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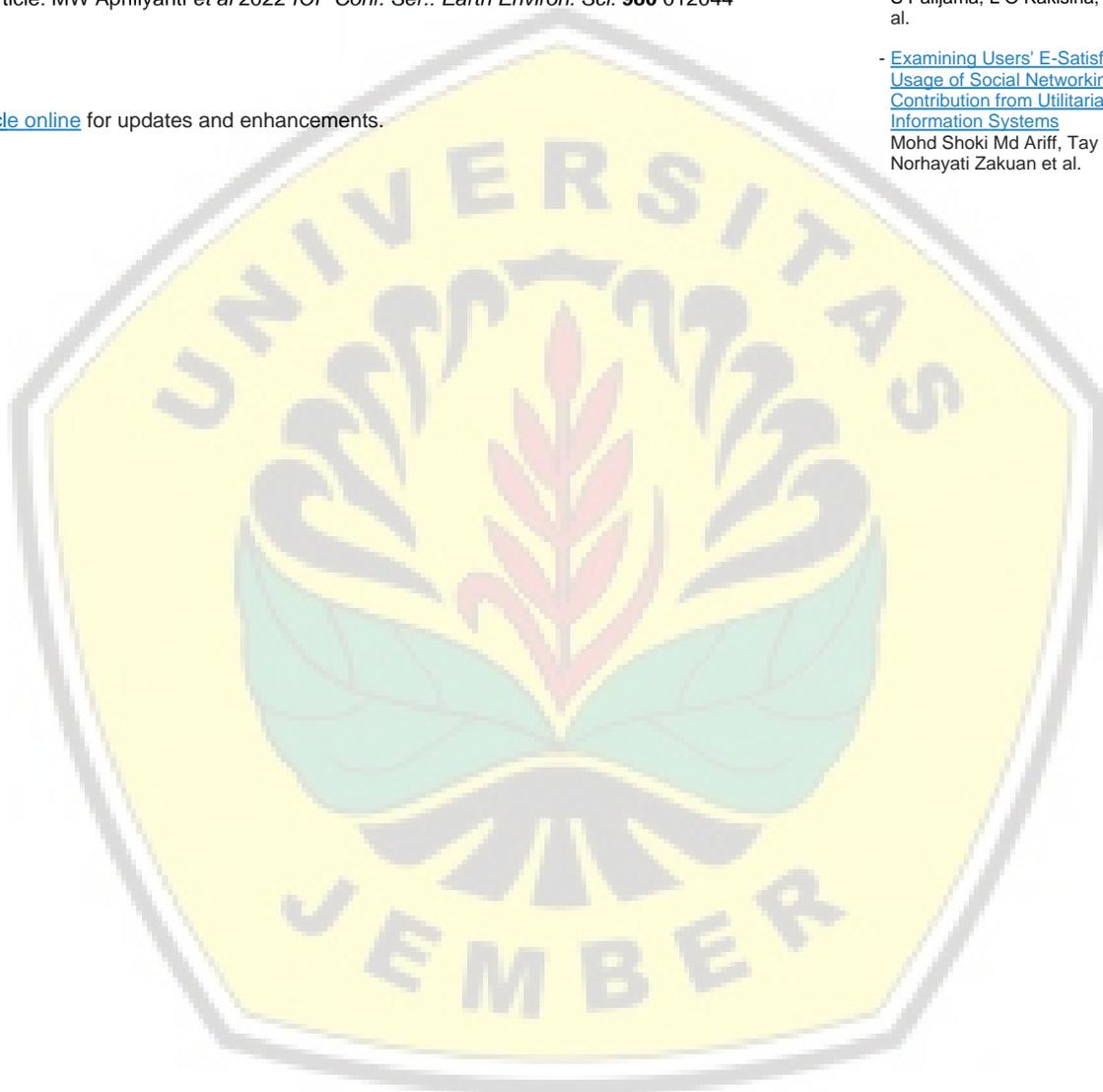
Antioxidant activity and hedonic evaluation of melinjo peel with variations of sodium metabisulfite concentration and soaking time

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Antioxidant activity and hedonic evaluation of melinjo peel with variations of sodium metabisulfite concentration and soaking time

