf extract had a total phenol content of 42.62 mg SAG/g. The fragancetic groups in phenol compounds show their ability as antioxidants and antimicrobials that can protect the body from oxidation reactions and pathogenic properties. Free radicals can damage cell biomolecules such as nucleic acids, proteins, lipids and carbohydrates, and contribute to oxidative stress and several diseases.

Phenolic compounds have many health benefits such as antioxidant, antimicrobial, and anticarcinogenic (Hasanah *et al*., 2017). Phenolic compounds are compounds that have antioxidant activity. Phenolic compounds have phenols and polyphenols with variations in the number of bound hydroxy groups. The more hydroxyl groups in phenolic compounds, the more their ability to scavenge free radicals increases. The hydroxy group attached to the fragancetic ring will be easily oxidized by donating hydrogen atoms to free radicals. The results of the highest total phenolic

value data were using a drying temperature of 70ºC (T4) with whole pieces (P0) of 0.16 and chopped pieces (P1) 0.13. The total phenolic value of purwoceng tea can be seen in Figure 5.

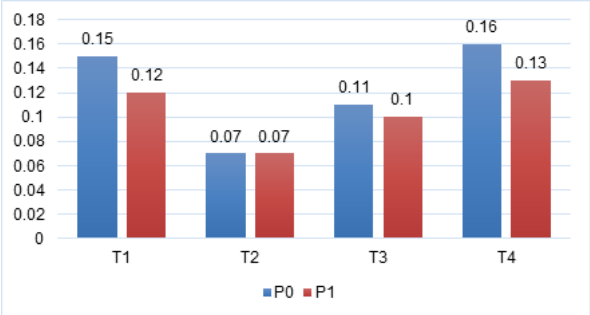


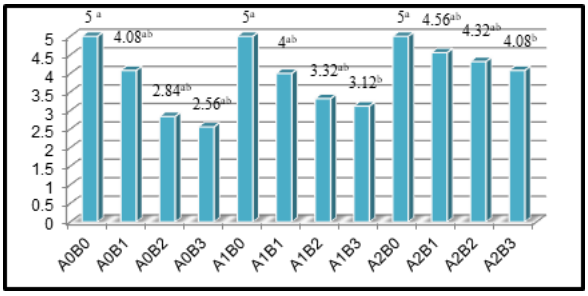
Figure 5. Total of Phenol

The total phenol content was determined using the Folin-Ciocalteu method with gallic acid as a comparison. The results of the analysis of whole dried puwoceng leaves with a temperature of 700C showed the highest value of 4,567 gave a significantly different effect ($p<0.05$) on the total phenol content produced. According to Mujumdar and Xiao (2019) that drying using an oven with a high temperature and a short time produces high phenolic values. This is because the high temperature and short drying time can accelerate the inactivation process of the polyphenol oxidase enzyme. Phenolic compounds as antioxidants have the ability to form stable phenoxy radicals when an oxidation reaction occurs (Lung and Destiani, 2017).

3.6. Organoleptic Test

a. Color

Color is the first organoleptic parameter in the presentation, namely by the sense of sight. Attractive colors will invite panelists or consumers to taste the product. Panelists' responses to the color of dry purwoceng infusion with crystalline sugar can be seen in Figure 6.



Picture 6. Color of purwoceng steeping

Based on Figure 6. the results of the preference test for the steeping color of purwoceng with a combination of dry purwoceng: coconut sugar crystal 10:0 which is preferred at temperatures of 60-70 ^{o}C, 70-80 ^{o}C, and 80-90^{o}C with a value of 5. These results indicate that the value for Steep colors give the impression of liking. The results of the organoleptic test showed that the difference in concentration in the four combinations of dry purwoceng steeping with crystalline coconut sugar gave a significant difference ($p<0.05$) in the panelists' preference for the steeping color. The results of the ANOVA test showed that the combination of dry purwoceng brewing with crystalline coconut sugar with variations in brewing temperature had a significant effect (□<0.05) on organoleptic test color preferences. Organoleptic test of preference level on the preferred color of dried purwoceng samples-crystalline coconut sugar from 4 formulations with 3 temperatures, namely the formulation with a ratio of dry purwoceng: 9:1 crystal coconut sugar with a temperature

of 80-90°C. The lowest level of color preference with dried purwoceng: 7:3 sugar with a temperature of 80-90°C.

