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THE EFFECT OF FILLER CONCENTRATION VARIATIONS AND DRYING TEMPERATURE ON JUWET (SYZYGIUM CUMINI) POWDER INSTANT DRINK

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ABSTRACT: Juwet fruit has a sour taste. The purple colour of this ripe juwet comes from anthocyanins. Anthocyanins in fruit or vegetables can appear red, purple, or blue, depending on the acidity (pH) conditions. Anthocyanins also act as a source of antioxidants. Antioxidants from anthocyanins are relatively safer than synthetic antioxidants that promote carcinogenesis. Antioxidants will stimulate the body's system response to destroy free radicals. The magnitude of the benefits of antioxidants has encouraged many researchers to lift the natural potential of high antioxidant content to be processed into practical and easy dishes. Therefore, Juwet fruit processing is needed to increase public acceptance of Juwet fruit, one of which is by removing tannins from Juwet fruit by blanching and processing juwet fruit into an instant powder that is practical and easy to consume, both in the process of evaporation and drying. This research aims to increase the economic value of Juwet fruit as an instant powder drink which is rich in vitamins and antioxidants. The process is optimized by combining the evaporation and drying processes to obtain products that comply with SNI standards. From the results of this study, the highest Vitamin C content was obtained at a drying temperature of 50^0C, which was 0.128%/1 g with an antioxidant reactivity of 50%.

Keywords: Juwet Fruit, Vitamin C, Antioxidant, Anthocyanin, Powder Drink

1. Introduction

Indonesia is located in a tropical area, making the conditions suitable for growing various kinds of flora, including fruits. Many native Indonesian fruits have good health benefits, including Duwet fruit. Duwet or Juwet (Syzygium cumini) is one of Indonesia's local fruits which is getting rare. Juwet fruit has a sour taste and is purple when ripe. Duwet fruit is known by various names such as jamblang, juwet, guava rivet, jambolan, or java plum. Duwet fruit included in the buni fruit (bacca) has a fruit wall consisting of two layers, namely an outer layer (exocarp or epicarp) which is thin and an inner layer (endocarp) which is thick, soft, and juicy. The purple colour of this ripe juwet comes from anthocyanins.

Anthocyanins are purple pigments found in many fruits and vegetables. Anthocyanins in fruit or vegetables can appear in red, purple, or blue, depending on the acidity (pH) conditions. Anthocyanins are a subclass of flavonoids that are important for plants. This compound attracts the attention of insects, so it helps plants in pollination. Anthocyanins can also protect plant tissues from photoinhibition and oxidation caused by photosynthesis. Anthocyanins also act as a source of antioxidants. Antioxidants from anthocyanins are relatively safer than synthetic antioxidants that promote carcinogenesis because this fruit has long been consumed, but there are no reports of side effects. Duwet fruit has high antioxidants because of its natural anthocyanin content. When compared, the antioxidant activity of ripe Duwet fruit is almost the same as BHT (Butylated hydroxytoluene), a synthetic antioxidant generally used. This high antioxidant content makes juwet fruit beneficial for the health of the body. Although it has excellent benefits, in terms of taste, juwet fruit is not preferred, mainly because of the aftertaste effect caused when consuming this fruit as fresh fruit. Therefore, processing juwet fruit is needed to increase people's acceptance of juwet fruit, one of which is by processing Duwet fruit into an instant practical powder that is easy to consume. After processing, the anthocyanin content and antioxidant activity in instant powder drink products may not be as large as fresh fruit, especially if handling the final product is inappropriate. Deviation may affect the levels of anthocyanins, affecting the product's antioxidant activity level. Therefore, it is crucial to determine the stability of anthocyanins in the product of duwet fruit powder made. Besides that, besides being able to be used as a practical powder

form and as a natural antioxidant, the high anthocyanin in Duwet fruit can also be used as a natural dye. Seeing so much potential for product diversification that can be produced from duwet fruit, it is essential to research to optimize the evaporation and drying process in the manufacture of duwet powder.