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Abstract. Melinjo peel is part of the melinjo plant which contains many compounds that are beneficial for the health of the body. This research was conducted to obtain a treatment that has optimal antioxidant activity and hedonic evaluation from melinjo peel steeping which has been pretreated with sodium metabisulfite in concentrations of 0.2%, 0.4%, and 0.6% with a long soaking time of 20 and 30 minutes. Based on the results of testing the antioxidant activity of steeping melinjo peel, the average value ranged from 37.2%-43.6%. In the hedonic organoleptic test, the concentration of sodium metabisulfite and the length of soaking time were significantly different for color with the highest average value (3.56) and taste with the highest average value (3.16) while the aroma was not significantly different from the average value. The highest average (2.96). The best treatment was the concentration of sodium metabisulfite 0.2%, immersion time of 20 minutes with antioxidant activity of 37.2%; color 2.92 (clear yellow); Aroma 4.28 (scented melinjo) and taste 3.96 (slightly taste melinjo peel).

1. Introduction

Melinjo plant (*Gnetum gnemo L*) is a native Indo-Malay plant which has a size of approximately 15.24 m which is commonly found in Indonesia such as in Sumatra and Java. According to [1] the seeds of the melinjo plant are used as chips, while the peel has not been used optimally even though the potential is quite large. According to [2] showed that melinjo plants, both leaves and seed coats, contain antioxidant compounds such as lycopene and carotenoids. Antioxidant activity of the phenolic content of melinjo was comparable to that of butylated hydroxytoluene (BHT).

Antioxidants are compounds that can absorb or neutralize free radicals so that they can prevent degenerative diseases such as cardiovascular, carcinogenesis and other diseases. In the research of [3] melinjo peel tea which was processed without enzymatic oxidation (non-oxidation) by withering at room temperature for 8 hours then dried in an oven at 105°C for 25 minutes, the yield was 6.48%.



water, ash content 3, ash content 5%, phenol content 34.8% and yield 56.9% with 37.93% brightness. The drying process can cause a decrease in natural antioxidant activity [4] and the organoleptic of melinjo peel. The drying temperature correlates with the degradation process of phenolic compounds so that it has become decreased antioxidant activity. According to [5] that melinjo peel contains polyphenols, tocopherols, and ascorbic acid which have antioxidant activity and have potential as xanthine oxidase inhibitors. Xanthine oxidase plays a role in the formation of uric acid by catalyzing hypoxanthine to xanthine and then uric acid. Several antioxidant compounds have potential as xanthine oxidase inhibitors because they are able to capture electrons.

Based on research [6] which discusses the optimum conditions for pretreatment and drying of dried dragon fruit peel, namely soaking with sodium metabisulfite on dragon fruit peel can increase antioxidant activity. Sodium metabisulfite can help retain bioactive compounds. [7] explained that the antioxidant activity of dragon fruit peel [7] can be increased through oven drying treatment and sodium metabisulfite soaking. Concentration factors and soaking time in metabisulfite solution affect the optimal antioxidant activity and organoleptic.

This study aims to determine the effect of sodium metabisulfite concentration and soaking time on antioxidant activity and organoleptic evaluation of brewing melinjo peel. The benefits of this research is expected to optimize the utilization of melinjo peel as a raw material for functional beverage products.

2. Material and Method

2.1. Tools and Material

The equipment used includes analytical balance, drying oven (Model R-5A Harvest Saver, USA), and spectrophotometer (Ultraspec 2100 Pro UV-Visible). The ingredients used are orange to red melinjo peel (Magetan Regency, East Java), sodium metabisulfite, aquades, methanol (pa, QREAC), and DPPH (2,2-diphenyl-1-pikridirazol) (sigma Aldrich).

2.2. Experimental Design

This study used a factorial Completely Randomized Design (CRD) consisting of 2 factors with 3 replications. The first factor was the concentration of sodium metabisulfite with 3 levels (0.2; 0.4; and 0.6%). The second factor was the soaking time of the sodium metabisulfite solution with 2 levels (20 and 30 minutes).

2.3. Raw material preparation

The melinjo peel was sorted and selected from orange to red. After that, washing was carried out to remove dirt.

2.4. Soaking with Sodium Metabisulfite

The melinjo peel was weighed as much as 100 g for each treatment. After that, it was soaked with a concentration of 0.2%, 0.4% and 0.6% sodium metabisulfite solution until all parts of the melinjo peel were submerged. Soaking was carried out for 20 and 30 minutes. Next process was draining. Modification method of [7].

