

The Effect of Brewing Time on the pH Level and Antioxidant Content of Liberica Coffee Peel and Siam Orange Peel Infusion Tea

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Abstract

Tea is the second most consumed beverage in the world after water. About two-thirds of the world's population consumes tea. The purpose of this research is to determine the pH and antioxidant content of Liberica coffee peel and Siam orange peel infusion tea. The approach taken in this research is quantitative with a factorial completely randomized design (CRD) and two factors. Each was replicated three times. The first factor is the comparison used for coffee peel and orange peel (X), namely coffee peel:orange peel (1:3) (X1), coffee peel:orange peel (1:1) (X2), coffee peel:orange peel (3:1) (X3). The second factor is the brewing time (Y) consisting of three treatment levels: 5 minutes (Y1), 10 minutes (Y2), and 15 minutes (Y3). The results of the analysis of variance (ANOVA) show that the comparison of the composition of Liberica coffee peel-Siam orange peel infusion tea (factor X) can significantly affect antioxidant activity. Additionally, the pH measurement results indicate significant differences in the composition comparison marked by factor X, brewing time (factor Y), and interaction factor (XY). The average pH measurement results in a neutral outcome and affect the stability of antioxidant activity. The conclusion of this research is that chemical analysis of the formula with a composition ratio of 1:1 (X1) with a brewing time of 5 minutes (Y1) has the highest antioxidant content.

Keywords: Antioxidant, Liberica coffee peel, pH, Tea

1. Introduction

Tea has become a very popular beverage in human life. According to (Susanti, 2016), the high consumption of tea worldwide, averaging 120 ml per day, can be explained by the various functions of tea. The high volume of coffee production results in various by-products during the coffee processing, including pulp, husk, silver skin, and coffee grounds (Muzaifa et al., 2021). One of the benefits of consuming tea regularly is its ability to act as an antioxidant agent that can prevent the formation of free radical compounds.

Antioxidants are substances that have the ability to stop or inhibit the oxidation process, thus forming more stable compounds. The main function of antioxidants is to protect cells from damage caused by unstable molecules, known as free radicals (Erawati, 2012). Thanks to its ability to combat free radicals, preventing cancer cell growth and enhancing immunity are some of the benefits of coffee peel (Sumihati et al., 2011). In addition to coffee, Siam orange is also a commodity that produces abundant yields, contributing to the large volume of by-products produced.

According to Mueller (2017), global orange production reached 68,925,200 tons in 2014, with most oranges used by the juice, jam, and marmalade industries, resulting in significant waste in the form of orange peel, about 3.8 million tons per year. Orange peel contains various compounds of importance, including phenolic compounds such as phenolic acid, flavonone, myelin flavonoids, carotenoids, and ascorbic acid (vitamin C).

The higher the concentration of antioxidants, the greater the health benefits of a product. The

antioxidant ability is also influenced by the pH level in the product, which is in line with the views expressed by Muzolf et al., (2008) cited in (Sutisna, 2016). Nilai pH dapat juga berhubungan dengan masa simpan produk sehingga akan mempengaruhi kandungan mikroorganisme. Nilai pH produk yang semakin rendah atau asam dapat menyebabkan produk akan semakin awet (Desy dkk., 2020).

2. Methods

This research was conducted at the Food Laboratory and Quality Analysis Laboratory of the Food Agroindustry State Polytechnic of Sambas, West Kalimantan. The activities took place from January to July 2023. The method used was an experimental study design with a purposive sampling approach. Experimental study research was used to determine causality between two intentionally induced factors by reducing interfering factors. Purposive sampling is a technique for sampling and data sources by determining specific product criteria (Sugiyono, 2016). This research used a Factorial Completely Randomized Design (CRD) with two factors, each repeated three times. The first factor is the comparison used for coffee peel and orange peel (X), namely coffee peel:orange peel (1:3) (X1), coffee peel:orange peel (1:1) (X2), coffee peel:orange peel (3:1) (X3). The second factor is the brewing time (Y), consisting of three treatment levels: 5 minutes (Y1), 10 minutes (Y2), and 15 minutes (Y3).

