Purwoceng chemical characterization by FTIR spectrum and feasibility analysis of jelly purwoceng diversification with the addition of gelatine and carrageenan

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Abstract Purwoceng is a Medicinal plant commodity that has very beneficial content to health. Purwoceng is known as Indonesian ginseng, which has almost the same efficacy as Korean ginseng. In this research, the purwoceng chemical group was analyzed using the FTIR spectrum. Aside from analyzing the purwoceng chemical group, feasibility analysis and diversification of the purwoceng jelly were also carried out with physical analysis. Purwoceng has high economic value but its use is limited to medicine, therefore research on the formulation of purwoceng jelly as a new innovation was carried out. The process of making purwoceng jelly is to add gelatin and carrageenan to purwoceng extract according to the formula namely gelatin 26, 28, 24, 22 grams and carrageenan 7, 8 grams stirred until evenly mixed. Citric acid then added stirred till homogeneous and formed a sticky mixture. Then lift and pour into the mold. The produced jellies were then organoleptically tested, their level of preference and water content. The results show that the more carrageenan added, the more water content. Whereas organoleptic test formula II are more preferred. The results of the characterization of the FTIR spectrum indicate that purwoceng has chemical groups such as alcohol, carboxylic acid, esters.

1. Introduction
Purwoceng is a medicinal plant that has high economic value. Results of the financial analysis show that cultivating purwoceng are profitable and worth to be developed [1][2]. The selling price of raw purwoceng in farmers and collecting merchants quite expensive. Dried purwoceng is priced around Rp. 70,000 per kg and the price in the form of powder around Rp. 75,000 per kg, while the price of raw Purwoceng around Rp. 80,000 per kg.

Purwoceng used as stamina enhancer and aphrodisiac drugs (tonic) known and hereditary by folks around Dieng. Previous research on mice showed that Purwoceng contains metabolites that restore and enhance the sexual potency of male rats [3]. Purwoceng Identified containing a number of chemical compounds that are very beneficial for health benefits. The content of these chemical compounds can be seen from their chemical groups using the FTIR spectrum.

FTIR spectroscopy (Fourier Transform Infra-Red) is an analyst metode to identify characteristics of functional groups. The FTIR spectrum is able to distinguish the spectrum of two different samples based on the characteristics of their intramolecular structure where the ability to absorb light from a
compound will differ depending on the physicochemical properties, bonds between atoms in compounds and characteristics of functional groups [4].

According to Rifai et al., (1992) based on the status of genetic erosion, purwoceng categorized as critically (endangered) or almost extinct. Inventory results in 2003 showed that in its natural habitat purwoceng already extinct and the remaining are the result of cultivation in Dieng Plateau, Wonosobo, Central Java [5][6]. The extinction is due to the limitation of the land (adaptive land), over-exploitation of natural plants without any attempt at conservation and cultivation, cultivating technology used into is not optimal, and competition with other important horticultural commodities. Rahardjo (2003) said that at this point the only remaining cultivation area is Sikunang village, Dieng Plateau. According to Ermiati et al., (2006), purwoceng cultivating in Sikunang Village is still in the form of a private garden with a very small land area [7][2].

In an effort to prevent this plant from extinction, it is necessary to cultivate on a large scale in areas that have environmental conditions that are almost the same as their natural habitat. Then the addition of a clear market share such as collectors merchant or middlemen. One of the threats to extinction is also caused by the decline in the enthusiasm of the people of Sikunang Village to cultivate Purwoceng because there is no clear market share and lack of knowledge about product innovations that can be produced from Purwoceng. Therefore, this article made innovations from purawaceng products as inspiration and knowledge for readers.

2. Research methods
The first study was conducted using FTIR (Fourier-transform infrared spectroscopy) to determine the functional groups of purwoceng. The design of the purwoceng jelly diversification research used in this study was an experimental laboratory in which results would be tested for physical properties. Experiments at research are variations in the concentration of gelatin and carrageenan as a gelling agent. The independent variable in this study are variations in the concentration of gelatin and carrageenan on purwoceng extract. While the dependent variable in this research is the physical properties test including organoleptic test, preference level test, and water content test.

The tools used in this study include digital scales, analytical scales, filter cloths, stoves, pans, stirrers, jelly molds, spoons, pans, ovens, desiccators, dropper drops, saucers, burettes, stopwatches. Then the ingredients used in this study were purwoceng extract, gelatin, carrageenan, sucrose, citric acid, water. The jelly was made by cleansing 2 kg of raw Purwoceng then blend it until smooth and add 1-liter water. Put as much as 250 ml purwoceng extract, add 45 grams of glucose then heat it while stirring. Gelatin and carrageenan are added according to the formula until well blended. Citric acid is then added stir until homogeneous and formed a sticky mix. Then lift and pour it in the mold. Let stand overnight at room temperature, then cut to size. The following is a formulation of jelly candy made:

| Material     | Formula I | Formula II | Formula III | Formula IV |
|--------------|-----------|------------|-------------|------------|
| Gelatin      | 26        | 28         | 24          | 22         |
| Carrageenan  | 7         | 7          | 8           | 8          |
| Glucose      | 90        | 90         | 90          | 90         |
| Citric Acid  | 0.7       | 0.7        | 0.7         | 0.7        |