2. Literature review

Juwet fruit is the fruit of the guava tribe (Myrtaceae). This fruit has the scientific name Syzygium cumini, which also has synonyms with Syzygium jambolanum, Eugenia cumini, or Eugenia jambolana. Juwet fruit is known by several names, in Indonesia, such as Juwet, Jambu rivet, Jamblang, and Jambolan. In India, juwet is known as jambool; in America, it is known as java plum [1] Juwet fruit is oval to ovoid, often slightly bent. The size of the fruit ranges from 1 to 5 cm, with a thin, smooth and shiny fruit skin. The colour of the ripe fruit is dark red to blackish purple, sometimes white. Juwet often grows in large groups. The fruit's flesh is white, yellow-grey, slightly red-purple and almost odourless. Juwet fruit has much juice with a sour-to-sour taste. Seeds are oval and can measure up to 3.5 cm [1]. Juwet fruit has various health benefits due to its high antioxidant activity. One of the benefits of juwet fruit is to reduce the fragility of the capillaries that cause diabetic wounds. A review of the health benefits of juwet fruit was carried out by Swami et al. [2], Stephen [3], also by Jebitta [4], S Ramya [5] and M. Wasswa [6]. Other benefits are maintaining normal cholesterol levels in the blood, treating asthma, diarrhea, stomach pain, as well as antidiabetic as in a study by Alam [7]. The antioxidant properties of the fruit come from the anthocyanins that cause the purple color of this fruit. In 100 grams of dried juwet fruit contains 161mg anthocyanins (3430mg/100g) dried fruit peel [8]. The magnitude of the benefits of antioxidants has encouraged many researchers to raise the natural potential with high antioxidant content to be processed into practical and easy dishes [3]. Process The processing of natural materials is susceptible to the heating process. The color stability of Duwet peel anthocyanins decreases with increasing contact time with oxidizing agents, ultraviolet light, heating, and storage time [4]. The research above shows that the drying process which includes drying temperature and time is a very influential factor on the quality of the drying product [3]. Veronika also stated in her research that thermal processing is very influential on dry products [5]. The levels of anthocyanins in Duwet fruit are higher in line with the increase in fruit maturity. If the duwet is green, the antioxidant activity is only 29%, then the red duwet can reach 60% as reported by Lestario (2003) quoted by [1]. Antioxidants are compounds that are important for the body to ward off free radicals. Antioxidants are generally found naturally in plants that have an important role for the body. These compounds can inhibit oxidation reactions or reactions that can cause rancidity in food [6]. Juwet has potential as an anti-cancer as stated by Sunil [9].

Isoflavones have the potential to protect and prevent cardiovascular diseases, cancer and osteoporosis, so isoflavones can be used as food components to become functional foods. Isoflavones are generally found in nuts with a content of about 0.25%. Some of the more popularly used synthetic antioxidants are phenolic compounds such as butylated hydroxyanisol (BHA), butylated hydroxy-toluene (BHT), tertiary butyllhydroquinone (TBHQ), and esters of gallic acid, such as propyl gallate (PG). The main synthetic antioxidants used have a usage limit of 0.02% of the fat or oil content and are quite stable to heat and are often used for fat stability [7]. In addition to juwet fruit which is high in benefits, it turns out that juwet seeds can also ward off diabetes and cholesterol, as stated by Shivani Sidana [10]. Juwet fruit seeds were also extracted by Mathur [11]. Juwet seed as an anti-inflammatory was studied by A. Kumar, R. Ilavarasan [12]. The research which aims to study the growth potential and immunomodulator of Syzygium cumini leaf powder was carried out by Prabu [13]. The manufacture of powdered drinks in industry generally uses freeze drying and spray drying methods. However, the resulting flour products are expensive because of the high costs that must be incurred to meet dryers such as freeze dryers and spray dryers, so many researchers use the foam-mat drying method. This method allows the use of lower temperatures, better quality of taste, color and nutritional content of the final product due to the relatively shorter drying time. In addition, the equipment used is simpler than freeze dryer and spray dryer, thus saving time and operational costs, drying with this method has a much lower investment cost [8]. This drying is used for drain the previous liquid has been foamed beforehand by shaking and applying a small amount of developer or foaming agent to the foaming liquid. Foam formation of a liquid creates a wider surface, thus allowing the use of lower drying temperatures [9]. Foam formation depends on various parameters, such as liquid composition, foaming method used, temperature, and duration of foaming. Variables that need to be

