The Characteristics of Yellow Pumpkin Flour That Has Been Processed Using Shard Gourd Method

Ida Farikha Azizah¹, Ika Mulawati PN², Ngatinem³, Novi Kuswardani⁴

¹Laboratory of Starch Technology, Agency for the Assessment and Application of Technology Lampung, Indonesia

*ida.farikha@bppt.go.id, ika.mulawati@bppt.go.id, ngatinem3246@bppt.go.id, novi.kuswardani@bppt.go.id

Abstract. As an alternative innovation for refined flour substitutes, pumpkin needs to be processed into flour which is more durable when stored and practical for further processing. This study aims to determine the chemical composition and morphological characteristics of pumpkin flour that has been processed using the method of shard gourd from pumpkin fruit, and to determine the yield in pumpkin flour processing. The making of pumpkin flour is done by cutting the pumpkin fruit which has been cleaned and separated from the skin and buds. The grated pulp is then cut into small pieces, dried, floured, and sieved in 110 mesh sizes. The yield of pumpkin flour obtained from processing from pumpkin fruit is 5 - 10%. The chemical composition of pumpkin flour produced has a water content of 6.9%, 22.8% protein content, 1.1% fat content, 5.7% ash content, 47.4% starch content, and 22.1% food fiber content. The chemical composition indicates that pumpkin flour is suitable to be processed into pumpkin sponge which is rich in nutrients and food fiber.

1. Introduction

Yellow pumpkin is a local food ingredient that can be used as a side dish. Yellow pumpkin is usually used by the community as an ingredient for compote, vegetable porridge and a practical food that is easy to process. It still displays the original form of the pumpkin itself. When viewed from the nutritional content, pumpkin contains nutrients that are good enough for consumption.

Besides having complete nutritional content, and high fiber, pumpkin also has a fairly good adaptability [11]. The availability of pumpkin in Indonesia is relatively high, as can be seen from the average production of pumpkin 21 tonnes per hectare [12]. Pumpkin production from year to year continues to increase.

High consumption of flour causes people to innovate to process pumpkin into flour. Yellow squash has a high water content so it needs innovation into flour which can be processed into food ingredients. As an alternative innovation for refined flour substitutes, pumpkin needs to be processed into flour which is more durable when stored and practical to use. Processing pumpkin into flour will extend shelf life, and provide added value to the pumpkin itself, so that it can be widely applied to various types of food [5]. Yellow Pumpkin most of the use of pumpkin around Lampung is processed as a mixture for making sauces on an industrial scale. It is very rare for pumpkin to be used as processed food which is practical and easy to use, so that the selling value of pumpkin is low.
This study aims to determine the chemical composition and morphological structure of pumpkin flour which has been processed using the method of shard gourd from pumpkin fruit, as well as to determine the yield of pumpkin flour obtained from pumpkin fruit by the method of shard gourd.

2. Methodology

Ingredients and Tools
The main ingredient used in this research is pumpkin fruit which is 3-4 months old from the harvest of the Laboratory of Starch Technology, Central Lampung. The part of the fruit used for this research is the fruit that is usually consumed. The materials and tools used to analyze the chemical composition are petroleum benzene, desiccator, ethanol, sodium hydroxide, sulfuric acid, sodium carbonate, oven, furnace, one soxhlet, stopwatch, soxhlet extractor, desiccator, glass tools, weigh bottles, vacuum pumps, porcelain plates, analytical scales, kjedahl flasks, distillators, condensers, knives, filter paper, cotton swabs, vortexes and UV-Vis spectrophotometers.

Sample Preparation
Pumpkin fruit is cleaned / washed with water, then separated from the skin, flesh, seeds and leg. The part of the fruit flesh that has been separated is cut into small pieces like sticks then dried in an oven at 60 - 70 °C, after drying it is mashed using a disc mill, then sieved until particles with a size of 110 mesh are obtained and yellow squash fruit flour is obtained.