3. Results and discussion

3.1 FTIR test results
Fourier-transform infrared spectroscopy (FTIR) test is used to find information related to chemical bonds that exist in pure purwoceng powder chemical bonds are indicated with different peaks. This test is carried out to determine the bonds of purwoceng plants.
Figure 1. FTIR purwoceng pure powder test results

FTIR test results pure powder purwoceng showed that the pure powder purwoceng containing a bond chemical compound that can be seen in Table 2. FTIR test results show that at peak number 1 according to the reference table shows the bond type of phenol compounds, hydrogen bonding alcohols. Peak number 2 indicates the presence of bonds of aldehydes, ketones, carboxylic acids, esters. Peak number 3 indicates the type of compound alcohol, ether, carboxylic acid, and esters. Peak number 4 indicates the type of alkene compound.

Table 2. Peak test of FTIR purified pure purwoceng powder

| Peak Number | X (cm⁻¹) | Y (% T) |
|-------------|---------|---------|
| 1           | 3276.27 | 96.79   |
| 2           | 1636.75 | 96.12   |
| 3           | 1025.41 | 92.43   |
| 4           | 534.51  | 97.96   |

3.2 Results of purwoceng plant extract (pimpinella pruatjan)
Purwoceng plants that have been cleansed and washed as much as 2 kg are chopped and then blended until smooth with the addition of 1 liter of water. The extract obtained was squeezed and filtered to obtain a quart extract of 1 liter.

3.3 Physical test results of jelly candy purwoceng extract (Pimpinella pruatjan)
3.3.1 Organoleptic Test. This test is done by visual observation of the jelly candy made. Organoleptic test results can be seen in table 3.

Table 3. Organoleptic test results

| Formula | Shape | Color       | Smell          | Taste                  | Texture         |
|---------|-------|-------------|----------------|------------------------|-----------------|
| I       | Box   | Dark brown  | Typical Purwoceng | Bitter is rather sweet | A little chewy  |
| II      | Box   | Greenish Brown | Typical Purwoceng | Bitter is rather sweet | Chewy           |
| III     | Box   | Green       | Typical Purwoceng | Bitter is a little sweet | Less springy    |
| IV      | Box   | Dark Green  | Typical Purwoceng | Bitter is a little sweet | Rather chewy    |
3.3.2 Test the level of preference of purwoceng jelly candy. The preference level test was conducted to determine the response of respondents to this purwoceng jelly candy. This test was conducted on 15 respondents of different ages. Testing data can be seen in table 4.

Table 4. Feasibility results of respondents

| Assessment criteria | Number of respondents who voted |
|---------------------|---------------------------------|
|                     | FI   | FII  | FIII | FIV  |
| Taste               | Do not like | 1  | 0  | 0  | 1  |
|                     | Like it | 3  | 3  | 3  | 3  |
|                     | Really like | 0  | 1  | 0  | 0  |
| Color               | Do not like | 2  | 0  | 0  | 2  |
|                     | Like it | 1  | 2  | 5  | 2  |
|                     | Really like | 0  | 2  | 1  | 0  |
| Appearance          | Do not like | 0  | 0  | 0  | 0  |
|                     | Like it | 2  | 2  | 3  | 5  |
|                     | Really like | 0  | 2  | 0  | 0  |
| Smell               | Do not like | 2  | 0  | 2  | 1  |
|                     | Like it | 2  | 3  | 2  | 3  |
|                     | Really like | 0  | 0  | 0  | 0  |
| Texture             | Do not like | 1  | 0  | 0  | 0  |
|                     | Like it | 4  | 3  | 3  | 2  |
|                     | Really like | 1  | 1  | 0  | 0  |
| Total value         | Do not like | 31.57% | 0% | 10.52% | 21.05% |
|                     | Like it | 63.15% | 68.42% | 84.21% | 78.95% |
|                     | Really like | 5.28% | 31.58% | 5.27% | 0% |

3.3.3 Moisture test. Water content testing is used to determine the water content contained in the resulting jelly candy. This level is used to determine the quality of jelly candy is feasible or not. The results of testing the water content can be seen in table 5.

