The difference in antioxidant capacity and tannin level in the production of parijoto fruit extract based dodol (sweet toffee-like sugar palm-based confection) using 4 different types of solvent

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Abstract. The use of parijoto/showy Asian grape fruit (Medinella speciosa L) extract in the making of dodol ganyong (sweet canna tubers sugar palm-based confection) can increase its shelf life up to more than 6 months. In the next study, dodol with additional red fermented rice extract up to 100% of the basic ingredients which was extracted using water as the solvent increased the beta carotene content up to 87 µg and the antioxidant capacity by around 10%. These conditions indicate that adding antioxidant sources can improve the quality of dodol. However, the addition must be significant enough so that it does not only increase the antioxidant capacity, but also preserves the life. The up to 10% increase in the antioxidant capacity is sufficient to prevent dodol from rancidity but is unable to avoid the microbial growth on the dodol. The ineffectiveness of the antioxidant use in the previous study is suspected due to the incompatibility of the extraction solvent used. Antioxidant compounds can be optimally dissolved in the extraction process if it uses a solvent with compatible electronegativity. In previous research, the making of dodol using parijoto fruit which was extracted using water successfully preserved the dodol and avoided rancidity and xerophilic fungi growth. This study re-examined the use of 4 different solvents in the extraction of Parijoto fruit in the making of sticky rice dodol. The solvents are water, 3% of soda water, 96% of ethanol and 96% of acetone. To have a good quality dodol, the extraction of Parijoto fruit using each solvent was examined by observing the level of extraction efficiency, tannin level as the indicator of anti-microbial and antioxidant capacity. The research data showed that the highest extraction efficiency level of Parijoto fruit was found in the extraction using water and soda water 3% (79% and 78%). The highest tannin level was found in the extraction of parijoto fruit using 96% ethanol (30mgTAE /100g), while the lowest was found in the extraction with water (3.5 mg TAE/100g) as the solvent. Sequentially, the highest antioxidant capacity level of Parijoto fruit extract is produced when 96% of ethanol (75%), 96% of acetone (72%), 3% of soda water (60%) and water (53%) are used as solvents. The extractions of antioxidant capacity from Parijoto fruit using 4 types of solvents were all classified as “satisfactory”.

1. Introduction
Based on the research of dodol ganyong making by Margareta et. al. [1], using Parijoto fruit extract (Medinella speciosa L) to diversify the flavors of dodol kudus (Kudus: name of a town in Central Java), it was found that the addition of Parijoto fruit extract was able to extend the shelf life of dodol ganyong up to more than 6 months. It was found that there was 29 mg difference of vitamin C with parijoto extract addition. As stated by Ansori et al. [2], dodol with up to 100% red fermented rice
extract addition of the basic ingredients which was extracted using water as the solvent increased the beta carotene content up to 87 ug and the antioxidant capacity by about 10%. These conditions indicate that adding antioxidant sources can improve the quality of dodol. However, the addition must be significant enough so that it does not only increase the antioxidant capacity, but also preserves the life. The up to 10% increase in the antioxidant capacity is sufficient to prevent dodol from rancidity but is unable to avoid the microbial growth on the dodol. The ineffectiveness of the red fermented rice use in the previous study is suspected due to the incompatibility of the extraction solvent used. Antioxidant compounds can be optimally dissolved in the extraction process if it uses a solvent with compatible electronegativity.

In previous research, the making of dodol using parijoto fruit which was extracted using water successfully preserved the dodol and avoided rancidity and xerophilic fungi growth. The dodol can last up to more than 6 months. Based on the condition, this research further studies the making of dodol with parijoto extract using 4 different types of solvent to find a good quality dodol. The research used 4 different solvents with different electronegativity level. They are water, 3% of soda water, 96% of ethanol and 96% of acetone. The Parjoto fruit extraction result using each solvent would be examined to see the level of extraction efficiency, tannin level as the indicator of anti-microbial as well as the antioxidant capacity.

Parijoto is a wild fruit plant which is often found in Muria Kudus mountains, Central Java and is known as "Medinella Speciosa L". The fruit is culturally believed to cure mouth ulcer and diarrhea, because it contains chemicals such as kardenolin, saponins, flavonoids, and tannins [11]. It is usually used as one of the ingredients for salad or pickles served in seven monthly pregnancy ceremonial events. It is believed by Kudus people that if the fruit is consumed by pregnant women, the born children will be beautiful if it is a girl and handsome if it is a boy [3]. According to Margareta et. al [1], the vitamin C in dodol that is provided by Parijoto fruit extract is pretty high, that is up to 132 mg / 100g. It shows that the fruit potentially sources antioxidant capacity. Some studies of antioxidant activity of Parijoto fruit extracts have been done [4-6].

Antioxidant capacity, according to Rubio et al. [7], is the ability to capture free radicals from a compound in a test solution. The antioxidant capacity of local Indonesian fruit is believed to be high. Sangkala et al. [8] noted that red fruit has 81% antioxidant activity in Dpph inhibition through ethanol extraction. The crown of god (mahkota dewa) fruit has 67% of antioxidant activity in MDA inhibition [9]. The ethanol fraction of sichuan pepper (andaliman) has 40% antioxidant activity against dpph radicals [10]. The higher the concentration of the extract used, the ability to inhibit free radicals increases. This research assessed the antioxidant capacity/activity and tannin level of parijoto fruit which was extracted using 4 solvents with different polarity, in which the extraction concentrate similar to the method of making of Parijoto fruit syrup or drink that up to now has been done by the people of Colo, Kudus, Central Java.