3. Results and Discussion

The pH value is used to measure the level of acidity or alkalinity of a substance, composition, or object. The typical pH value is 7, and if the pH value is > 7 , it indicates alkaline properties, while if the pH value is < 7 , it indicates acidity. pH in beverages has an influence on the acidity level of the product. According to (Batubara & Pratiwi, 2018), the pH value in food products is an important factor related to product shelf life, such as microbial resistance during processing, distribution, and storage. The interaction of treatments on Liberica coffee peel and Siam orange peel infusion tea can be seen in table 1.

Table 1. The interaction of treatments on Liberica coffee peel and Siam orange peel infusion tea.

The comparison of Liberica coffee peel infusion tea to Siam orange peel infusion tea (X)	Brewing Time (Y)		
	Y1 (5 minutes)	Y2 (10 minutes)	Y3 (15 minutes)
X1 (1:3)	7,87b	7,60a	7,53a
X2 (1:1)	7,50a	7,43a	7,53a
X3 (3:1)	7,53a	7,47a	7,50a

From table 1, it can be observed that treatment X1Y1 significantly differs from X1Y2 to X3Y3, indicating that these eight treatments have equal potential in affecting pH levels. The pH values of Liberica coffee peel and Siam orange peel infusion tea range from 7.43 to 7.87. Treatment X2Y2 has the lowest pH value, which is 7.43 for both Liberica coffee peel and Siam orange peel infusion tea, while treatment X1Y1 has the highest pH value, which is 7.87. Based on the pH measurement results using a pH meter, the average pH of the packaging of orange peel and Liberica coffee tea from different processing processes is classified as neutral because the obtained pH is greater than pH 7.0. The pH values of Liberica coffee peel and Siam orange peel infusion tea range from 7.43 to 7.87. The influence of the ratio of Liberica coffee peel to Siam orange peel on pH levels can be seen in Figure 1.

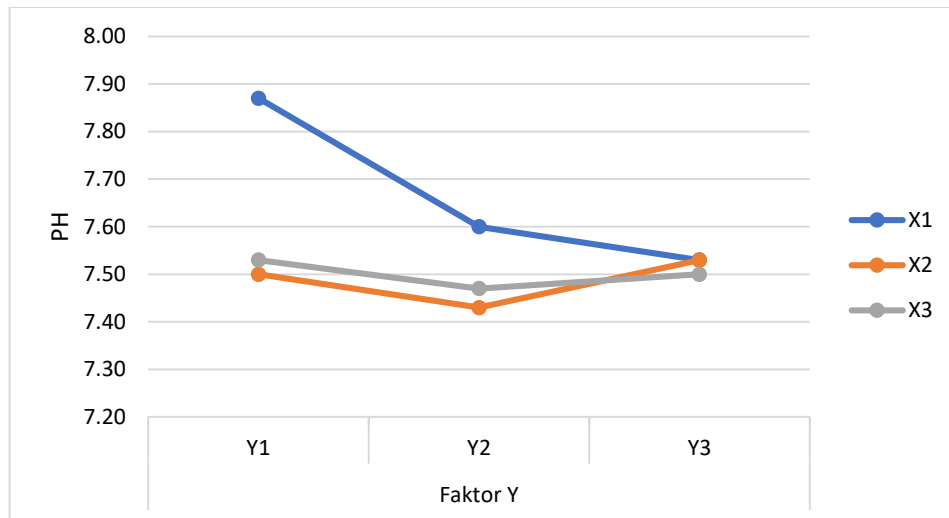


Figure 1. The effect of the ratio of Liberica coffee peel to Siam orange peel on pH levels

Antioxidant activity refers to the ability of a substance containing antioxidants to neutralize free radicals present in its surroundings. Several studies have been conducted to identify and understand the antioxidant activity content in various plant species, with the aim of developing natural antioxidant formulations for use in food or beverages.

Table 2. Post Hoc test (Duncan's Multiple Range Test - DMRT) for antioxidant activity on Liberica coffee peel and Siam orange peel infusion tea.