considered during the drying process include the composition of the material to be dried, the thickness of the drying layer, and the temperature of the drying process [10]. Alternative evaporation and drying methods such as vacuum evaporator to maintain the vitamin content and nutritional content of foodstuffs were also studied in the research conducted by Nilna [8]. In addition to the evaporation and drying processes that affect the quality of powdered foodstuffs, there is a packaging factor that determines the shelf life, which from research conducted by nilna shows that the type of packaging affects the storage time and product quality. The best results were obtained with the use of aluminum foil-coated pp plastic packaging [11].

3. Experimental

The research method used foam-mat drying method. This drying method is used to dry the liquid that has previously been added in small amounts of filler to the fruit juice. Foam formation in fruit juice aims to create a large surface area, thus allowing the use of lower drying temperatures. The drying process lasts for 8 hours. After drying, it was ground into powder and sieved using a 60 mesh sieve. Then the juwet powder was analyzed.

Data analysis is obtained from the analysis process carried out by making the data in the form of a graph which is then explained and adjusted to the quality and synchronization with the shelf life of food ingredients. Equipment for the analysis process to be carried out is available at the analytical chemistry laboratory, Chemical Engineering, National Institute of Technology, Malang.

Research variable

Fixed Variable

- Juwet juice : 100 g
- Drying time : 8 hours
- Type of solvent : water
- Blanching temperature: 80oC
- blanching time : 10 minutes
- pH : 3.0
- Filler type : tween 80
- Dextrin concentration: 20 g
- Citric acid : 3 g

Variable Change

- Drying temperature : 50; 55; 60; 65; 70 oC
- Concentration of filler : 1; 2; 3; 4; 5 g/ 100 g porridge

Research procedure

Raw Material Preparation

-Separating juwet fruit between the flesh and the seeds of the fruit

-Blanching the juwet porridge at 80oC for 10 minutes

- Crush the juwet flesh using a blender until it becomes mush

-Strain the pulp to separate the juice from the pulp

- Dissolve 3 g of citric acid with 100 mL of water

- Adding citric acid solution to juwet juice

Fruit juice foaming

-Adding tween 80 to juwet juice with a concentration of 1; 2; 3; 4; 5 g

- Added dextrin 20 g

- Mix the ingredients using a mixer for 10 minutes until foam or froth is formed

Beverage Powder Making

- Pouring foam into the tin

- Put the pan into the pan with a temperature variation of 50; 55; 60; 65; 70 oC for 8 hours

- Take out the baking sheet, grind it into powder and sieve it using a sieve with a size of 60 mess.

- Product Packaging

-Product Analysis

4. Result

4.1. Water Content Analysis Results

The water content in foodstuffs greatly affects the quality and shelf life of these foodstuffs. Therefore, determining the water content of a food ingredient is very important so that in the processing and distribution process it gets proper handling. The water content in foodstuffs affects the resistance of foodstuffs to microbial attack.

If a food ingredient has a high water content, it can affect the appearance of the texture and taste of the food. And determine the quality of the food ingredients. Affect the freshness, stability, and durability of food and determine the level of food safety risk

Therefore, determining the water content of a food ingredient is very important so that in the processing and distribution process it gets proper handling. Based on the theory, that the lower the water content, the less likely it is that microbes can grow in foodstuffs. So the longer the shelf life. In accordance with the provisions of SNI that the maximum permissible water content for instant powder drinks is 10.0%.

Based on the results of the analysis of variance which can be read in Figure 4.1. The relationship between moisture content and drying temperature can be seen. Where the higher the drying temperature, the lower the percentage of water content. This is because the higher the drying temperature, the more water evaporates and the less water content in the product. This results in a longer storage time for instant powder drinks.

