Anjoro: International Journal of Agriculture and Business
Vol. 2 Issue 2, September 2021
p-ISSN: 2721-8678 | e-ISSN: 2721-7914. **DOI: 10.31605/anjoro.v2i2.1058**

Effect of maltodextrin concentration and drying temperature on the characteristics of watermelon (*Citrullus vulgaris* S.) albedo instant drink enriched with telang flower (*Clitorea ternatea*) extract

Ulya Sarofa* and Poppy Saraswati

Department of Food technology, Faculty of Engineering, University of Pembangunan Nasional Veteran East Java, Raya Rungkut Madya Street, Gunung Anyar, Surabaya 60294, Indonesia

**Corresponding author's e-mail: sarofaulya@yahoo.co.id*

Received May 29th, 2021; revised August 8th, 2021; accepted 28th, September 2021

ABSTRACT

Watermelon albedo is a food waste that still contains nutrients. The presence of nutritional compounds such as vitamins, minerals, citrulline and antioxidant components cause watermelon albedo potential processed into instant drinks. The addition of telang flower extract in watermelon albedo instant drinks aims to provide an attractive color of the drink, and telang flowers contain high antioxidant compounds. This study aims to determine the effects of maltodextrin concentration and drying temperature on the characteristics of instant drinks made from mixed watermelon albedo and telang flower extract and got the best treatment. This study used a Complete Randomized Design factorial pattern of 2 factors namely the concentration of maltodextrin (10%, 15%, 20%) and drying temperature (40 °C, 50 °C, 60 °C). The obtained data were tested using ANOVA and DMRT advanced tests. The results showed that the best treatment was on the concentration of maltodextrin 20% and drying temperature of 40 °C which produced instant drinks with a moisture content of 3.90%, ash content 0.83%, yield 17.69%, solubility 99.58%, vitamin C 2.89 mg.100g^{-1}, antioxidant activity 30.76%, and organoleptic test of taste 4.15 (like-really like), color 3.65 (rather like-like) and aroma 3.55 (rather like-like).

Keywords:
Instant drink, Watermelon albedo, Telang flower extract, Maltodextrin, Drying temperature

1. Introduction

Watermelon albedo is an organic waste with a high moisture content, so it is easily become damaged. Watermelon albedo is a white watermelon mesocarp, containing several nutritional components that can be utilized. According to Oseni et al. [1], watermelon albedo contains vitamin C, minerals, soluble fiber and citrulline [2]. Based on these facts, the processing of watermelon albedo into food or beverage products is needed. Instant drink is one of alternatives that can be done, because it is practical, easy to serve and has a long shelf life. The characteristics of instant drink are having a taste, smell, color, and appearance close to fresh produce, has nutritional characteristics and good storage stability [3]. To increase the attractiveness and nutritional value of watermelon albedo instant drink, so it is added telang flower extract as a source of natural color, besides it contains flavonoids and anthocyanins as antioxidant components. According to Hartono et al. [4], telang flowers contain antioxidant activity of 61.72% while according to Kazuma in Mastuti et al. [5], telang flowers contain anthocyanins as much as 5.40 mmol.mg^{-1}. However, telang flowers have a deficiency where the chemical structure of anthocyanins tends to be less stable and easily degraded, among them influenced by pH and temperature [6]. The processing of instant drink is done by foam mat drying method, because the process

is relatively simple by using a relatively low temperature so that colors, flavors, vitamins, and other nutrients can be maintained, as well as the powder produced also have nutritional characteristics and good organoleptic quality. The success of foam drying technique is influenced by several factors, including temperature regulation and proper concentration of filler materials [7]. Too high temperatures will cause loss of thermosensitive compounds that are easily oxidized and accelerate browning reactions in foodstuffs while too low temperatures will cause less efficient drying processes and will also encourage damage during the process [8]. While filler material is an ingredient added to the food processing process to encapsulate flavor components, increase the total amount of solids, increase volume, accelerate the drying process, and prevent damage to materials due to heat [9]. One type of filling material is maltodextrin. It is widely used because it has several advantages such as having high soluble power, being able to form films, having low hygroscopic properties, being able to form a body (texture), low browning properties, being able to inhibit crystallization, having strong binding power, and can be used in low-calorie foods [10]. Therefore, it is necessary to research with the treatment of drying temperature and the addition of filler materials (maltodextrin), to know its influence on the characteristics of watermelon albedo instant drinks enriched with telang flower extract.