Organoleptic data on color testing got the best results, namely on dry purwoceng: crystalline coconut sugar that was 9:1 at a temperature of 80-90°C with a value of 4.56 with a yellowish brown purwoceng color. The addition of more crystalline coconut sugar produces a more yellowish-brown color. This is because crystalline coconut sugar has a thick and distinctive color.

b. Fragance

The results of consumer acceptance of the fragance of steeping purwoceng dry-crystal coconut sugar can be seen in Figure 7.

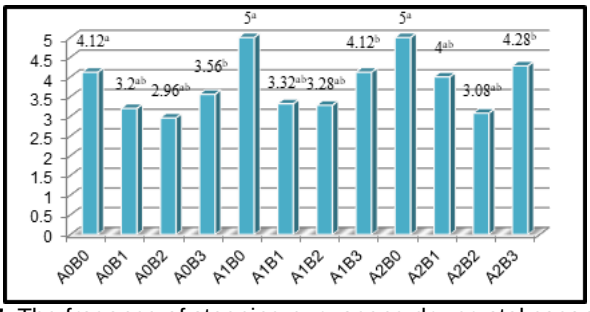


Figure 7. The fragance of steeping purwoceng dry-crystal coconut sugar

Based on Figure 7, the organoleptic test of the level of preference for the fragance of steeping dried purwoceng with crystal coconut sugar, namely steeping purwoceng: crystal coconut sugar, which is a combination of 10:0 at a temperature of 70-80 and 80-90°C with a value of 5, while the lowest value is at the same temperature. ie 60-70 with a value of 3.20. The results of the ANOVA test on the combination of steeping purwoceng dry-coconut sugar crystals with variations in brewing temperature had a significant effect (α = 0.05) on fragance preferences in organoleptic tests. The fragance of dry purwoceng brewing with crystal coconut sugar that panelists tend to like is the fragance with no addition of crystal coconut sugar because the fragance produced is stronger, while dry purwoceng brewing with no addition of crystal coconut sugar produces a not too strong dry purwoceng brewing fragance. This is because coconut sugar has a more concentrated and distinctive fragance so that when it is combined with coffee drinks, the fragance of crystal coconut sugar is more dominant so that the fragance produced is not too pronounced.

c. Taste

The results of the panelists' assessment of the taste of dry purwoceng steeping with crystalline coconut sugar can be seen in Figure 8.

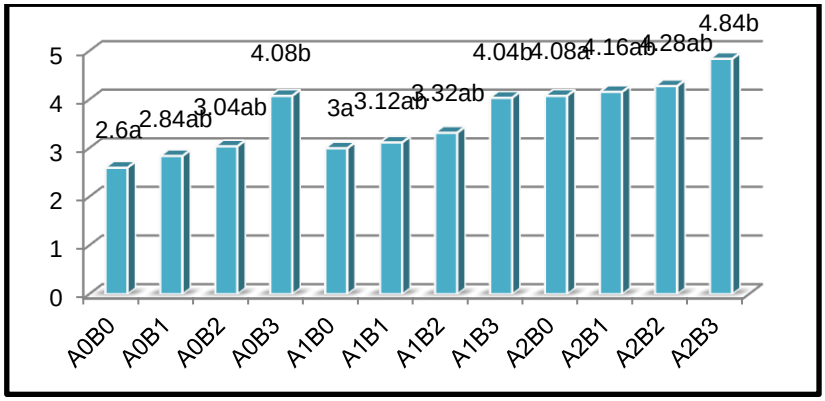


Figure 8. Taste preference test

Based on Figure 8. the organoleptic test of the level of preference for the taste of steeping dried purwoceng with crystalline coconut sugar which is widely preferred at a temperature of 80-90oC with a total of 4.84, while the lowest at the same temperature is 70-80^{o}C with a total of 4.04. The results of the ANOVA test showed that the combination of steeping purwoceng dry-crystal coconut sugar with variations in brewing temperature had a significant effect (α = 0.05) on the taste of the organoleptic test. The taste of steeping dried purwoceng with crystal coconut sugar is the most preferred, which tends to be with the addition of crystal coconut sugar with dry purwoceng steeping: crystal coconut sugar 7:3 with a brewing temperature of 80-90^{o}C and steeping purwoceng dry-coconut sugar which has a low level of taste preference. Dried purwoceng steeping: 10:0 crystal coconut sugar with a brewing temperature of 60-70^{o}C, this is because the addition of crystal coconut sugar helps to give a sweet taste to the dried purwoceng brew with crystal coconut sugar.

