



## Effect of Drying Temperature and Wilting Period on the Physical and Sensory properties of Indonesian Pondoh Snake Fruit (*Salacca zalacca*) Powder

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**ABSTRACT:** Snake fruit (*Salacca zalacca*) is a thorny plant that grows in clusters. The relatively rapid browning process and the phytochemical content in Pondoh variety snake fruit present its potential as a raw material for fruit tea production. This study aimed to determine and identify the optimal combination of the interaction between drying temperature and wilting duration of the fruit flesh powder in the production of snake fruit powder tea on its physical and sensory characteristics. The research was conducted in two stages: the production of Pondoh snake fruit powder through wilting and drying processes, and the testing of physical characteristics including solubility level and powder tea appearance (L, a, b values), as well as sensory properties encompassing taste, aroma, and color. A randomized block design (RBD) with two factors was employed. The first factor was wilting duration (45 minutes, 60 minutes, and 75 minutes), and the second factor was drying temperature (60°C, 70°C, and 80°C). Based on the analysis of physical and sensory characteristics, it was concluded that the influence of wilting duration (45 to 75 minutes) and drying temperature (60°C to 80°C) resulted in generally easily soluble tea powder with solubility levels ranging from 82.45% to 84.03%. Furthermore, the variations in drying temperature (60°C to 80°C) and wilting duration (45 to 75 minutes) did not show a significant effect on the sensory properties, solubility level, lightness (L), redness (a), and yellowness (b). However, the treatment with drying temperatures of 70°C to 80°C and wilting durations of 60 to 75 minutes tended to yield better results. The taste, aroma, and color were generally liked to very liked, particularly in the treatment with a wilting duration of 75 minutes and a drying temperature of 80°C.

**KEYWORDS:** Drying Time, Drying, Tea powder, Snake fruit.

### INTRODUCTION

Indonesia, with its tropical climate, is a country rich in plant biodiversity. One of these plants is the snake fruit [*Salacca zalacca* (Gaert.) Voss.], whose fruit is widely favored and can be processed into various products such as dried fruit, pickles, chips, and canned fruit in syrup (Ridho et al., 2019). The production of snake fruit in Indonesia has shown an annual increase, recorded at 1,030,412 tons in 2014 and rising to 1,118,962 tons in 2015 (Yola Septika et al., 2018). Among the approximately 20 species of snake fruit worldwide, the Pondoh variety is particularly popular due to its sweet taste and year-round fruiting capability (Rianto & Harjonko, 2017).

The proximate composition per 100 g of snake fruit consists of sucrose (7.6%), fructose (5.9%), glucose (3.9%), total sugar (17.4%), soluble dietary fiber (0.3%), insoluble dietary fiber (1.4%), water (80%), calories (77 kcal), protein (0.7%), ash (0.6%), and fat (0.1%) (Saleh et al., 2018). Snake fruit (*Salacca zalacca* (Gaert.) Voss) is a fruit rich in antioxidants due to its content of flavonoid, phenolic, and polyphenol compounds, including chlorogenic acid ((Widowati et al., 2023); Sulaksono et al., 2015; Gusrianto et al., 2018). Antioxidants provide numerous benefits for human health (Ilmiah et al., 2021). The total phenolic content in snake fruit is reported as 257.17 µL/mL (Rahmah & Handayani, 2024).

Snake fruit is classified as a fruit with a relatively short shelf life. The freshness of snake fruit after harvesting undergoes changes and spoilage after 6-8 days of storage due to respiration processes (Mandei et al., 2021). During the peak harvest season, production is abundant and prices tend to be low. To anticipate this condition, handling and processing are necessary to produce products with a longer shelf life and desirable taste, one of which is processing into snake fruit tea. This research is designed to produce snake fruit powder tea by investigating the effects of wilting duration and drying temperature. According to (Wiranata et al., 2016), the appropriate wilting and drying processes are essential for forming physical, sensory, and chemical characteristics. During the wilting

process, polyphenol oxidation occurs, which affects flavor, color, and taste. A total of 14 phenolic compounds have been identified in snake fruit flesh, known for their broad biological properties that enhance health (Čepková et al., 2021). The drying temperature for tea should not be less than 60°C and should not exceed 95°C, as it can affect the texture, moisture content, and active chemical compounds in the tea (Wiranata et al., 2016).

This study aims to investigate the influence of wilting duration and drying temperature in producing snake fruit powder tea and their effects on its physical and sensory properties.

## RESEARCH METHOD

The primary material used in this research was the flesh of pondoh snake fruit obtained from Malang, Indonesia. The study employed a factorial Randomized Block Design (RBD) with two factors. The first factor was the wilting duration (L) of the snake fruit powder, consisting of three levels: 45 minutes (L1), 60 minutes (L2), and 75 minutes (L3). The second factor was the drying temperature (P), consisting of three levels: 60°C (P1), 70°C (P2), and 80°C (P3). Each treatment was replicated three times. The resulting data were analyzed using Analysis of Variance (ANOVA).