2.5. Melinjo Peel Drying

Drying was carried out in an drying oven at 50°C for 12 hours.

2.6. Brewing

The brewing process was carried out to facilitate the analysis of antioxidant activity and organoleptic (hedonic).

2.7. Determination of Antioxidant Activity

Analysis of antioxidant activity based on [8] on melinjo peel that has been soaked with various concentrations of sodium metabisulfite and variations in soaking time using the DPPH (2,2-diphenyl 1-pikrihidrazi) method. Preparation of the DPPH solution is to weigh 0.0040 g of DPPH dissolved in methanol until the volume is 100 ml. For blank preparation, 0.5 ml of methanol is added, 3.5 ml of DPPH is added, then is mixed, left it for 15 minutes and the absorbance measured at a wavelength of 517 nm using a spectrophotometer. Further testing of antioxidant activity, 0.1 ml of sample is put into a test tube and then 0.4 ml of methanol is added. The suspension was then added with 3.5 ml of 1.25 mM DPPH solution which is then homogenized using a vortex. The series of reaction activities are carried out in a dark room and at room temperature. Next, the absorbance is measured at a wavelength of 517 nm. Capacity is expressed in terms of percentage inhibition against DPPH radicals by calculating:

$$\% \text{ Antioxidant Activity} = \frac{(\text{Blank Abs} - \text{Sample Abs}) \times 100\%}{\text{Abs blank}}$$

Abs blank = absorbance of the blank before being reacted with the sample.

Abs sample = Absorbance of the sample after being reacted with the sample

2.8. Hedonic Evaluation

Acceptance test or preference test used hedonic test with 25 panelists. Hedonic evaluation showed the level of preference of the panelists. Panelists fill out the questionnaire by giving an assessment on a scale of 1-5, namely from dislike very much, dislike, slightly like, like, and like very much.

2.9. Data Analysis

Data were analyzed using analysis of variance or ANOVA (Analysis of Variance) with Microsoft Excel 2010. If significant, followed by the Least Significant Difference (LSD) with a significant level of 5%. Determination of the best treatment with the De Garmo method.

3. Results and Discussion

3.1. Antioxidant Activity

Antioxidants are compounds that have a molecular structure that can donate electrons to free radical molecules without being disturbed at all by their function and can break the chain reaction of these free radicals. Epidemiological studies stated that there is an increase in natural antioxidants found in fruits, vegetables, flowers and other parts of plants that can prevent diseases caused by oxidative stress such as cancer, heart disease, kidney and liver inflammation. One of them is melinjo peel which has antioxidant activity.

The antioxidant activity test used the DPPH method (2,2-diphenyl 1-picrylhydrazyl), because this method is quite simple, easy to do and does not take much time. The presence of antioxidant compounds in plant extracts can change the color of the DPPH solution from purple to yellow. The results of the antioxidant activity of melinjo peel steeping can be seen in table 1.

Table 1. Average of Antioxidant Activity in Melinjo Peel

Sodium Metabisulfite Concentration (%)	Soaking Time (Minutes)	Average of Antioxidant Activity (%)
0,2	20	37.2
0,2	30	39.4
0,4	20	38.9
0,4	30	40.3
0,6	20	41.7
0,6	30	43.6

Table 2. Average of Antioxidant Activity by Treatment with Sodium Metabisulfite Concentration

Sodium Metabisulfite Concentration (%)	Average of Antioxidant Activity (%)
0,2	38.3 ^a
0,4	39.6 ^b
0,6	42.65 ^c

Note: The numbers followed by different lowercase letters show that they are significantly different based on the LSD follow-up test at the 5% level

Table 3. Average of Antioxidant Activity by Treatment with Soaking Time

Soaking Time (Minutes)	Average of Antioxidant Activity (%)
20	39.2 ^a
30	41.1 ^b

Note: The numbers followed by different lowercase letters show that they are significantly different based on the LSD follow-up test at the 5% level