4. CONCLUSION

The best moisture content is the water content of dried purwoceng with the lowest value at 70℃ (T4) with a value of whole pieces (P0) 27.95 and chopped pieces (P1) with a value of 26.53. The best pH for drying purwoceng tea is at a temperature of 70℃ (T4) with whole pieces (P0) getting a value of 6.85, while chopped pieces (P1) get a value of 6.77. The best yield in purwoceng drying is the least yield at 70℃ (T4). The best antioxidant test results are those that have the highest value at a temperature of 70℃ (T4). The best test for phenol content is with the highest value at a temperature of 70 (T4). The organoleptic test on dried purwoceng steeping with crystalline coconut sugar got the best values, including: color test with a value of 5, fragance test with a value of 5, and taste test with a value of 4.84.

ACKNOWLEDGEMENTS

A big thank you to DRTPM (Directorate of Research, Technology, and Community Service), Directorate General of Higher Education, Research, and Technology, Ministry of Education, Culture, Research and Technology Republic of Indonesia for the costs for this research in the 2022 fiscal year.

REFERENCES

Alkarkhi, A.F.M. & Alqaraghuli, W.A.A. (2019). Easy Statistics for Food Science with R. London: Academic Press

Apak, R., E. Çapanoğlu & F. Shahidi. (2018). Measurement of antioxidant activity and capacity: recent trends and applications. Wiley, USA.

Bagchi, D. & Nair, S. (2017). Developing New Functional Food and Nutraceutical Products. Academic Press, USA.

Decker E., Elias, R., & McClements, D.J. (2010). Oxidation in Foods and Beverages and Antioxidant Applications. Understanding Mechanisms of Oxidation and Antioxidant Activity. Woodhead Publishing, USA.

Decker, E., Elias, R., & McClements, D.J. (2010). Oxidation in Foods and Beverages and Antioxidant Applications. Management in Different Industry Sectors. Woodhead Publishing, USA.

Firdaus, M. (2015). Indeks Aktivitas Antioksidan Ekstrak Rumput Laut Coklat (Sargassum aquifolium). *Jurnal Pengolahan Hasil Perikanan Indonesia*, 16(3).

Galanakis, C.M. (2017). Nutraceutical and Functional Food Components: Effects of Innovative Processing Techniques. Academic Press. New York. USA.

Hasanah, M., Maharani, B., & Munarsih, E. (2017). Daya antioksidan ekstrak dan fraksi daun kopi robusta (Coffea rubosta) terhadap pereaksi dpph (2,2-difenil-1- pikrilhidrazil). *IJPST*, 4(2), 42-49.

Hollowood, T., Hort, J., & Kemp, S.E. (2018). Descriptive Analysis in Sensory Evaluation. New Jersey: John Wiley & Sons.

Ibrahim, D. & Zamfirescu, C. (2016). Drying Phenomena: Theory and Applications. Wiley, USA.

Isabel, C.F., Ferreira, R., & Barros, L. (2019). Functional Food Ingredients from Plants. Elsevier Science & Technology. Elsevier Science & Technology, USA.

Lung, J.K.S. & Destiani, D.P. (2017). Uji aktivitas antioksidan vitamin A, C, E dengan metode dpph. Farm, 15(1), 53-62.

Mandarini, N.P. (2014). Analisis kapasitas antioksidan dan kandungan total fenol pada sayuran [tesis]. Bogor (ID): Institut Pertanian Bogor.

Meilgaard, M.C., Civille G.V., & Carr, B.T. (2016). Sensory Evaluation Techniques. Boca Raton: CRC Press.

Mujumdar, A.S. (2014). Handbook of Industrial Drying, Fourth Edition. CRC Press, USA.

Mujumdar, A.S. & Xiao, H.W. (2019). Advanced Drying Technologies for Foods. CRC Press, USA.

Nopiyanto, Y.E., Raibowo, S., Sugihartono, T., & Yarmani. (2020). Pola hidup sehat dengan olahraga dan asupan gizi untuk meningkatkan imun tubuh menghadapi Covid-19. *Dharma Raflesia: Jurnal Ilmiah Pengembangan dan Penerapan Ipteks*, 18(2), 90-100.

