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 1st Lekantara Annual Conference on Natural Science and Environment (LeNS 2021) IOP Conf. Series: Earth and Environmental Science 1097 (2022) 012037 IOP Publishing doi:10.1088/1755-1315/1097/1/012037 1 Physicochemical properties of instant beverage powders from red dragon fruit peel extracts with maltodextrin and cocoa powder as fillers

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Abstract. The peel of red dragon fruits contains a bioactive component, which is beneficial as a raw material to make instant beverage powder. The peel extract was combined with milk and a filler and then dried with a spray drying method. The study aimed to determine the characteristics of instant powder with a maltodextrin and cocoa powders as fillers. 15% filler of the total volume of liquid was added, and the treatment of ratio of maltodextrin and cocoa powders

were P1 (15%:0%), P2 (14.5%:0.5%), P3 (14%:1%), P4 (13.5%:1.5%), and P5 (13%:2%). The results showed that the solubility of instant powder was 92.86-97.13% with a pH value of 5.73-5.96. The moisture content of powder was 3.95% -4.45%. Meanwhile, protein and fat contents were 8.23%-9.34% and 0.30%-0.84%, respectively. The highest total phenolic content of instant powder was 60.17 mg GAE/100g of the sample. Keywords: Instant powder; dragon fruit peel extract; filler; spray drying

1. Introduction

People recently prefer consuming practical and easy-to-serve products, such as instant beverage powder. Powdered drinks are dried forms of beverages produced and qualified as instant food. The food requires little effort to reconstitute prior to consumption [1]. The instant powder constitutes a food product that dissolves easily in water and has a long shelf life because the water content is low. Agglomerated powders that dissolve or disperse in a liquid after being swirled for a short time are also known as instant beverages [2]. Instant drinks with natural ingredients and high bioactive components can contribute to health. Dragon fruit peel is potentially developed as a source of raw materials for instant drinks. Red dragon fruit peel is rich in active components, such as polyphenol compounds as a source of antioxidants and to inhibit the growth of melanoma cells [3]. The red color of dragon fruit peel is caused by the presence of betacyanin compound as a source of antioxidants and a natural colorant in food products [4], [5]. Besides, the peel contains vitamins, minerals, dietary fiber, organic acid, alkaloids, terpenoids, and flavonoids [6]. In this study, the extract of the peel was combined with milk and a filler to make instant powders with spray drying methods. Spray driers are wide to produce powdered milk, soymilk, or juice. The spray-dried beverages can produce stable powders consumed with minimum physical and chemical changes or nutritional losses [7]. The filler or encapsulating agent used in this method is maltodextrin. Maltodextrin is a modified starch product resulting from the partial degradation of starch by the alphaamylase enzyme that can be used as a filler or thickening agent in beverages [8]. The addition of maltodextrin alters the pH values, total dissolved solids, antioxidant activities, colors, sensory, and particle sizes [9]. Cocoa powders are added as a filler to make beverage powders to

improve the colors

1st Lekantara Annual Conference on Natural Science and Environment (LeNS 2021) IOP Conf. Series: Earth and Environmental Science 1097 (2022) 012037 IOP Publishing doi:10.1088/1755-1315/1097/1/012037 2 and tastes. For centuries, cocoa has been recognized for its delectable taste and health benefits. The cocoa contains antioxidant compounds from the phenolic group, such as flavonoids, catechins, epicatechins, and procyanidins [2], [10]. The health benefits of cocoa and cocoa-based products potentially prevent or treat allergies, cancers, oxidative injuries, inflammatory conditions, anxiety, hyperglycemia, and insulin resistance [11]. Based on the previous explanation, this study investigated the properties of beverage powders produced from the extract of red dragon fruit peel with a filler of maltodextrin and cocoa powders. 2. Methodology Samples preparation and spray drying Red dragon fruits (Hylocereus polyrhizus) were obtained from the farm of Politeknik Pertanian Negeri Payakumbuh. After being washed, the fruits were peeled, and the peel was separated from the flesh. After that, the peels were cut into thin pieces and extracted with acidified water solvent with citric acid 3%. The filtrate was evaporated with a rotary evaporator to reduce water content. Afterward, 15% filler of the total volume of liquid (extract of peel and UHT milk) was added. This study employed five treatments (formulation): P1 (15%:0%), P2 (14.5%:0.5%), P3 (14%:1%), P4 (13.5%:1.5%), and P5 (13%:2%) of maltodextrin cocoa comparison. The homogenized solution was spray-dried in a spray dryer at an inlet air temperature of 170°C and an outlet air temperature of 90°C. The produced powder was collected in a clean container. After cooling, the powders were weighed, sealed, and stored in a refrigerator for further analysis. The characteristics of instant powder investigated were solubility, pH, proximate analysis (moisture, ash, protein, and fat content), and total phenolic content. The pH was determined by the potentiometric method using a pH meter. The pH meter is a calibration with buffer solutions of pH 4 and 7. Afterward, the probe was placed, and the values were read digitally. The moisture content of powder drinks was determined by