2. Method
The Parijoto fruits were freshly purchased in Colo, Kudus, Central Java. They were purple in color and have similar size. The solvents, which were 96% acetone, 96% ethanol, 3% soda water and distilled water, were purchased at local chemical stores with food grade standardization. This research was carried out in three stages, consisted of the making of parijoto fruit extract using food graded 96% ethanol, 96% acetone, 3% soda water and water (as a control). The dodol was made by adding parijoto extract. There was also an analysis of tannin compounds, antioxidant capacity, durability level of dodol, both the extract and the dodol product. However, the data that will be presented in this article is limited only to the analysis of the extract.

The fruits were cleaned and then blended with solvent in a cold condition, with RPM 12000 for 15 minutes. The mixed liquid was then filtered using Whatman filter paper No. 42. The extract was then tested for its tannin level and antioxidant capacity along with the blank sample. In this study, every 1 kg of Parijoto fruits were dissolved with 1 liter of solvent. The extraction and filtration processes were carried out before testing the antioxidant capacity and tannin level. The addition of Parijoto extract in the making of dodol was done using solvent evaporation process after the filtration stage. The dry extract was then applied to the hot dodol consisting of a mixture of glutinous rice flour, granulated sugar, palm sugar, thick coconut milk, water and salt. The product was then tested again for their tannin level, antioxidant capacity and durability.
3. Results and Discussion

The results showed that the highest level of Parijoto fruit efficiency was obtained by the extraction process using 3% soda water and water (Table 1.)

Table 1. Parijoto fruit extraction efficiency using 4 types of solvents

| Type of Solvent | Ethanol 96% (gram) | Aceton 96% (gram) | Soda Water 3% (gram) | Water (control) (gram) |
|-----------------|-------------------|------------------|----------------------|------------------------|
| Efficiency      | 71%               | 64%              | 78%                  | 79%                    |

Higher extraction efficiency was obtained by highly polar solvents [12]. The application of efficient solvents in the fruit extraction and low price purchase will be more profitable and easier for the dodol making using parijoto fruit extract.

Anti-microbial capacity is usually analysed using a test against microbes or at least with the TPC (Total Plate Count) test. However, it can also be done by testing the content of anti-microbial compounds in the ingredients. Tannins and saponins are anti-microbial compounds that are easily found in the stems, leaves and fruits of Parijoto [9]. The results showed that the highest tannin level (30.17mgTAE/100g) was obtained from Parijoto fruit which was extracted using 96% ethanol. Where according to Kharismawati et al. [13], it was equivalent to the tannin level of bay leaves, but still lower than that in green tea leaves (0.04%) and red betel leaves, which the average was 0.25% (Table 2.)

Table 2. Tannin level test result of Parijoto fruit extracted using 4 different types of solvents.

| Type of Solvent | Ethanol 96% (gram) | Aceton 96% (gram) | Soda Water 3% (gram) | Water (control) (gram) |
|-----------------|-------------------|------------------|----------------------|------------------------|
| Tannin (mg TAE/100g) | 30.17            | 24.03            | 17.27                | 3.57                   |

The data on the antioxidant capacity of Parijoto fruit which was extracted using 4 different solvents are presented in Table 3. The table shows that the lowest antioxidant capacity of Parijoto fruit was found when it was extracted with water as a solvent, which is about 53%. Meanwhile, the highest capacity was obtained by the extraction using 96% ethanol, which was almost 75%. Based on the data above, it is believed that Parijoto fruit is a strong source of antioxidant compounds equivalent to andaliman, which according to research by Septiana and Dwiyanti [9] has 40% antioxidant capacity, or the crown of god which has 67% antioxidant capacity [9]. The antioxidant capacity of parijoto fruit extract in this study is still lower than those of Papua red fruit which is around 81% [14]. It is possible that if the concentration of the ethanol fraction extraction method is increased, it will obtain a higher antioxidant capacity. It conformed the results obtained by Jahan et al. [15]. It was revealed that total antioxidant capacity of CEE and various fractions of leaves were ranked as follows: CF > CEE > EF > HF > AF.

Table 3. The antioxidant capacity of parijoto fruit extracted using 4 different types of solvents.

| Antioxidant (%) | Ethanol 96% | Aceton 96% | Soda Water 3% | Water (Control) |
|-----------------|-------------|------------|---------------|-----------------|
| 74.96           | 72.23       | 60.60      | 53.11         |                 |
Based on the comparative analysis between extraction efficiency, tannin level test and antioxidant capacity test, it is believed that the use of soda water as a solvent has an optimization point that can be used as a basis for extraction of parijoto fruit in the making of parijoto dodol considering that it has almost the same efficiency as the process using water as the solvent, but can improve the level of tannins as well as the antioxidant capacity (Figure 1). Even though the antioxidant capacity and tannin level of the fruit extract are not as high as those using acetone and ethanol as the solvents, with an estimated lower cost and food graded assurance, soda water can be an alternative for the solvent other than water. So far, water is used to extract parijoto fruit in the making of syrup and other processed food preparations Kudus area, Central Java.

![Figure 1](image)

**Figure 1.** The comparison of extraction efficiency with antioxidant capacity and tannin level in parijoto fruit extraction using 4 different type of solvents

4. **Conclusion**

The most efficient extraction of Parijoto fruit is the one using water as the solvent. However, the result has the lowest tannin level and antioxidant capacity. Meanwhile, the best solvent to use and is able to produce highest antioxidant capacity and tannin level is 96% ethanol.

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