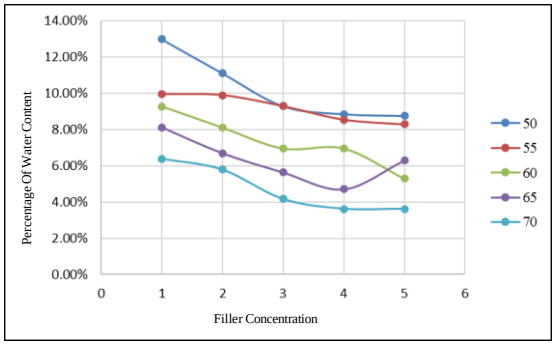

Figure 4.1 Result Curve of Relationship between Filler Concentration and Drying Temperature on Total Water Content in Instant Powder Drinks

The higher the drying temperature and the higher the filler concentration, the lower the water content in instant powder drinks. This is because the high concentration of filler affects the surface area produced in the form of foam so as to reduce the water content.

4.2. Results of Analysis of Vitamin C Content

Vitamin C is a water-soluble vitamin and is easily oxidized. Vitamin C can be formed as L-ascorbic acid and L-dehydroascorbic acid, both of which have activity as vitamin C. Ascorbic acid is very easily oxidized reversibly to L-dehydroascorbic acid. L-dehydroascorbic acid is chemically very labile and undergoes further changes to L-diketogulonic acid which has no vitamin C activity anymore.

For plants, the function of vitamin C is not yet known. However, some vitamins can be identified by their importance in assisting the activity of various enzymes, for example many B-complex vitamins are coenzymes of certain enzymes found in living cells. Vitamin C in plants is a secondary metabolite, because it is formed from glucose via the D-glucuronic acid and L-gulonic acid pathways. In humans, higher mammals, and guinea pigs, this biosynthesis does not occur, due to a genetic biosynthetic barrier between L-golonolactone and 2 keto-L-gulonolactone so that for these species vitamin C is an important dietary factor. Temperature affects vitamin C resistance, vitamin C resistance decreases with increasing treatment temperature. In the drying process, the release of air is important, because the ingredients (fruits) that contain air in them and are processed at high temperatures will destroy all of the vitamin C. In accordance with the value of vitamin C levels in juwet fruit, which is quite a lot, which is 130 mg per 100 grams of juwet fruit, this vitamin C analysis needs to be carried out to find out how much vitamin C is in juwet fruit powder drink products. Based on the results of the analysis of variance that can be read in Figure 4.2, it can be seen the relationship between vitamin C levels and drying temperature. Where the higher the drying temperature, the lower the percentage of vitamin C levels. This is due to the higher drying temperature, the resistance of vitamin C in powdered beverage products decreases so that, vitamin C levels increase with increasing concentration of Tween 80. This happens because Tween 80 is able to form a protective layer between the dispersed phase and the continuous phase.

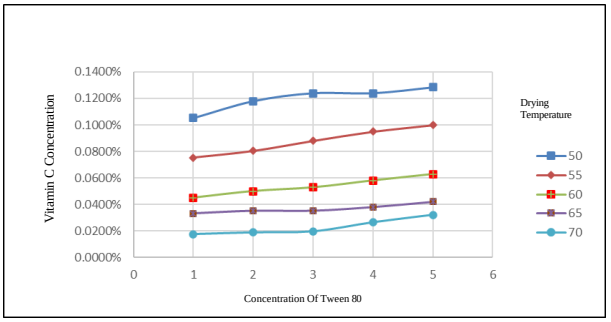

Figure 4.2 Yield Curve Relationship between Drying Temperature and Filler Concentration on Vitamin C Content in Instant Powder Drinks

In Figure 4.2, it can be seen that the vitamin C content obtained is inversely proportional to the higher drying temperature, this is because vitamin C in powdered drinks is degraded at high temperatures. Because at high temperatures the molecules that make up vitamin C are broken, so that vitamin C breaks down or breaks down. Judging from the picture above, it can be seen that at a temperature of 55°C with a concentration of 3 grams and at a temperature of 60°C with a concentration of 4 grams, there was a significant decrease in vitamin C. This is because the longer the heating time with the same temperature the concentration of vitamin C in the manufacture of juwet powder drinks decreases.