the thermogravimetry method. The percentage weight loss (%) of the powder after oven-drying until a constant weight was obtained and calculated as the moisture content of the drink powders. Meanwhile, ash content was analyzed by the complete incineration of the organic compounds in a tanur at 550°C. The protein content of the samples was analyzed by the Kjeldahl method and the fat content determination with soxhlet methods. Determination of solubility The powder drinks powders were weighed and homogenized by grinding 1 g of powder in 100 ml of distilled water in a Waring blender for five minutes at a high speed. The solution was centrifugate for 10 min, and then the supernatant was collected. An aliquot of 25 ml of the supernatant was transferred to pre-weighed Petri dishes and oven-dried at 105°C overnight. The solubility was calculated by weight difference and expressed as a percentage. Phenolic content The total phenolic content in samples was determined using the Folin-Ciocalteu methods [12]. The absorbance of the solution was measured at 765 nm. Gallic acid using as a reference standard. 17 The results were expressed as milligram gallic acid equivalent (mg GAE)/100 gram of powder. Statistical Analysis All experiments were designed in complete random design. The results are shown as mean values with standard deviations of triplicates. Duncan's multiple range tests were used to statistically analyze differences between mean values at a significance level of 95%. 3. Result and Discussion Physicochemical characteristics of the powder drinks, we are made from the extract of 3 red dragon fruit peel and milk with maltodextrin and cocoa powder as filler is shown in Table 1. Table 1. Characteristics of instant drink powders Parameters Comparison of maltodextrin: Cocoa powder P1 P2 P3 P4 P5 Solubility (%) 97.130a 0.583 96.700a 1.669 94.912a 2.308 94.009a 2.383 92.864a 1.913 pH 5.733 a0.252 5.767a 0.116 5.833a 0.116 5.867a 0.153 5.967a 0.208 Moisture content (%) 4.203a 0.580 3.953a 0.392 4.557a 0.351 4.450a 0.426 4.201a 0.461

 3 Ash content (%) 2.457d 0.015 2.560c 0.036

2.730b 0.036 2.947a 0.049 3.013a 0.072 Crude protein (%) 9.337a 0.634 9.103a 0.195 9.010a 0.737 8.797a 0.339 8.213a 0.400 Crude fat (%) 0.300d 0.114 0.420c 0.161 0.563bc 0.137 0.697b 0.136 0.840a 0.066 Phenolic (mgGAE/100g) 30.596e 1.476 35.426d 2.193 43.256c 2.720 53.583b 1.167 60.169a 1.529 Each value is a mean ± standard deviation. n = 3; values in the same line with different letters are significantly different at p 0.05 Solubility Solubility refers to dissolving powders in water or a liquid medium [13]. Higher solubility values are very desirable in instant powders. This study obtained relatively high solubility values of the spray-dried 1 peel of red dragon fruit powders by 92.86%-97.13%. Higher spray drying temperatures tended to reduce the moisture content of powder so that the powder was more soluble. The addition of cocoa powders decreased solubility because the cocoa beverage powders had a solubility value of 44.2%-76.6% [1]. The solubility of instant powders could also be affected by particle sizes, particle shapes, and bulk density. pH Table 1 shows that the pH of powder drinks ranges from 5.733-5.967 indicating that this product had low acidity. The sour taste in the product was caused by the acid properties of the solvent used to extract 3 red dragon fruit peel. Betacyanin is a major component of peel, which is soluble in a water solvent. The optimum extraction condition giving the highest betacyanin was a pH of 5.5 [14]. This number could be achieved with the distillation water used to extract acidified substance with citric acid 3%. The acidity of the product is also affected by 14 the presence of organic acids in dragon fruit, which is malic acid as the dominant acid in red dragon fruit peel [15]. Moisture content The water content of powder drink had to reach the lowest level after drying to extend the shelf life with the highest quality [16]. Spray drying techniques were suitably used for this step because they were commercial, profitable, and faster. Table 1 shows that 1 the moisture content of drink powders with different treatments had no specific relation. The value of the moisture content ranges from 3.95% to 4.45%. These numbers were more than the moisture content of the peel powder produced with a spray dryer at an inlet air temperature of 165°C and an outlet air temperature of 80°C, with a value of 3.36%3.51% [17]. Beverage powders are sensitive to moisture; thus, the slight increase in moisture