Based on the results of analysis of variance (ANOVA) on the antioxidant activity of melinjo peel, it shows that the F count < F table is $1.16 < 6.92$ (1% level) and $1.16 < 3.88$ (5% level) so that it shows the concentration sodium metabisulfite and soaking time were not significantly different on antioxidant activity. The results of testing the antioxidant activity of steeping melinjo peel obtained an average value ranging from 37.2%-43.6%. The treatment that produced the highest antioxidant activity (43.6%) was 0.6% sodium metabisulfite concentration with 30 minutes of soaking while the treatment that produced the lowest antioxidant activity (37.2%) was 0.2% sodium metabisulfite concentration with 20 minutes of soaking. In the study of [6] the antioxidant activity of melinjo peel tea without pretreatment was lower (32.37%). Antioxidant activity are also affected by the processing through the heating and storage process. [9] explained that storage at room temperature will also reduce the color intensity and antioxidant activity of the natural dye solution of dragon fruit flesh. Meanwhile, the storage treatment at refrigerator temperature also decreased the pH value, color intensity, and antioxidant activity but the decrease was not as large as that in room temperature storage.

Table 2. and 3 shows that the treatment of sodium metabisulfite concentration and soaking time, each showed a very significant effect. The higher concentration of sodium metabisulfite, the higher the antioxidant activity of steeping melinjo peel. The longer of drying process caused lower the antioxidant activity. The antioxidant activity in avocado leaf tea decreased from 85.11% to 73.13% with a drying time of 1 hour at 50°C. The longer of drying time caused lower the antioxidant activity of melinjo peel tea. Therefore, pre-treatment with sodium metabisulfite soaking can optimize antioxidant activity in steeping melinjo peel. Increasing the concentration of citric acid and sodium metabisulfite solutions will increase the antioxidant activity of dry matter [10].

The treatment soaking time, 20 minutes treatment was significantly different from the 30 minutes treatment. The length of soaking time in sodium metabisulfite solution will affect the antioxidant activity of steeping melinjo peel, the longer the soaking time, the higher the antioxidant activity. This

is in accordance with the statement of [7] that the length of soaking time and the addition of sodium metabisulfite concentration can increase the compounds contained in food ingredients.

3.2 Hedonic Evaluation

The organoleptic test is carried out with a hedonic evaluation or what is called a preference test, which is a test based on personal responses from panelists about the product or sample presented, whether they like it or not. The scale used starts from very like, like, somewhat like, dislike and dislike very much. Based on this scale, it can be seen that there are differences in preferences for the product or sample presented.

3.2.1 Color Color is one of the sensory properties that can be assessed by the sense of sight (eyes). The first impression that someone is interested or not with a product or food is influenced by its attractive color. The results of the hedonic test of steeping melinjo peel can be seen in table 4.

Table 4. Average of The Hedonic Evaluation

Sodium Metabisulfite Concentration (%)	Soaking Time (Minutes)	Color	Aroma	Taste
0,2	20	3.4 ^{ab}	2.56	3.16 ^c
0,2	30	3.56 ^b	2.76	3.08 ^c
0,4	20	3.24 ^{ab}	2.72	2.64 ^a
0,4	30	3.12 ^{ab}	2.96	2.8 ^{ab}
0,6	20	3 ^{ab}	2.8	2.8 ^{ab}
0,6	30	2.84 ^a	2.72	2.68 ^a

Note: The numbers followed by different lowercase letters show that they are significantly different based on the LSD follow-up test at the 5% level

Based on the results of analysis of variance (ANOVA) of color hedonic organoleptic evaluation data, it is found that if $F_{count} > F_{table}$ is $3.02 > 2.28$ (5% level) and $F_{count} < F_{table}$ is $3.02 < 3.17$ (1% level) then the concentration of sodium metabisulfite and the duration of soaking significantly affected the color of the melinjo peel brewing. The results of the hedonic evaluation on the color of brewing melinjo peel obtained an average value ranging from 2.84-3.56. The treatment with the highest value of the color hedonic evaluation was found at 0.2% sodium metabisulfite concentration and 30 minutes soaking time, which was 3.56 (lemon yellow) while the treatment with the lowest value was 0.6% sodium metabisulfite concentration and 30 minutes immersion time, which was 2.84 (clear yellow). Panelists prefer the color of melinjo peel with the treatment of lower sodium metabisulfite concentration and fast soaking time because the higher the addition of sodium metabisulfite, the resulting color will dissolve and decrease. [11] stated that the color of melinjo peel steeping water is influenced by carotenoid pigments. Panelists like green melinjo peel tea with a greenish yellow color. This is because the existing chlorophyll compounds are more easily dissolved in water and the cell walls of the melinjo peel are exposed due to heating.