Table 5. Data on water content test results (%)

| Formula | Concentration | Water content (%) |
|---------|---------------|-------------------|
|         |               | Replication I | Replication II | Replication III | X     |
| I       | Gelatin: 26   | 5,978        | 5,347       | 5,323         | 5,289 |
|         | Carrageenan: 7 |             |             |               |       |
| II      | Gelatin: 28   | 6,147        | 6,122       | 6,037         | 6,022 |
|         | Carrageenan: 7 |             |             |               |       |
| III     | Gelatin: 24   | 7,356        | 7,128       | 7,089         | 7,077 |
|         | Carrageenan: 8 |             |             |               |       |
| IV      | Gelatin: 22   | 8,986        | 8,567       | 8,456         | 8,434 |
|         | Carrageenan: 8 |             |             |               |       |

The results of testing the water content based on the table above obtained the results of water content between 5.289% - 8.434%. These results indicate that jelly candies meet the water jelly candy water level standards that must not be more than 20% [8]. Making purwoceng extract is done by the process of chopping it first then blending until smooth. Purwoceng plants are first cleansed with running water
to remove soil impurities that are still attached to the plant. After the plants are chopped into small sizes and added about 1 liter of water to 2 kg of purwoceng plants. The addition of water is not allowed too much, it is intended that the content of purwoceng is not lost. The results of the mixture are then filtered to take the extract.

The addition of gelatin is used as a gelling agent (gel-forming), converting the liquid into an elastic solid, to form the texture of the resulting jelly candy. Carrageenan is also a gelling agent. Glucose and citric acid were added to improve the taste of jelly candy. Physical quality testing in this study included an organoleptic test, a preference level test, and a moisture content test. Organoleptic testing of jelly candy from each formula includes appearance, smell, color, and taste. Of the six jelly candy formulas made have met the standards with a distinctive odor, distinctive taste purwoceng. The formula I am dark brown, formula II is greenish-brown, formula III is green, and formula IV is dark green. The preference level test was carried out on 15 respondents. The results show that formula II is preferred with the best value. Water content is a quality parameter of a product. The water content in food affects the resistance of food to microbial, bacterial, and fungal contamination that can cause chemical, color and other changes [9].

According to Sudarmadi, et al (2007), free water is present in the spaces between cells and pores in the material. Water is weakly bound because it is absorbed (adsorbed) on the surface of macromolecular colloids such as proteins. Each formula that has been tested has an average increase in water content due to the higher concentration of gelatin and the higher concentration of carrageenan added, causing the water content of the candy to increases[10]. According to Harijono (2010), carrageenan as a hydrocolloid has the ability to bind large amounts of water. Carrageenan has OH- free ions which are capable of binding to H2O (water). According to Candra (2014) carrageenan functions more to bind water compared to fat binding [11][12].

The result of water content is Formula I 5.289%, Formula II 6.022%, Formula III 7.077%, and Formula IV 8.434%. The water content obtained from the four formulas is in accordance with the standard, which is no more than 20.0% [8]. Water content increases with the increase of carrageenan concentration.

This study has several limitations including jelly candies that still have a very strong purwoceng flavor that causes a bitter taste. So it is necessary to add more glucose to eliminate the bitter taste of purwoceng. Purwoceng is known to contain known alkaloid compounds that can be used as an antioxidant. So, this jelly candy needs more research to test the antioxidant level in the jelly.

4. Conclusion

Based on the results of the study, it can be concluded that research on the physical quality test of jelly candy purwoceng plants can be concluded as follows, Purwoceng has functional groups including alcohol, carboxylic acids, esters, aldehydes, and ketones, Purwoceng plant extracts can be used for making jelly. There is an influence on variations in the concentration of gelatin and carrageenan in jelly formulations. The differences in the concentration of gelatin and carrageenan affect organoleptic tests, preference levels, and water content tests. From the test results, it was found that in the organoleptic and preference tests the results were obtained that formulation II was preferred and based on the water content test Formulation IV was preferred.

References

[1] Yuhono J T 2004 *Bulletin of Spices and Medicinal Crops Research* 15 (1) 25-32
[2] Ermiati C and O Rostiana Indrawanto 2006 *Proceedings of the National Seminar on Medicinal Plants Indonesia* XXVII Bogor p 91-100
[3] Rostiana O, B C Rosita, H Muhammad, Hermani, S F Shahid, W Haryudin, Miftakhurommah, D Seswita, Aisha S, D Surachman and Nasrun 2003 *Technical Report Research Mastery Spices and Medicinal Plants Technology Cimanggu Year 1994/1995* Balittro Bogor
[4] Kumasinski and Farrel 1993 *Journal technology* Bogor
[5] Rifai M A, Rugayah and E A Widjaja 1992 *Thirty Indonesian endangered medicinal plants*. Floribunda 2 1-28

[6] Rahardjo M I and A Shusena Darwati 2006a *Indonesia journal Nature Materials* 5 (1) 1412-2855

[7] National Standardization Agency 2008 SNI 3547.2.2008 Confectionery Part 2 Soft. Jakarta National Standardization Agency

[8] Winarno, FG 2004 *Chemistry of Food and Nutrition* Jakarta Gramedia

[9] Sudarmadji S, B Haryono Suhandri 2003 *Journal of Agricultural Technology* 2 (2) 110-116

[10] Candra F And W Ima 2014 *Jurnal Temperature Storage Fishery Products Processing and Biotechnology* Volume 3 Number 1 Page 167-176.