2. Material and Methods

2.1 Material

The material used in this research were watermelon albedo obtained from traditional market in Sidoarjo, and telang flower obtained from Semolowaru area Surabaya. The supporting materials for instant drink (maltodextrin, tween 80, citric acid) were obtained from grocery in Surabaya. The materials for analysis (DPPH, methanol, H_2SO_4, HCL, iodine, amylum, Buffer KCl, Buffer natrium acetate, cyanidin 3-glucoside, dan NaOH, aquadest) obtained from Merck KGaA, Darmstadt, Germany. The tool used in this research included: cabinet dryer, waring blender, 80 mesh-sieve, oven, furnace, analytical balance, and spectrophotometer uv-vis.

2.2 Methods

Preparation of materials include the manufacture of watermelon albedo extract that was: weighing the watermelon albedo, blending with the addition of water 1:1 then filtering. The manufacture of telang flower extract included washing, weighing, maceration with aquadest (1:6) at 50 °C for 15 minutes with the addition of citric acid 0.5% then filtering. The manufacture of instant drink included: a mixture of watermelon albedo extract and telang flower extract added by maltodextrin (10%, 15%, and 20%), 0.3% of tween 80, 10% of sucrose, then mixed, after dried with cabinet dryer (40, 50, 60) °C for 7 hours, then crushed and sieved by 80 mesh. The product then analyzed included: yield [11], moisture content, ash content, vitamin C content [12], Solubility [11], antioxidant activity [13] and sensory evaluation [14].

This study used a Complete Randomized Design factorial pattern with 2 factors and 3 repetitions. The data was processed using ANOVA 5% and further tested DMRT 5%. Sensory evaluation was carried out by organoleptic test on 25 panelists using the hedonic scale scoring method. The hedonic scale was transformed into a numerical scale according to the panelist's level of preference (1 = really dislike, 2 =

dislike, 3 = rather like, 4 = like and 5=really like). The data obtained were processed using the Friedman test at a significance level of 5%. To determine the best treatment based on all parameters, used effectiveness index [15].

3. Result and Discussion

3.1 Physicochemical Analysis

Based on the result of statistical analysis, there was a significant interaction ($p \leq 0.05$) between concentration of maltodextrin and drying temperature in moisture content and solubility parameters. However, in the parameters of yield, ash content, vitamin C content and antioxidant activity there was no significant interaction, but each factor gave a significant effect ($p \leq 0.05$). Table 1 showed the result of effect maltodextrin concentration and drying temperature in moisture content and solubility parameters of watermelon albedo instant drink enriched with telang flower extract. While in Table 2 showed the average value of yield, ash content, vitamin C content and antioxidant activity of watermelon albedo instant drink affected by each maltodextrin concentration and drying temperature.

Table 1. The average value of moisture content and solubility due to the effect of maltodextrin concentration and drying temperature

Treatments		Moisture Content (%)	Solubility (%)
Maltodextrin (%)	Temperature (°C)		
10	40	4.91±0.10^{d}	98.21±0.04^{a}
10	50	4.12±0.16^{c}	98.31±0.00^{b}
10	60	3.62±0.05^{c}	98.92±0.07^{c}
15	40	4.21±0.13^{c}	98.95±0.07^{c}
15	50	3.58±0.05^{b}	98.99±0.07^{c}
15	60	3.46±0.09^{b}	99.04±0.04^{c}
20	40	4.18±0.04^{b}	99.58±0.01^{d}
20	50	3.50±0.12^{b}	99.73±0.04^{e}
20	60	3.15±0.04^{a}	99.97±0.01^{f}

Description: The average value accompanied by different letters expresses a significant difference ($p \leq 0.05$).

Table 1 showed that the higher of maltodextrin concentration and drying temperature, the lower the moisture content of the product. According to Sumanti et al. [16], maltodextrin consists of hydrophilic granules. Maltodextrin molecules have many hydroxyl groups so that they can bind free water to the material. The increase in heating temperature tends to lower the water content because the higher the heating temperature, the more the water molecules evaporate from the dried material [17].