Chemical Composition Analysis
Chemical composition analysis includes moisture content using thermogravimetry [8], ash content in the dry ashing method, fat content with soxhlet, protein content with Kjedhal [9], starch content with the method enzymatic (enzyme hydrolize) and dietary fiber content using AOAC Official Methods 993.19; and 991.42 with minor modifications.

Morphology Analysis
The morphological characteristics of pumpkin flour were analyzed using a scanning electron microscope (EVO MA 10, Carl Zeiss, Germany) at magnifications of 500, 1000, and 1500 times. The surface of the sample was coated with a thin layer of gold under a sputter time of 60 seconds and a sputter current of 20 mA. The sample was inserted into the SEM tool and the surface image was taken using a Secondary Electron (SE) detector; working distance (WD) 8.5 mm; EHT 20 kV.

3. Result and Discussion
As one of the innovations in the processing of pumpkin to have a high selling value, the pumpkin is processed into flour which can be easier and more practical in food processing. There are two methods of shading made of pumpkin, namely shredded and grated. In this study, the processed pumpkin flour was processed by shredding or shaved. Processing by making sticks on pumpkin flesh that has been peeled, then dried for 10 hours until it dries and the moisture content reaches 4-6%. This makes it easier to hold the pumpkin if the water content of the pumpkin is getting less and dry.

The pumpkin flour used in the sample was pumpkin fruit which was cultivated by using mulch and spacing. Yellow pumpkin that has been processed into flour is measured for the nutritional content of food and the results of the analysis can be seen in Table 1. The results of proximate analysis of pumpkin that have been processed by shredding into flour.
Table 1. The results of the proximate analysis of pumpkin processed by means of shard gourd

| NO | Sample Code | Water Content (%) | Protein Content (%) | Fat Content (%) | Ash Content (%) | Starch Content (%) | Food Fiber Content (%) |
|----|-------------|-------------------|---------------------|----------------|---------------|-------------------|-----------------------|
| 1. | AX          | 7.81              | 24.01               | 1.19           | 5.56          | 47.44            | 20.995                |
| 2. | AY          | 7.1               | 19.83               | 1.08           | 7.1           | 47.93            | 21.238                |
| 3. | AZ          | 7.52              | 25.1                | 1.3            | 5.1           | 49.72            | 23.689                |
| 4. | BX          | 6.43              | 17.6                | 1.1            | 6.27          | 44.67            | 25.369                |
| 5. | BY          | 6.82              | 24.8                | 0.98           | 5.33          | 46.3             | 22.048                |
| 6. | BZ          | 6.53              | 25.2                | 1.39           | 5.38          | 47.76            | 23.627                |
| 7. | CX          | 6.46              | 22.33               | 0              | 5.7           | 47.6             | 21.563                |
| 8. | CY          | 6.97              | 24.8                | 1.26           | 5.49          | 45.64            | 19.380                |
| 9. | CZ          | 6.75              | 21.6                | 1.39           | 4.97          | 49.23            | 21.026                |
|    | Average     | 6.9               | 22.8                | 1.1            | 5.7           | 47.4             | 22.1                  |

Methods

|     | SNI 3451:2011 | SNI 3451:2011 | SNI 3451:2011 | SNI 3451:2011 | Modified Somogy (enzimatis) | AOAC |
|-----|---------------|---------------|---------------|---------------|-----------------------------|------|
|     |               |               |               |               |                             |      |

Information:

A : Without mulch  X : without organic fertilizer
B : with organic mulch  Y : with compost (GGP)
C : with plastic mulch  Z : with cow manure