3.2.2 Aroma Aroma is a sensory property that can be assessed using the sense of smell. Everyone has a different level of smell based on their respective preferences. The results of the hedonic test on the aroma of steeping melinjo peel can be seen in table 4.

The results of analysis of variance analysis (ANOVA) obtained that hedonic evaluation on aroma showed that the concentration of sodium metabisulfite and the length of soaking time did not significantly affect the aroma of brewing melinjo peel. Hedonic aroma evaluation of steeping melinjo peel obtained an average value ranging from 2.56-2.96. The treatment with the highest average value from the hedonic evaluation was found at 0.4% sodium metabisulfite concentration for 30 minutes soaking time, which was 2.96 (slightly like) while the lowest average value was 0.2% sodium

metabisulfite concentration treatment 20 minutes soaking peel that has been soaked with various concentrations of sodium metabisulfite and the difference in soaking time in the heating (drying) process will cause different aroma changes. The higher the concentration of sodium metabisulfite used, the panelists preferred the aroma of steeping melinjo peel. The processing process can trigger the emergence of a natural aroma, such as due to the roasting process, roasting and other processes. During the heating process there will be a change in aroma caused by the evaporation of volatile compounds, caramelization of carbohydrates, decomposition of protein and fat and protein coagulation [14].

3.2.3 Taste Taste is one of the sensory properties that can be assessed using the sense of taste. Compared to other sensory properties, taste is an important factor to accept or reject a food to be consumed. The results of the hedonic evaluation on the taste of steeping melinjo peel can be seen in the table 4.

Based on the results of analysis of variance (ANOVA) hedonic test data on the taste of steeping melinjo peel shows if F count $>$ F table, namely $2.36 > 2.28$ (5% level) and F count $<$ F table $2.36 <$ 3.17 (1% level) then the concentration of sodium metabisulfite and the duration of immersion significantly affect the taste of steeping the peel. Hedonic test on the taste of steeping melinjo peel obtained an average value ranging from 2.64-3.16 (dislike to slightly like). The treatment with the highest average value from the hedonic taste test was at 0.2% sodium metabisulfite concentration, 20 minutes soaking time, which was 3.16 (slightly like) while the treatment with the lowest average value was 0.4% sodium metabisulfite concentration treatment 20 minutes soaking time, which is equal to 2.64 (dislike). Panelists preferred the soaking treatment with a concentration of 0.2% sodium metabisulfite with an soaking time of 20 minutes, which had a melinjo peel taste.

Melinjo peel which contains phenolic compounds from the flavonoid group can bring bitterness to steeping. The higher the temperature used, the faster the taste of the tea produced. Polyphenol compounds and essential oils contained in melinjo peel contribute to the taste. The taste contribution given is in the form of a bitter and astringent taste which can be reduced if using a high temperature and drying time. If the drying time is too long and the drying temperature is too high, the taste of Torbangun leaf tea will become less bitter because the essential oil evaporated [12].

3.3 Determination of Best Treatment

Based on the results of De Garmo's analysis to determine the best treatment with hedonic evaluation index and antioxidant activity, it was obtained if the best treatment was from steeping melinjo peel, namely the treatment with 0.2% sodium metabisulfite concentration, 20 minutes soaking time with 37.2% antioxidant activity; color 2.92 (clear yellow); Aroma 4.28 (scented melinjo) and taste 3.96 (slightly taste melinjo peel).

4. Conclusion

Based on the results of this study, the following conclusions were obtained:

1. Interaction concentration of sodium metabisulfite and the length of soaking time were not significantly different from the antioxidant activity. However, the treatment of sodium metabisulfite concentration and immersion time each showed a significant effect.
2. In the hedonic evaluation, the concentration of sodium metabisulfite and the length of immersion time were significantly different for color with the highest average value (3.56) and taste with the highest average value (3.16) while the aroma was not significantly different from the average value highest average (2.96).
3. The best treatment is the concentration of sodium metabisulfite 0.2%, soaking time 20 minutes with antioxidant activity 37.2%; color 2.92 (clear yellow); Aroma 4.28 (scented melinjo) and taste 3.96 (slightly taste melinjo peel).

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