

## Sensory characteristics of lotus (*Nelumbo nucifera*) leaves-flower herbal tea

Sherly Ridhowati, Siti Hanggita Rachmawati \*, Puspa Ayu Pitayati and Kriska

Department of Fishery Product Technology, Agriculture Faculty of Universitas Sriwijaya, South Sumatera, Indonesia, 30662

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### Abstract

This study aimed to determine the sensory characteristics of lotus (*Nelumbo nucifera*) leaves-flower herbal tea. This study used combination of two treatment factors i.e. formulation (P) and withering duration (H). The treatment uses the formulation P0 (100% lotus leaves), P1 (70% lotus leaves: 30% lotus flowers), P2 (40% lotus leaves: 60% lotus flowers) as well as for the long withering treatment, namely H1 (8 hours withering time) and H2 (without withering). The results show formulation treatment and withering time have a significant effect on color, aroma and taste in lotus flower leaf tea.

**Keywords:** Lotus Leaves-Flower; Herbal Tea; Formulation; Withering

### 1. Introduction

The Lotus plant (*Nelumbo nucifera*) is an aquatic plant that is similar to the lotus, but there are differences in its morphology. The lotus has leaves that stick out upwards, while the lotus leaves float on the water's surface. Lotus can live in muddy water such as swamps and ponds. The lotus plant has many benefits, including its roots, seeds, leaves, and flowers [1].

Lotus is a plant that contains high levels of nutrients and bioactive compounds [2]. The lotus leaf is part of the lotus plant, which has many benefits for the human body. Various types of diseases can be overcome with these leaves, such as for the treatment of dysentery, overcoming diarrhoea, anti-stroke, healthy breathing, fever medicine, maintaining endurance, obesity medicine and also used as an effective medicine for hematemesis, hemoptysis, hematuria, and metrorrhagia. Lotus flowers contain polyphenolic compounds, isoquercitrin, luteolin, kaempferol and others which are thought to act as antioxidants [3]. Therefore, the lotus plant has benefits for the health of the body and can be made into various preparations such as supplement capsules, extracts, powders and teas.

Lotus flower tea has the best characteristics, which are processed without enzymatic oxidation with a withering time of 8 hours, has a moisture content of 9.55%, ash content of 7.30%, antioxidant activity of 32.19%, tannin content of 152.73 ppm, lightness of 48.63%, chroma 7.36%, hue 69.77% and yield 25.88. Meanwhile, fresh lotus flowers have a tannin content of 8.87 ppm, a moisture content of 89.52% and an ash content of 1.60% [4]. Tea drinks made from lotus leaves and flowers are called herbal teas.

Herbal teas are actually mixtures of several ingredients and are more accurately called 'tisanes'. Tisanes are made from combinations of dried leaves, seeds, grasses, nuts, barks, fruits, flowers or other plant elements that give them their flavour and provide the benefits of herbal teas [5]. The withering aims to reduce the water content to 70%. During the withering process, the tea leaves will experience two changes, namely changes in the chemical compounds contained in the tea leaves and a decrease in the water content so that the tea leaves become limp.

\* Corresponding author: Siti Hanggita Rachmawati

Withering is a significant factor affecting the resulting tea product in terms of colour, aroma and taste. In green tea processing, the withering process aims to inactivate enzymes, especially polyphenol oxidases, so that it will inhibit the fermentation process [6]. Many studies have been carried out on this part of the lotus plant, such as on processing the seeds into flour, chips, and flowers as a mixture for green tea. This study made the herbal tea of lotus leaves and flower, then investigated the acceptance of panellist.

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## 2. Materials and methods

### 2.1. Materials

The tools and material analysis used in this study were , oven (the Memmert brand), fan, stainless-steel rack and blender (Philips brand).The materials for herbal tea are fresh lotus leaves and flowers.

#### 2.1.1. Procedure

The process of making lotus tea, according to previous research [4] that has been modified as follows:

- Sortage the fresh lotus leaves and flowers, then wash them clean and then drain them
- The lotus leaves, and flowers are mixed with the ratio according to the formulation. Each formulation comparison consisted of 2 samples for 8 hours withering and without withering.
- The mixture of leaves and flowers are exposed on a rack, then withered at room temperature for 8 hours, flipped over three times and given airflow using a fan.
- The mixture of lotus leaves and flowers is grounded to get size reduction by using a blender.
- Then, the mixture is dried using an oven with a temperature of 105°C for 25 minutes.