Table 2. The average value of yield, ash content, vitamin C content and antioxidant activity due to the effect of maltodextrin concentration and drying temperature

Treatments	Yield (%)	Ash content (%)	Vitamin C (mg.100g^{-1})	Antioxidant activity (%)
Maltodextrin				
10%	9.39 ± 0.083^{a}	0.851 ± 0.009^{a}	1.00 ± 0.100^{a}	23.19 ± 0.28^{a}
15%	13.83 ± 0.066^{b}	0.857 ± 0,009^{a}	1.87 ± 0.169^{b}	25.51 ± 0.49^{b}
20%	17.35 ± 0.066^{c}	0.863 ± 0.011^{a}	2.41 ± 0.236^{b}	29.72 ± 0.33^{c}
Temperature				
40 °C	13.81 ± 0.096^{c}	0.830 ± 0.009^{a}	2.36 ± 0.179^{b}	27.22 ± 0.23^{b}
50 °C	13.54 ± 0.067^{b}	0.854 ± 0.010^{a}	1.68 ± 0.085^{a}	26.19 ± 0.44^{b}
60 °C	13.23 ± 0.051^{a}	0.887 ± 0.010^{b}	1.24 ± 0.148^{a}	25.01 ± 0.44^{a}

Description: The average value accompanied by different letters expresses a significant difference ($p \leq 0.05$).

While in the parameters of solubility indicated that the higher the maltodextrin concentration and drying temperature, the higher the solubility produced. Maltodextrin was a filling material that was very easily soluble in water, binding to hydrophilic substances to form an evenly dispersed system. The hydroxyl group contained in maltodextrin will interact with water so that the more the maltodextrin-free hydroxyl groups the higher the solubility [17]. Drying temperature affects the hygroscopic properties of the product so that the more hygroscopic will increase solubility [3].

Table 2 showed that maltodextrin concentrations did not have a significant influence ($p \geq 0.05$) on increased ash content while the increase in drying temperature significantly increased the ash content, this was due to the higher the drying temperature causing the water to evaporate more so that the concentration of inorganic compounds present in the ash will increase.

On the yield parameters, each treatment gave a significant effect ($p \leq 0.05$). The higher the concentration of maltodextrin, the higher the product yield because in addition to being an encapsulant material, maltodextrin also served as a filler material to increase the volume of the product. According to Paramita et al. [18], high concentration of maltodextrin then total solids will increase. otherwise, high drying temperatures will reduce product yield, this was related to the amount of water evaporated so that the weight of the product was reduced.

On the parameter of vitamin C, increasing the concentration of maltodextrin will increase the content of vitamin C, while increasing the temperature will decrease the content of vitamin C. This was because the function of maltodextrin can protect the nutritional components of the material it covers, one of which was vitamin C. The use of maltodextrin in the encapsulation process can bind nutritional elements to the dried material because maltodextrin has a strong bond and a spiral helical structure that helps reduce loss of volatile components during the processing [19]. A decrease in the content of vitamin C in products that undergo a drying process was due to the contact of hot air with the product so that the oxidative process was easier to occur. This was also in line with the opinion of Yuliawaty et al. [17], that vitamin C was a compound that is easily damaged by heat.

On the parameter of antioxidant activity, each treatment had a significant effect ($p \leq 0.05$). The higher the concentration of maltodextrin, the more the ability to increase antioxidant activity. The processing using maltodextrin can also protect important compounds such as antioxidant components due to extreme temperatures, because maltodextrin can form a body and has a strong binding power to coated compounds [20]. Drying at high temperatures will reduce antioxidant activity. This was because high heat can result in the decomposition of antioxidant compounds into other forms resulting in a decrease in antioxidant activity and bioactive components such as flavonoids and phenols are damaged at temperatures above 50 °C and the long drying process can cause structural changes into compounds that no longer have activity as antioxidants [19].