Based on the test results in Table 1 that pumpkin flour has a sufficient value for the nutritional content of a food ingredient. The cultivation technique had little influence on the proximate content analysis of pumpkin flour, although the increase was not too clear. Without the use of mulch, pumpkin has a high proximate content compared to the others. When compared with previous research in [14] has in Table 2 the results are not much different. The difference is seen in the protein and carbohydrate results which [14] stated as having a higher value. This can be due to different test methods.
Table 2. Pumpkin powder nutritional content

| Parameter               | Yellow Pumpkin Powder |
|-------------------------|-----------------------|
| Water Content (%)       | 6.37 ± 0.86           |
| Ash Content (%)         | 5.39 ± 0.97           |
| Protein (%)             | 5.06 ± 0.20           |
| Fat (%)                 | 1.16 ± 0.29           |
| Carbohydrate (%)        | 82.02 ± 1.38          |
| Total Sugar (%)         | 24.3                  |

Source of reference [11]

Water Content

The water content of a food material needs to be known, especially to determine the percentage of nutrients as a whole. The amount of water content contained in a pagan substance greatly affects the entire percentage composition of the nutrients as a whole. The water content of a food ingredient aims to determine the dry weight of the material which is usually constant.

The water content in food ingredients affects the resistance of foodstuffs to microbial attack, which is stated by Aw, namely the amount of free water that can be used by microorganisms for their growth. Various microorganisms have a minimum Aw in order to grow well, for example the bacteria Aw: 0.90; khamir Aw: 0.80-0.90; mold Aw: 0.60-0.70. To extend the durability of a material, some of the water in the material must be removed in several ways depending on the type of material. Generally, drying is done, either by drying it or using an artificial dryer [16].

The criteria for water bonding in the aspect of food durability can be viewed from the water content, solution concentration, osmotic pressure, balanced relative humidity and water activity. The water content in food will change according to the environment, and this is closely related to the durability of these foods. This is a major consideration in post-processing and management of foodstuffs [6]. All food ingredients contain different amounts of water, be it animal or vegetable food ingredients. Water acts as a carrier for food substances and metabolic waste, as a reaction medium that stabilizes the formation of biopolymers, and so on.

Fresh pumpkin fruit contains 86 - 92% moisture. One yellow squash measuring 2.09 kg consists of 5.46% juices; 2.92% of seeds; 16.33% fruit skin; 75.29% pulp. The yield of fruit pulp is 1.57 kg when powdered by means of mawning, it will produce pumpkin flour of 5.39% (0.08 kg) flour.

The water content in food ingredients determines the acceptability, freshness and durability of the material. Water content is a test to measure the water content in food ingredients. This is a measure of the ability of materials in food processing. The water content of 6.9% indicates that pumpkin flour has good storage capacity and food processing ability. Pumpkin flour can be processed into pastries, cakes with a ratio of 2: 1.

The test results showed that the water content in the meat was 6.75%, compared to the water content of pumpkin flour according to [14], which was 11.14%. The above comparison concluded that the moisture content in the fleshy pulp of yellow labuh fruit was lower than the water content in previous studies. The water content in foodstuffs determines the freshness and durability of the foodstuffs, the high water content makes it easy for bacteria, molds and yeast to reproduce, so that changes will occur in foodstuffs.
Protein Content

Protein is a food substance that is very important for the body, because in addition to functioning as fuel in the body, it also functions as a building and regulatory substance. As a building block, protein is a material for forming new tissues that always occur in the body. The higher the protein content in the food ingredients, the better the nutritional value for humans. The main function of protein for the body is to form new tissue and maintain existing tissue. Protein can also be used for fuel if carbohydrates and fats are not fulfilled.

Protein is closely related to water content in food processing. It is known that by decreasing the water content, the protein value increases. The same thing was also expressed by [7] that the increase in the value of protein content continues with the longer time used during the drying process to processing time. The drier the material, the higher the protein content. In line with statement [17] stated that by reducing water content, food ingredients will contain compounds such as protein, carbohydrates, fats and minerals in higher concentrations. This is like what happened in this study which stated that the water content was quite low and was followed by an increase in proximate levels except for low fat. According to [6] explains that water content and water activity in food have a very large role, especially in determining the texture of food.