Nuryadin. E. & Nabiil, A. (2018). Potential Development of Purwoceng (Pimpinella pruatjan Molk or Pimpinella alpine Kds) Plant Scale Industry Using In-Vitro Culture Technique By Means of Rooting Induction. *Journal of Tropical Biodiversity and Biotechnology*, 3(3), 92-96.

Ohtake, S., Izutsu, K.I, & Lechuga-ballesteros, D. (2020). Drying Technologies for Biotechnology and Pharmaceutical Applications. Vch Pub, USA.

Pratama, I.G.A.A. & Danarto, H.R. (2018). Effect Of Purwoceng Extract On The Expression Of Nitric Oxide Neuronal Synthase In Penile Tissue Of White Male Rattus Novergicus. *Jurnal Urologi Indonesia*, 25(1).

Prawiradilaga, R.S. (2020). Covid-19 dan Tatalaksana Gizi. Pusat Penerbitan Unisba (P2U) LPPM Unisba. Bengkulu. Indonesia.

Putri, D.D. dan Ulfin, I. (2015). Pengaruh suhu dan waktu ekstraksi terhadap kadar kafein dalam teh hitam. *J Sains Seni ITS*, 4(2), 105-109.

Qodri, Z.U., Cahyono, B., & Suzery, M. (2013). Analisis Kimiawi Fraksi n-Heksana dari Tanaman Purwoceng (Pimpinella Alpina Molk.). Jurnal Kimia Sains dan Aplikasi, 16(1), 27-32.

Ramlah. (2017). Penentuan suhu dan waktu optimum penyeduhan daun teh hijau (Camellia sinensis L.) p+2 terhadap kandungan antioksidan kafein, tannin, dan katekin [skripsi]. Makassar (ID): Universitas Islam Negeri Alauddin Makassar.

Rani, V. & Yadav, U.C.S.. (2018). Functional Food and Human Health. Springer Singapore.

Syska, K. & Ropiudin. (2020). Perpindahan Panas pada Pengering Tipe Drum Berputar pada Kondisi Tanpa Beban. *Agroteknika*, (3)1, 1-15.

Saputri, R. & Susiani, E.F. (2018). Uji Aktivitas Antioksidan Ekstrak Etanol Buah dan Biji Buah Kalangkala (Litsea angulata) asal Kalimantan Selatan. Borneo Journal of Pharmacy, 1(2), 81-84.

Satyaningtijas, A.S., Maheshwari, H., Achmadi, P., Bustaman, I., Kiranadi, B., Julianto, & Kurnia, M.L. (2016). Pemberian Ekstrak Etanol Purwoceng pada Masa Pascaplasentasi Meningkatkan Kinerja Reproduksi Tikus Bunting. *Jurnal Veteriner*, 17(1).

Widayat, T. & Soetarto, A.E.S. (2012). Isolation of endophyic bacteria from purwoceng (Pimpinella alpina Kds.). *Health Science Journal of Indonesia*, 3(1), 31-36.

Widyasanti, A., Farddani, C.L., & Rohdiana, D. (2016). Pembuatan sabun padat transparan menggunakan minyak kelapa sawit (palm oil) dengan penambahan bahan aktif ekstrak teh putih (Camellia sinensis). *JTPL*, 5(3), 125-136.

Winarti, S., Djajati, S., Hidayat, R., & Jilian, L. (2018). Karakteristik Dan Aktivitas Antioksidan Beras Analog Dari Tepung Komposit (Gadung, Jagung, Mocaf) Dengan Penambahan Pewarna Angkak. *Jurnal Teknologi Pangan*, 12(1), 27-40.

Winarti, S., Sudaryati, & Usman, A.E.S. (2016). Karakteristik Dan Aktivitas Antioksidan Rosela Kering (Hibiscus sabdariffa L.). Jurnal Teknologi Pangan, 9(2).

Zhong, J. & Wang, X. (2019). Evaluation Technologies for Food Quality. Cambridge: Woodhead Publishing.

Winangsih, E., Prihastanti, & Parman, S. (2013). Pengaruh Metode Pengeringan Terhadap Kualitas Simplisia Lempuyang Wangi (*Zingiber fraganceticum* L.). *Buletin Anatomi dan Fisiologi*, 21(1), 19-25.

Sayekti, E. D., Asngad, A., & Chalimah, S. (2016). Aktivitas Antioksidan Teh Kombinasi Daun Katuk Dan Daun Kelor Dengan Variasi Suhu Pengeringan (Doctoral dissertation, Universitas Muhammadiyah Surakarta).