3.2 Sensory Evaluation

Based on the Friedman test, it showed that the treatment of maltodextrin concentration and drying temperature had no significant effect ($p \geq 0.05$) on taste and aroma but had a significant effect ($p \leq 0.05$) on the color of the watermelon albedo instant drink enriched with telang flower extract. The results of sensory evaluation can be seen in Table 3.

Table 3. The average value of preference in sensory test with parameters of taste, aroma and color of the watermelon albedo instant drink enriched with telang flower extract

Treatments		Taste	Aroma	Color
Maltodextrin (%)	Temperature (°C)			
10	40	3.50	3.10	4.30
10	50	3.55	3.35	4.15
10	60	3.80	3.15	4.10
15	40	4.00	3.30	3.75
15	50	3.60	3.20	3.45
15	60	4.10	3.00	3.35
20	40	4.15	3.55	3.65
20	50	4.00	3.50	3.10
20	60	4.30	2.95	2.95

Based on Table 3, The addition of 20% maltodextrin and 60 °C drying temperature resulted in the highest preference taste with average value 4.3 (like – really like) while the 10% concentration of maltodextrin and 40°C drying temperature resulted in the lowest average value of 3.5 (rather like-like). Panelists tend to prefer instant drinks with a higher maltodextrin concentration (20%) because the addition of maltodextrin can give a little sweet taste to the product [21]. Maltodextrin concentration and drying temperature variations did not affect the aroma of instant drinks. The overall aroma

produced in each product sample was thought to have an aroma that tended to be the same and was difficult to distinguish by panelists. This might be due to the difference in the concentration of maltodextrin and the drying temperature, which was not much different, so that its ability to protect the aroma component was not different. The 10% concentration of maltodextrin formulation and 40 °C drying temperature was the most preferred color for panelists. This was because the product produced a dark purple steeping color so that it looked more attractive, the higher the maltodextrin concentration, the product tended to be paler so that the color became less attractive, and panelists liked it less. Maltodextrin, which has a white base color when added to the extract, will increase the brightness of the product [22]. Meanwhile, according to A et al. [23], the color change that occurred due to the drying process was caused by the degradation of heat-sensitive dye compounds.

3.3 Effectivity Test

An effectivity test was conducted to determine the best treatment. Based on the results of the effectivity test on all research parameters including the physiochemistry test and sensory evaluation, treatment of 20% maltodextrin concentration and drying with a temperature of 40 °C was the best treatment. It resulted in water content 3.90% ash content 0.83%, yield 17.69%, solubility 99.58%, vitamin C 2.85 mg.100g^{-1}, antioxidant activity 30.76%, taste 4.15 (like-really like), color 3.65 (rather like-like), and aroma 3.55 (rather like-like).

4. Conclusion

Treatment of maltodextrin concentration and drying temperature affected the characteristics of the instant drink produced. The best treatment was obtained at 20% maltodextrin concentration and 40 °C drying temperature with the value of water content 3.90%, ash content 0.83%, yield 17.69%, solubility 99.58%, vitamin C 2.85 mg.100g^{-1}, antioxidant activity 30.76%, taste 4.15 (like-really like), color 3.65 (rather like-like), and aroma 3.55 (rather like-like).

References

1. Oseni OA, Okoye VI. Studies of phytochemical and antioxidant properties of the fruit of watermelon (Citrullus lanatus). (Thunb.). J Pharm Biomed Sci. 2013;27:508–14.
2. Gladvin G, Sudhaakr G, Swathi V, Santhisri K V. Mineral and vitamin compositions contents in watermelon peel (rind). Int J Curr Microbiol App Sci. 2017;5:129–33.
3. Permata DA, Sayuti K. Pembuatan minuman serbuk instan dari berbagai bagian tanaman meniran (Phyllanthus niruri). J Teknol Pertan Andalas. 2016;20:44–9.
4. Hartono MA, Purwijantiningsih LME, Pranata S. Utilization of extract butterfly pea flowers (Clitoria ternatea L.) as natural colorant of ice lolly. J Biol. 2013;1–15.
5. Mastuti E, Fristianingrum G, Andika Y. Ekstraksi dan uji kestabilan warna pigmen antosianin dari bunga telang (Clitoria ternatea L.) sebagai bahan pewarna makanan. Simp Nas RAPI XII - 2013 FT UMS. Universitas Muhammadiyah Surakarta; 2013. p. 44–51.