Based on Figure 4.2, it can also be seen that the greater the concentration of Tween 80, the greater the concentration of vitamin C obtained, the addition of tween 80 makes the remaining vitamin C greater than the control, because the addition of tween 80 causes the formation of a protective layer and electric charge around the surface of the phase. dispersed phase (lycopene) and continuous phase (Vitamin C) so that the solid particles (dispersed phase) can be evenly dispersed in the continuous phase, resulting in no grouping of solid particles. This layer protects vitamin C from oxidative damage. Therefore, increasing the concentration of Tween 80 can increase the levels of vitamin C in juwet juice powder.

4.3. Antioxidant Activity Analysis Results

Antioxidants are compounds that are important for the body to ward off free radicals. Antioxidants are generally found naturally in plants that have an important role for the body. These compounds can inhibit oxidation reactions or reactions that can cause rancidity in foodstuffs.

Antioxidants have the ability to neutralize free radicals, so they can protect the body from oxidative stress damage and inhibit the occurrence of degenerative diseases.

Anthocyanins are colored compounds that are responsible for most of the red, blue, and purple colors in fruits, vegetables, and ornamental plants. This compound belongs to the flavonoid group. Its main structure is characterized by the presence of two benzene aromatic rings (C6H6) linked by three carbon atoms to form a ring. The antioxidant properties of the fruit come from anthocyanins which cause the purple color of juwet fruit.

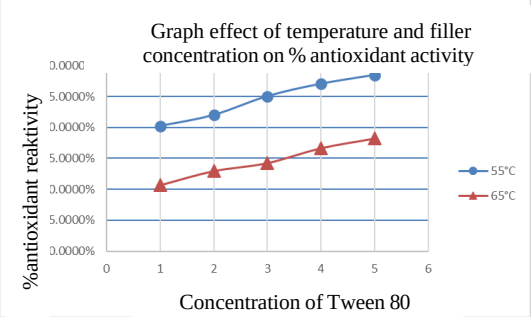

Figure 4.3 Yield Curve of the Relationship between Drying Temperature and Filler Concentration on the Content of Antioxidant Activity in Instant Powder Drinks

In Figure 4.3, it can be seen the relationship between the percentage of antioxidant reactivity to the filler concentration and also the drying temperature. Where the higher the drying temperature used, the percentage of antioxidant activity decreases. This is because the higher the temperature and the drying time have a very significant effect on the antioxidant activity. This condition is caused by the drying process resulting in the destruction of the active substances contained in a food ingredient, including the antioxidant itself.

However, Figure 4.3 also shows that the higher the concentration of Tween 80 or the filler used, the percentage of antioxidant reactivity does not decrease significantly, this is in accordance with the literature because Tween 80 is able to form a protective layer between the dispersed phase and the continuous phase. will protect the antioxidant compounds in Duwet pollen so that the antioxidant levels are higher. The function of the Tween 80 filler will protect the antioxidant compounds of Duwet pollen, but with increasing drying temperature it will damage the antioxidant structure so that the levels are low.

In addition, from the analysis of % antioxidant reactivity, the percentage of antioxidant activity in pure duwet juice before being processed into duwet pollen was 59.6857%. This slightly deviates from the literature which states that the purple duwet fruit with the highest level of maturity has an active percentage of 64.75%, it is possible that the reduction in the percentage of antioxidant reactivity in pure duwet juice is caused by oxygen, light, and long storage given that the weakness of antioxidants Among them are its properties that are easily damaged when exposed to oxygen, light, high temperatures and drying. While pure duwet juice before being processed has been stored in the refrigerator for a long time before being analyzed.

4.4. Metal Contamination Analysis Results

The method used in the analysis of metal contamination is selected by using the cation-anion analysis method for group I cation analysis. In the typical case, group I cations will form a precipitate with dilute hydrochloric acid. Included in group I cations are lead, mercury (I) (mercury), and silver.

In the test criteria for traditional instant powder drink SNI-01-4320-1996, the permissible metal contamination of lead (Pb) is a maximum of 0.2 mg/kg. Through the results of observations on all samples of instant juwet fruit powder drink, no lead (Pb) metal contamination was found.