### Research Implementation

Fresh and unblemished Pondoh snake fruits were selected. The fruit flesh was separated from the skin and subsequently washed with running water. The flesh was grated using a coarse grater. The grated flesh was placed in an incubator at 37°C and wilted according to the treatments in the study (45 minutes, 60 minutes, and 75 minutes). The wilted grated snake fruit was weighed to 250 g and dried in an oven according to the temperature treatments (60°C, 70°C, and 80°C) until it became dry powder. The resulting snake fruit powder tea was then evaluated for:

#### - Solubility

Solubility was evaluated using a modified method based on Fahrullah et al. (2023) as follows: 1 gram of powder sample from each treatment was weighed, dissolved, and added to 100 mL of boiling distilled water for 3 minutes, then filtered. Before use, the filter paper was dried in an oven at 105°C for 30 minutes and then weighed. After the filtration process, the filter paper with the residue was dried in an oven at 105°C for 3 hours until a constant weight was achieved. It was then cooled in a desiccator to room temperature, and the weight was recorded. The percentage of solubility was calculated based on the weight difference using the formula:

$$\text{Solubility (\%)} = \frac{\text{Initial weight of filter paper} - \text{Weight of filter paper and residu}}{\text{Initial weight of filter paper}} \times 100\%$$

#### - Color

Color was detected using a color reader with the following steps: 3 grams of pondoh snake fruit powder were weighed, brewed with 200 mL of distilled water at 80°C, and placed in a clear plastic container with a white paper background. The color reader was placed on the surface of the sample to read the color characteristics, namely lightness (L\*), redness-greenness (a\*), and yellowness-blueness (b\*). L\* represents the level of lightness (luminance), a\* represents the value of redness (positive) or greenness (negative), and b\* represents the value of yellowness (positive) or blueness (negative).

#### - Sensory Properties

The sensory properties of the snake fruit powder tea were evaluated using a modified method based on Ahmad et al. (2013) as follows: 3 g of pondoh snake fruit powder were weighed and placed in a beaker glass, 30 g of granulated sugar were added, followed by 200 mL of hot water at 90°C, and stirred for 2.5 minutes. The sample was filtered and 50 mL of the filtrate was poured into a clear cup. Panelists were asked to complete a questionnaire containing a line hedonic scale ranging from 1 to 5, where 1 = very dislike, 2 = dislike, 3 = neutral, 4 = like, and 5 = very like, for the attributes of taste, aroma, and color of the pondoh snake fruit powder tea. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it. Wherever Times is specified, Times Roman or Times New Roman may be used.

## RESULTS AND DISCUSSION

### Performance and Physical Properties

The performance of pondoh snake fruit and snake fruit powder tea products are presented in Figure 1. While the solubility properties and surface detection results of samples from various treatments using a color reader instrument on the color brightness, reddish and yellowish color of snake pondoh powder tea are presented in Table 1.



Figure 1. Pondoh snake fruit (1), snake fruit flesh (2) and snake fruit powder tea product (3)

Table 1. Solubility properties of color brightness, redness and yellowness of snake pondoh powder tea samples.

Treatment	Characteristics of snake fruit tea powder			
	Solubility (%)	Brightness (L*)	Redness (a*)	Yellowness (b*)
L1P1	84.52	41.3	8.8	15.3
L1P2	84.72	41.1	8.1	15,0
L1P3	85.16	39.8	7,0	22,0
L2P1	87.14	40.6	8.5	15.2
L2P2	85.34	40.9	8.4	15.5
L2P3	85.59	35.3	11.9	27.9
L3P1	82.45	40.5	8.3	16.3
L3P2	83.99	40.3	8.2	16,0
L3P3	84.03	28.4	16.7	17.4

### Solubility

The solubility of pondoh snake fruit powder tea product ranged from 82.45% to 87.14%. The results of the analysis of variance of solubility showed that the interaction treatment between the length of aging and drying temperature had no significant effect (Table 1). This solubility data indicates that pondoh snake fruit powder tea is relatively soluble. (Kris et al., 2013 stated that the highest soluble solids content in fresh snake fruit is sucrose, followed by glucose and fructose. In general, fructose has the highest solubility, followed by glucose, while sucrose has the lowest solubility. Sucrose is a disaccharide formed from glucose and fructose. In addition, snake fruit contains phytochemical components such as vitamin C, lycopene, beta carotene, phenolic, and soluble organic acids (Afrianti et al., 2014). A high level of solubility is an expected property of products consumed in steeping form.