6. Purwaniati, Arif AR, Yuliantini A. Analysis of total anthocyanin content in telang flowers preparations (Clitoria ternatea) with pH differential method using visible spectrophotometry. J Farmagazine. 2020;7:18–23.
7. Asiah N, Sembodo R, Prasetyaningum A. Aplikasi metode foam-mat drying pada proses pengeringan spirulina. J Teknol Kim dan Ind. 2012;1:461–7.
8. Naibaho LT, Suhaidi I, Ginting S. Pengaruh Suhu Pengeringan dan Konsentrasi Maltodekstrin Terhadap Mutu Minuman Instan Bit Merah. J Rekayasa Pangan dan Pert. 2015;3:178–84.
9. Aliyah Q, Handayan MN. Gum arabic as bulking agent in the making of yellow pumpkin instant drink powder using foam mat drying method. EDUFORTECH. 2019;4:118–27.
10. Ekpong A, Phomkong W, Onsaard E. The effects of maltodextrin as a drying aid and drying temperature on production of tamarind powder and consumer acceptance of the powder. Int Food Res J. 2016;23:300–8.
11. Yuwono SS, Susanto T. Pengujian fisik pangan. Malang: Fakultas Teknologi Pertanian. Universitas Brawijaya; 1998.
12. AOAC. Official methods of analysis of AOAC international. 16th ed. Washington DC: Association of Official Analytical Chemists; 1995.
13. Abbott SL, Cheung WKW, Janda JM. The genus Aeromonas: biochemical characteristics, atypical reactions, and phenotypic identification schemes. J Clin Microbiol [Internet]. J Clin Microbiol; 2003 [cited 2021 Oct 31];41:2348–57. Available from: https://pubmed.ncbi.nlm.nih.gov/12791848/
14. S S. Penilaian organoleptik-handout. Jurusan Pendidikan Kimia. Universitas Pendidikan Indonesia; 2009.
15. DeGarmo EP, Sullivan WG, Canada JR. Engineering economy. London: Macmillan; 1984.
16. Sumanti DM, Lanti I, Hanidah I-I, Sukarminah E, Giovanni A. The effect of skim milk and maltodextrin concentration as coating agent towards viability and characteristics of lactobacillus plantarum bacteria microencapsulated suspension using freeze drying method. J Penelit Pangan. 2016;1:7–13.
17. Yuliawaty ST, Susanto WH. Effect of drying time and concentration of maltodextrin on the physical chemical and organoleptic characteristic of instant drink noni leaf (Morinda citrifolia L.). J Pangan dan Agroindustri. 2014;3:41–52.
18. Paramita IAMI, Mulyani S, Hartiati A. Pengaruh konsentrasi maltodekstrin dan suhu pengeringan terhadap karakteristik bubuk minuman sinom. J Rekayasa dan Manaj Agroindustri. 2015;3:58–68.
19. Ismandari T, Wignyanto, Wijana S, Mustaniroh SA. Optimization of foam mat drying process of karamunting fruit (Rhodomyrtus Tomentosa, (w.ait), Myrtaceae) powder as antioxidant sources. Int J Adv Sci Technol. 2020;29:3675–84.
20. Putra SDR, Ekawati LM. The quality of instant mangosteen fruit pericarp (Garcinia mangostana Linn.) with maltodextrin and heating temperature variations. J Biol. 2013;1:1–15.
21. Affandy MKA, Widjanarko SB. Optimization of the addition maltodextrin concentration on making solid brem with orange flavour. J Pangan dan Agroindustri. 2018;6:23–32.
22. Lestari PDA, Wrasiati LP, Suwariani NP. Karakteristrik enkapsulat ekstrak pewarna fungsional bunga rosella (Hibiscus sabdariffa L.) pada perlakuan perbandingan kasein-maltodekstrin. J Rekayasa dan Manaj Agroindustri. 2019;7:509–20.

23. A S, Venkatachalam S, John SG, Kuppuswamy K. Foam mat drying of food materials: a review. J Food Process Preserv. 2015;39:3165–74.