All samples tested did not show a white precipitate at the bottom of the test tube. From these observations, it can be concluded that the instant juwet fruit powder drink is negative for lead metal contamination.

5. Conclusions

The highest levels of vitamin C are located at a temperature of 50°C with a concentration of Tween 80 5 grams with a concentration of 0.128%

The antioxidant activity at a temperature of 55°C with a concentration of Tween 80 5 grams, which is 48.4% and the highest antioxidant activity at a temperature of 50°C with a concentration of Tween 80 5 grams, which is 50%.

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References

[1] Safitri, Debby Endayani. Anthocyanin Stability and Antioxidant Activity in Sari Java Plum Drink (Syzygium cumini) (Stabilitas Antosianin Dan Aktifitas Antioksidan Pada Minuman Sari Java Plum (Syzygium cumini)). Jurnal Matematika dan Ilmu Pengetahuan Alam Institut Pertanian Bogor, 2012.

[2] Swami, Shrikant Baslingappa, Nayan Singh J. Thakor, Jamun (Syzygium cumini (L.)): A Review of Its Food and Medicinal Uses, Food and Nutrition Sciences, 2012, 3, 1100-1117.

[3] Stephen, A., Syzygium cumini (L.) Skeels: A multipurpose tree, its phytotherapic and pharmacological uses, Journal of Phytotherapy and Pharmacology (2012)-, VOL-1,(4), 22-32.

[4] Jebitta, Reginold, Jeyanth Allwin S, Antioxidant Activity, Total Phenol, Flavonoid, And Anthocyanin Contents Of Jamun (Syzygium Cumini) Pulp Powder, Asian J Pharm Clin Res, Vol 9, Issue 2, 2016, 361-363.

[5] S Ramya, K Neethirajan, Profile of bioactive compounds in Syzygium cumini – a review, Journal of Pharmacy Research 2012,5(8), 4548-4553.

[6] M. Wasswa, G.A. Tumuhimbise and H. Acham, Chemical characterization of pulp, seed powder and a readyto-drink juice produced from Syzygium Cumini fruit, Makerere University Journal of Agricultural and Environmental Sciences Vol. 8. pp. 44 - 57, 2019.

[7] Alam, Md. Rashedul, Evaluation of antidiabetic phytochemicals in Syzygium cumini (L.) Skeels (Family: Myrtaceae), Journal of Applied Pharmaceutical Science Vol. 2 (10), pp. 094-098, October, 2012

[8] Minah, F. Nilna, S. Astuti. (Kajian Penggunaan Vaktor (Vakum Evaporator) dalam mempertahankan Kandungan Vitamin dan antioksidan Pada Minuman serbuk), Indonesian Chemistry and Application Journal (ICAJ) Vol 2 No.2, 2018.

[9] Sunil S Yadav, Ga Meshram, Antibacterial and Anticancer Activity of Bioactive Fraction of Syzygium cumini L. Seeds, HAYATI Journal of Biosciences September 2011 Vol. 18 No. 3, p 118-122

[10] Shivani Sidana, Veer Bahadur Singh, Effect of Syzygium cumini (jamun) seed powder on dyslipidemia: a double blind randomized control trial, International Journal of Research in Medical Sciences Sidana S et al. Int J Res Med Sci. 2016 Jul;4(7):2603-2610 www.msjonline.org

[11] Mathur, Akleshwar, Extraction and characterization of Syzygium cumini (Jamun) seed oil , International Journal of Advance Research in Engineering, Science & Technology (IJAREST), ISSN(O):2393-9877, ISSN(P): 2394-2444, Volume 2,Issue 12, December-2015, Impact Factor: 2.125, IJAREST-2015 78

[12] A. Kumar, R. Ilavarasan, Anti-inflammatory activity of Syzygium cumini seed, African Journal of Biotechnology Vol. 7 (8), pp. 941-943, 17 April, 2008

[13] D. Linga Prabu, S. Chandraseka, K. Ambashankar, Effect of dietary Syzygium cumini leaf powder on growth and non-specific immunity of Litopenaeus vannamei (Boone 1931) and defense against virulent strain of Vibrio parahaemolyticus, Aquaculture 489 (2018) 9–20