### 2.2. Data Analysis

The treatments of this research are combination between formulation (P) and withering duration (H) which describe below :

- P0H1 : (100% Lotus Leaf Withering 8 hours)
- P0H2 : (100% Lotus Leaf Without Withering)
- P1H1 : (70% Lotus Leaf : 30% Lotus Flower Withering 8 hours)
- P1H2 : (70% Lotus Leaf : 30% Lotus Flower Without Withering)
- P2H1 : (40% Lotus Leaf : 60% Lotus Flower Withering 8 hours)
- P2H2 : (40% Lotus Leaf : 60% Lotus Flower Without Withering)

The assessment criteria for the hedonic test consist of a score of 7 to 1, namely (7) strongly Like, (6) Like, (5) slightly Like, (4) Neutral, (3) slightly Dislike, (2) Dislike (1) strongly Dislike. The data then carried out using the Kruskal-Wallis test. If it had a significant effect, then continued using the multiple comparison test.

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## 3. Result and discussion

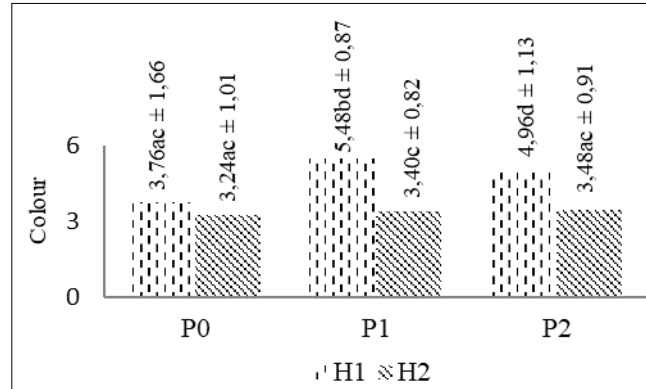
### 3.1. Color

Colour is one of the quality parameters of food products that can be seen visually. Colour can attract consumers' attention and affect product acceptance [7]. The average value of sensory test results based on colour parameters can be seen in Figure 1.

It is showed that the mean value of the panellists' preference test for the colour of lotus leaf tea ranged from 3.24 to 5.48 (Slightly dislike to slightly like). The highest sensory parameter value was obtained in the P1H1 treatment (70% lotus leaf: 30% lotus flower withered for 8 hours), which was 5.48 (slightly liked), while the lowest parameter was obtained in the P0H2 treatment (100% lotus leaf without withering) which was 3.24 (Slightly dislike). The results of the Kruskall Wallis analysis showed that the formulation treatment and withering time significantly affected the colour of the lotus leaf tea produced. The difference in the formulation and the withering time gives a significant difference in the colour of the tea produced.

Based on the hedonic test, the panellists' preference for colour in lotus leaf tea tends to increase with the length of withering time. From the observations and comments of the panellists during the sensory test, the colour preferred by

the panellists was the P1H1 treatment (70% lotus leaf: 30% lotus flower with 8 hours of withering time) with a brownish-yellow colour. It is because the longer 8 hours of ageing can reduce the activity of the polyphenol oxidase enzyme, which works as a catalyst in the oxidation process; besides that, it can also be caused by the tannin content, which increases with a large amount of lotus leaf added. The withering process can also inactivate the chlorophyllase enzyme, where the enzyme can activate the process of chlorophyll degradation into pheophytin and euphorbia, which can turn a yellow colour to darken if exposed to high temperatures [8].

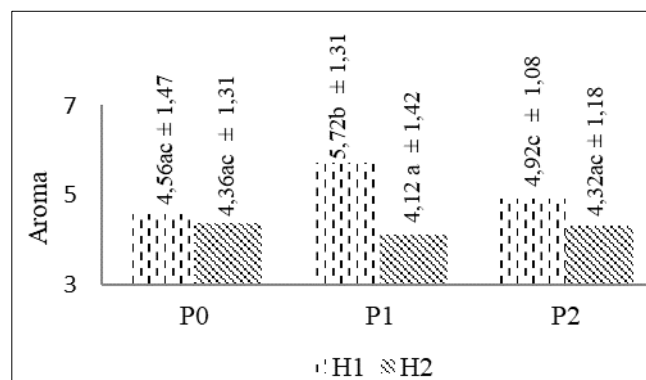


**Figure 1** The average color value of lotus leaf-flower herbal tea

It is also following previous research which states that the longer the withering, the more melanin compounds or brown pigments are formed due to enzymatic oxidation reactions of phenolic compounds [9]. Phenol undergoes oxidation to become quinone. Quinone is a compound belonging to the ketone group, which causes the colour to turn yellowish brown; the higher the quinone level, the more the colour of the dipped anna apple tea. Tannins can cause the color of the brew to get darker so the levels are higher tannins in the ingredients, the darker the tea produced [10]. When tea is brewed, the tannins are dissolved and then oxidized to produce theaflavins and thearubigins, which cause the colour of the tea to darken.