Fat Content

Determination of fat content by extraction using solvents in the material is an analysis of crude fat content because not only fat is extracted, but also phospholipids, free fatty acids, carotenoids, and other fat-soluble pigments. As nutrients, fats or oils are of better quality if they contain unsaturated fatty acids. Oil or fat is non-polar so that it does not dissolve in polar solvents such as water and acidic solutions, but dissolves in non-polar organic solvents such as n-Hexane, Benzene, Chloroform, petroleum ether. [9].

Data disclosed by [4], where the fat content of pumpkin flour is 1.34%. This data is almost the same as the measurement results which state the fat content value of 1.1%. This value is a food scale which indicates that the fat content is relatively small so that it provides the advantage of avoiding the problem of rancidity.

Ash Content

Ash content refers to the inorganic residue that remains after complete oxidation of the organic components of foodstuffs. The ash content of the analysis results in pumpkin flesh was 5.7%, compared to the ash content of pumpkin powder of 5.39 ± 0.97. The determination of ash content has to do with the minerals of a material. The content and composition of the ash or minerals of a material depends on the type of material and the method of ashing used. Determination of total ash content is used to determine whether or not a processing process is good, to determine the type of material used and the parameters of the nutritional value of food ingredients.

Carbohydrate Content

These polysaccharides are a food reserve in plants, especially in large quantities in tubers, such as potatoes and in grains such as corn.

The levels of glucose in food sources of carbohydrates include: monosaccharides that are already available or come from the breakdown of polysaccharides (starch / starch) in these materials. The process of breaking down polysaccharides into monosaccharides can occur during the food processing process or through hydrolysis during the polysaccharides which are catalyzed by acids and enzymes in the digestive tract [2].

Another study by [10] stated that the results of the proximate analysis of the carbohydrate content of pumpkin flour and wheat flour were 58.71%. It differs slightly from the research conducted this time, resulting in carbohydrate content of 40.203 - 44.307% from starch content of 44.67 - 49.23%. This means that the pumpkin flour consists mostly of starch resulting from the breakdown of polysaccharides.
Food Fiber Content
Dietary fiber is a component of food that cannot be digested by enzymes in the digestion of the human body. Dietary fiber consumed in sufficient amounts can reduce the risk of colon cancer and can maintain blood fat levels so that it can reduce the risk of obesity, hypertension, and heart disease. The amount of dietary reference intake (DRI) for food fiber is 25 g per 2000 kcal per day [3].

Dietary fiber based on its solubility in water is divided into two, namely soluble food fiber (SDF) consisting of pectin and its derivatives, gum and mucilage, and insoluble fiber (IDF) consisting of cellulose, hemicellulose, lignin and modified cellulose.

Fiber Based on the results of testing the fiber content in meat flour is 0.93%, compared to the data disclosed by [4], where the fiber content of pumpkin flour is 2.90%, the fiber content of the research results is smaller than the fruit fiber, pumpkin from previous research.

In this study, the dietary fiber content of pumpkin flour ranged from 20,995 - 25,369, which means that pumpkin flour contains high levels of dietary fiber so it is suitable for consumption for those who carry out a special diet.

Morphology
The results of observations using SEM (Figure 1 and Figure 2) show that the pumpkin flour has irregular granules and visible food fiber sheets / patterns in the granules. This is in accordance with the chemical composition content that most of the constituent granules consist of starch and dietary fiber.

4. Conclusion
The analysis of characteristic of yellow pumpkin flour which has been done in this study shows it has good nutritional values and suitable to be used as food processed ingredient, like pastry, cake and other foods that more dominated with the original of yellow color and not as additional food coloring. The yield analysis of chemical composition of yellow pumpkin flour has water content 6.9%, protein content 22.8%, fat content 1.1%, ash content 5.7%, carbohydrate content 40,203 – 44,307%, and food fiber content 22.1%. With those yields is suitable to be processed into pumpkin sponge. The yield of the observation with SEM tool shows that yellow pumpkin flour has irregular granule with fiber covers the starch granule.
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