content of the product during the storage made the powder sticky. For this reason, dried products were stored in moisture-proof packages to keep them below the glass transition temperature [18]. Ash content The ash content represented the total mineral content in food. Commonly, minerals are unaffected by heat and cannot be destroyed like other nutrients. The ash content of the drink powder was 2.45% - 3.01%. These values were affected by the dragon fruit peel content of minerals, such as Fe, Ca, K, Mg, Mn, and the other [19]. The mineral contents of fresh and dried dragon fruit peel were 14.29% and 10.57%, respectively [20]. The cocoa addition can also be influential because cocoa is rich in minerals with 4.63% of ash content [21]. Protein content The protein content of powder drinks were be affected by the ingredients of the raw material of the product such as red dragon fruit peel with a protein content is 6.00-6.13% [20], 3.0%-3.49% of cow milk protein [22], and 6.80%-9.55% of cocoa powder protein [23]. The samples of beverage powders decreased protein content from 9.34% to 8.21% after adding cocoa powder, however this decrease is statistically insignificant. It's maybe caused by the drying process at high temperature of spray dryer could denature some protein and Maillard reaction between amino acid and sugar reduction. Besides, in during processing, the polyphenols present in cocoa powder may undergo many transformations, including polymerization, hydrolysis, or reactions with proteins [24]. Fat content

 The fat content of beverage powder samples ranged from 0.30% to 0.84%. The significant increase in the fat content of the samples was the result of the cocoa powder added to the production of beverage powder. The fat content of cocoa powder varied from 10.05% to 12.65% [23]. Total phenolic content The highest total phenolic content of instant powder was 60.17 mg GAE/100g. This number was obtained from the sample receiving the treatment of adding high cocoa powder. The addition of cocoa powder was strongly correlated with phenolic content.

Cocoa powder contained up to 50 mg of polyphenols per gram. Polyphenol compounds in cocoa powder could significantly contribute to their health-promoting activities [10]. 4. Conclusion 1 The peel of red dragon fruits can be utilized to produce instant beverage powder. The powder was made by combining the peel extract of red dragon fruit with the UHT milk and a filler of maltodextrin and cacao powder. The characteristics of powder drinks such as pH, solubility, moisture, and protein content values is not statistically different 4 with the addition of cocoa powder. But for ash, fat, and phenolic contents showed a significant difference with the that's treatments. References [1] T. A. Shittu and M. O. Lawal, "Food Chemistry Factors affecting instant properties of powdered cocoa beverages," vol. 100, pp. 91–98, 2007. [2] B. Aliakbarian, A. A. Casazza, A. Nani, and P. Perego, "Production of Chocolate Powdered Beverage with Enhanced Instant Properties," vol. 57, pp. 877–882, 2017. [3] L. Wu, H. Hsu, Y. Chen, C. Chiu, Y. Lin, and J. A. Ho, "Food Chemistry Antioxidant and antiproliferative activities of red pitaya," vol. 95, pp. 319–327, 2006. [4] S. Wybraniec, B. Nowak-wydra, and K. Mitka, "Minor betalains in fruits of Hylocereus species," vol. 68, pp. 251–259, 2007. [5] W. S. Choo, "Betalains : Natural plant pigments with potential application in functional foods functional foods." [6] H. Jiang, W. Zhang, X. Li, C. Shu, W. Jiang, and J. Cao, "Trends in Food Science & Technology Nutrition , phytochemical profile , bioactivities and applications in food industry of pitaya (Hylocereus spp .) peels : A comprehensive review," Trends Food Sci. Technol., vol. 116, no. June, pp. 199–217, 2021. [7] A. Lúcia, F. Pereira, F. Diva, and L. Almeida, "Spray-Drying of Probiotic Cashew Apple Juice Spray-Drying of Probiotic Cashew Apple Juice," no. December, 2013. [8] Husniati, "Studi karakterisasi sifat fungsi maltodekstrin dari pati singkong." . [9] E. Basuki and S. Saloko, "The Addition of Maltodextrin on Characteristics of Red Dragon Fruit Skin (Hylocereus costaricensis) Instant Powder Using Freeze Drying Techniques," vol. 4, no. 9, 2019. [10] D. L. Katz, K. Doughty, and A. Ali, "Cocoa and Chocolate in Human Health and Disease Cocoa and Chocolate in Human Health and Disease," no. April, 2011. [11] R. Latif, "Health benefits of cocoa," 2013. [12] A. K. Das, V. Rajkumar, A. K. Verma, and D. Swarup, "Original article Moringa oleiferia leaves extract : a

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