Treatment	Total	Average (ppm)	Notation*
X1 (1:3)	1145,96	127,328	a
X2 (1:1)	1162,73	129,192	a
X3 (3:1)	1822,11	202,456	b

Based on table 2, it can be seen that treatments X1 and X2 did not yield significantly different results, indicating that both treatments equally affect antioxidant activity. Meanwhile, treatment X3 significantly differed from treatments X1 and X2. Tea bags with a material ratio of 1:3 (X) produced the highest antioxidant activity, at 127.328 ppm, and were classified as moderate. In the 1:1 (X2) and 3:1 (X3) material ratios, antioxidant activity decreased.

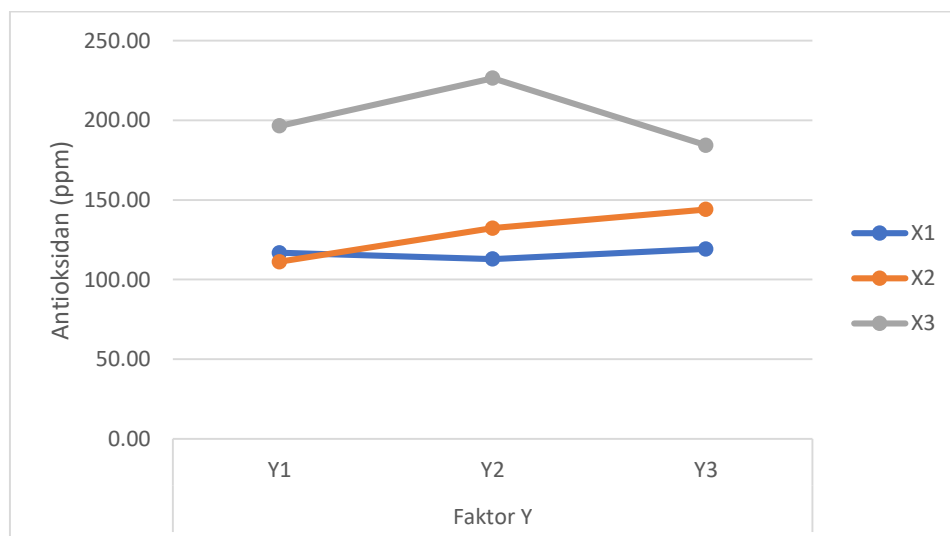


Figure 2. The effect of the ratio of Liberica coffee peel to siam orange peel on antioxidant activity

Based on the results of the diphenyl picryl hydrazyl (DPPH) antioxidant activity test, observed from the absorbance at a wavelength of 517 nm using a spectrophotometer, the average antioxidant activity of Liberica coffee and Siam orange peel tea ranged from 111.1991 to 226.4693. The highest antioxidant activity in parts per million (ppm) was found in treatment Y21, which is 111.1991 ppm, while the lowest antioxidant activity was mainly in treatment Y32, which is 226.4693 ppm. The influence of the ratio of Liberica coffee peel to Siam orange peel on antioxidant activity can be seen in Figure 2.

According to Husnul Khotimah (2018), the stability of antioxidant activity can be influenced by several factors such as pH, oxygen, light, and temperature. The results of antioxidant activity testing on Liberica coffee peel and Siam orange peel infusion tea show significant instability, and one of the factors affecting it is the level of acidity or pH, which is neutral on average. This research aligns with the findings of Giuliana (2015), indicating that pH plays a crucial role in maintaining antioxidant stability, with previous research showing that antioxidant activity in miana plants remains stable at acidic pH levels and decreases at neutral or alkaline pH levels.

4. Conclusion

The pH measurement results show a significant difference in the composition comparison indicated by factor X. Chemical analysis results of the formula with a composition ratio of 1:1 (X1) and a brewing time of 5 minutes (Y1) have the highest antioxidant content and indicate that the composition comparison of Liberica coffee peel-Siam orange peel infusion tea (factor X) can result in significant differences in antioxidant activity testing. Antioxidant stability can be influenced by several factors, one of which is pH. It is evidenced that the average pH measurement results in a neutral outcome and affect the antioxidant activity stability in Liberica coffee peel and Siam orange peel infusion tea.

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