### Powder brightness (L\*)

The highest brightness level was 41.3, obtained in the P1L1 treatment, i.e. 60°C drying temperature and 45 minutes drying time (Table 1). Increasing the temperature and duration of drying tended to decrease the brightness level. The brightness of snake fruit powder tea is affected by the increase in temperature during drying. Higher drying temperatures accelerate the formation of melanoid compounds due to the Maillard reaction. The presence of melanoid compounds changes the color of pondoh snake fruit to brown and causes a decrease in brightness. In addition, color brightness is also affected by enzymatic browning reactions due to tissue damage. Wiranata et al. (2016) stated that the best treatment for apple powder tea products of the Anna variety was processed at a



drying temperature of 70°C and a 60-minute aging time. Hustiany (2016) explained that color changes become darker if the temperature is too high. Therefore, drying at temperatures above 60°C in pondoh snake fruit powder tea decreased the brightness level.

**Redness (a\*)**

The highest value of reddish color is 16.7, which is red and darker. The color occurred in the treatment of 80°C drying temperature with 75 minutes drying time (L3P3). The longer drying process with drying at high temperatures causes the Maillard reaction in forming melanoid compounds to run faster so that the color tends to be darker. Reducing sugars and protein compounds contained in snake fruit powder are factors in the occurrence of the Maillard reaction in addition to temperature. The withering process also occurs enzymatic oxidation reactions on phenolic compounds by the enzyme polyphenol oxidase due to the presence of oxygen which changes the substrate and forms quinones. According to (Pardede, 2017) that quinones are reactive and can combine with each other to form brown pigments. Therefore, the length of the softening process that is not optimal can cause the color of the wrong fruit tea powder to become a dark red color.

**Yellowness (b\*)**

The highest yellowish color level of 16.7 is the result of 80°C drying temperature treatment with 60 minutes of aging (L2P3). The yellowish color occurs due to the high drying temperature (80°C) in the lowest aging time (60°C). From the 60-minute drying process, the oxidation reaction by the enzyme polyphenol oxidase has not occurred completely so that the brown color has not been formed completely when compared to the L3P3 treatment.

**Sensory Properties**

Sensory testing was used to observe the level of liking for the taste, aroma and color of the pondoh fruit powder tea. This test uses a hedonic scale involving 10 panelists, the test results are presented in Table 2.

**Table 2. Data from organoleptic test results on the taste, aroma and color of pondoh snake fruit powder tea.**

Sensoris Properties	Treatment								
	L1P1	L1P2	L1P3	L2P1	L2P2	L2P3	L3P1	L3P2	L3P3
Taste	3.3	3.3	3	3.1	3.1	3.5	3.5	3.4	3.5
Aroma	2.3	2.9	2.7	2.6	2.7	2.9	3.2	3	3.5
Colour	2.6	2.8	2.9	2.3	2.4	3.3	3.1	2.7	4.3

**Taste**

The highest favorability of snake fruit powder tea at a score of 3.5 which means like occurred in the treatment (L2P3) (L3P1, L3P3). This condition shows that the length of 60 minutes to 75 minutes tends to be favored by panelists. It is suspected that the 60 minutes to 75 minutes aging condition gives an optimal astringent/sweet taste. The astringent taste is due to the presence of phenol compounds in the form of tannins that are soluble in water and alcohol. Tannins include polyphenolic compounds and can form complexes with proteins (Datu et al., 2023).

**Aroma**

The highest level of liking for the aroma of snake fruit powder tea at a score of 3.5, which means that liking occurs in the L3P3 treatment, namely the drying temperature of 80 C with a length of 75 days. The high drying temperature and length of time trigger the caramelization reaction because snake fruit contains a relatively high sugar component (Saleh et al., 2018). In addition, snake fruit contains ethyl acetate component, namely methyl-pyrrole-2,4-dicarboxylic acid (Afrianti et al., 2010). Chemical components in snake fruit can cause a fragrant aroma (Joshua & Sinuraya, 2018).



## Color

The highest level of color preference score was 4.3 = like to very like in the treatment (L3P3), which is a drying temperature of 80 °C with a drying time of 75 minutes. The color intensity of snake pondoh powder tea which is getting reddish brown is actually preferred by panelists because it is close to tea made from tea leaves.

## CONCLUSION

Based on the results of the study, it can be concluded that the effect of the interaction between the treatment of drying temperature and the length of aging does not significantly affect the physical properties of solubility and sensory properties of pondoh snake fruit powder tea. The effect of 45 minutes to 75 minutes of aging, 60°C to 80°C drying temperature as a whole is easy to dissolve with a solubility level reaching 82.45% - 84.03%. Taste aroma and color tend to be liked to be very liked, and are found in the treatment of 75 minutes of aging and 80 °C drying temperature with a brightness level value ( $L^*$ ) = 28.4, reddish color ( $a^*$ ) = 16.7, and yellowish color ( $b^*$ ) = 17.4.

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