### 3.2. Aroma

Aroma is a parameter to determine the panellist's level of preference by using the sense of smell for a product. Aroma is essential in increasing product attractiveness [11]. The average value of the aroma parameter in lotus leaves-flower tea can be seen in Figure 2 that show the mean value of the panellists' preference test for the aroma of lotus leaf tea ranged from 4.12 to 5.72 (Neutral to slightly like).



**Figure 2** The average aroma of lotus leaf tea

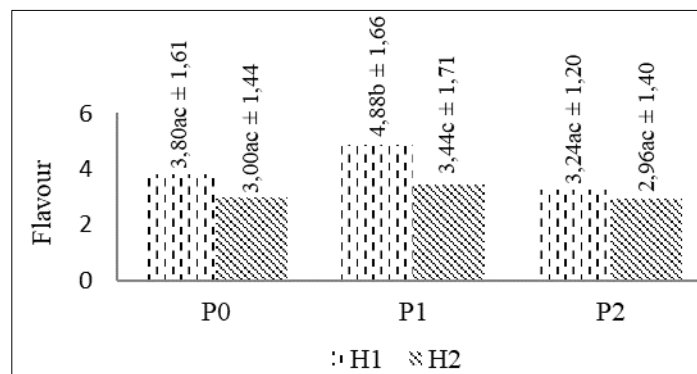
The P1H1 treatment obtained the highest value in the hedonic test for the aroma parameter (70% lotus leaf: 30% lotus flower withering time for 8 hours), which was 5.72 (slightly like), while the PIH2 treatment obtained the lowest value (70% lotus leaf: 30 % lotus flower without withering) which is 4.12 (Neutral). The results of the Kruskal Wallis analysis showed that differences in formulation treatment and withering time significantly affected the aroma of the lotus leaf

tea produced. The difference in the formulation and the withering time gives a significant difference in the aroma of the tea produced.

From the observations, the aroma that emerges from lotus leaf tea with different formulations and withering time has a different aroma. It is presumably due to the addition of the formulation and the different ageing times, thus causing differences in the level of preference of the panellists for the aroma of steeping lotus leaf tea. Adding lotus flowers with 8 hours of withering time produced a distinctive aroma that the panellists slightly liked. Several research in herbal tea with different materials showed fragrant aroma in tea due to essential oils, which are volatile and easily reduced to produce [12] [13].

### 3.3. Flavour

Taste is related to human taste. Therefore, taste is an essential factor in product selection. The taste produced by the product comes from the food ingredients used. The mean value of the hedonic test results for the taste parameter in lotus leaf tea can be seen in Figure 3 which showed the mean value of the hedonic test on the taste parameter ranges from 2.96 to 4.88 (Dislike to slightly like).



**Figure 3** The average flavour of lotus leaves-flower tea

The highest value on the taste parameter was obtained by the P1H1 treatment (70% lotus leaf: 30% lotus flower with 8 hours of withering time), which was 4.88 (rather like it), while the lowest value was obtained by P2H0 (40% lotus leaf: 60% flower lotus without withering) that is equal to 2.96 (dislike). The results of the Kruskal-Wallis analysis showed that differences in formulation treatment and withering time significantly affected the taste of the resulting lotus leaf tea. The difference in the formulation with the withering time significantly affects the taste of the resulting lotus leaf tea.

From the results of observations, the taste of steeping lotus leaf tea with formulation treatment and withering time produces a taste that tends to be bitter and astringent. However, the longer the withering and the large number of flowers added to the panellist lotus leaf tea, the more like it is. The taste produced by all treatments tends to be the same but has a different level of bitterness. It is suspected as the cause of the effect on the level of panellists' preference for the taste of steeping lotus leaf tea. Tannins usually cause an astringent and bitter taste in plants or food ingredients. Tannins are compounds that can determine the quality of tea related to the colour, aroma and flavour of tea [14]. The catechins in tannins are colourless to yellowish, can dissolve in water and bring bitterness and astringency to brewed tea. The presence of tannin compounds in food ingredients can determine the taste of these foods [15].

## 4. Conclusion

Overall, of the sensory test results showed the formulation treatment and withering time had a significant effect on the color, aroma and taste parameters. the best treatment based on sensory analysis test results is P1H1 : (70% Lotus Leaf : 30% Lotus Flower Withering 8 hours).

## Compliance with ethical standards

### Disclosure of conflict of interest

Authors have declared that no conflict of interests exists.

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