Chemical purification of Gunungpati elephant foot yam flour to improve physical and chemical quality on processed food

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Octavianti Paramita, Wahyuningsih, and Muhammad Ansori

Chemical Purification of Gunungpati Elephant Foot Yam Flour to Improve Physical and Chemical Quality on Processed Food

Octavianti Paramita[1,a)], Wahyuningsih[1,b)], Muhammad Ansori[1]

[1]*Food Chemistry Lab, Department of Family Welfare Education, Universitas Negeri Semarang, Semarang, Indonesia.*

[a)]Corresponding author: mita.violet81@gmail.com; [b)]octavianti.paramita@mail.unnes.ac.id

Abstract : This study was aimed at improving the physicochemical quality of elephant foot yam flour in Gunungpati, Semarang by chemical purification. The utilization of elephant foot yam flour in several processed food was also discussed in this study. The flour purification discussed in this study was expected to become a reference for the manufacturers of elephant foot yam flour and its processed food in Gunungpati. This study modified the elephant foot yam flour using pre - gelatinization method. The physical and chemical quality of each elephant foot yam flour purification sample were assessed using proximate analysis. The likability test was conducted for its processed food. 20 grams of elephant foot yam flour was put into a beaker glass, then 60 ml of water was added. The suspension was then heated at a temperature of 60 ° C and 70 ° C while stirred until it was homogeneous and thickened for 10, 30 and 60 minutes. The flour which had been heated was then cooled at room temperature for 1 hour and then at a temperature of 0 ° C until it was frozen. Furthermore, flour was dried in an oven at a temperature of 60 ° C for 9 hours. The dried flour was sifted with a 80 mesh sieve. Chemical test was conducted after elephant foot yam was pre-gelatinized to determine changes in the quality flour: test levels of protein, fat, crude fiber content, moisture content, ash content and starch content. In addition, color tests and granular test on elephant foot yam flour were also conducted. The pre-gelatinization as chemical treatment on elephant foot yam flour in this study was able to change the functional properties of elephant foot yam flour towards a better processing characterized by a brighter color (L = 70, a = 6 and b = 12), the hydrolysis of polysaccharides flour into shorter chain (flour content decreased to 44%), the expansion of granules in elephant foot yam resulting in a process – ready flour, and better monolayer water content of 9%. The content of protein and fiber on the elephant foot yam flour also can be maintained at a level of 9% and 2.1% levels.

INTRODUCTION

Elephant foot yam (Amorphophallus campanulatus B1) is included into taro plants which previously known as the main ingredient flour and starch. The main contents on elephant foot yam are 1.2g protein, 0.1g fat, 18.4g carbohydrate, mineral 0.8 g, 79 g water, and mannan / glucomannan 10 – 80 % [6]. According to [7], 100 grams of material on elephant foot yam contain 69 cal of calories, 62 mg of calcium, 41 mg of phosphorus, 4.2 mg of iron and 5 grams of vitamin C. Elephant foot yam was used as food ingredient because it has a thick flesh, is likely to be processed as flour and starch. However, elephant foot yam has several drawbacks such as little content of protein and Rafid, microscopic oxalate crystal compound, which can cause itch. [8]. Therefore, the process of flour from elephant foot yam requires special treatment unlike the process of manufacturing of cassava flour or other flour. Flour made from elephant foot yam when compared with cassava flour has more advantages such as higher fiber content. A total value of dietary fiber of Cassava flour is only 9.89 percent dietary fiber while the fiber content of elephant foot yam flour can reach 15.09 percent. However, the weakness of elephant foot yam flour produced in Gunungpati is the blackish color and still feels itchy when it is processed into food. Even though, it has been manufactured into flour, some of the weaknesses of the functional properties of elephant foot yam can still be found which resulted in the low quality of the flour. Therefore, quality improvement of elephant foot yam flour has paramount importance. One of the efforts discussed in this study was to modify the functional properties of elephant foot yam using pre - gelatinization as chemical purification.

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METHOD

Materials in this study were obtained from the elephant foot yam flour obtained from elephant foot yam flour production in Plalangan village, Gunungpati District of Semarang, which has been sieved to 40 mesh and the distilled water was obtained from Indrasari chemical shop, Semarang. The modification of elephant foot yam flour was conducted using pre - gelatinization chemical purification.

20 g of flour elephant foot yam flour was prepared in a glass cup, then 60 ml of water was added. The suspension was subsequently heated at a temperature of 60 ° C and 70 ° C while stirred until it was homogeneous and thickened for 10, 30 and 60 minutes. The flour was then cooled at room temperature for 1 hour and continued in a temperature of 0 ° C until it was frozen. Furthermore, flour was dried in an oven at a temperature of 60 ° C for 9 hours. The dried flour was sifted with a 80 mesh sieve.

The chemically purified flour was investigated for its functional properties. Observation was also conducted on unmodified flour as a controlled variable. Therefore, the properties of the flour can be compared. The flour moisture, ash, starch, fiber were included into chemical analysis **[1],** amylose (IRRI method). The water content in the powder was analyzed using an oven at a temperature of 105 o C until constant weight was achieved. The ash content was analysed using incineration in furnace, heating it a temperature of 500-600 ° C for 6 hours. Determination of fat content was carried out by Soxhlet method. Color testing method using CIE L * a * b. Meanwhile, the characterization of starch granules observation used a microscope photograph.

RESULTS AND DISCUSSION

Based on the results of water content in elephant foot yam flour after pre - gelatinization and control, it can be seen that the elephant foot yam flour after pre - gelatinization had better ability to bind water (8-9%) compared to the controlled elephant foot yam flour (7%). Pre-treatment gelatinization was able to degrade most of the elephant foot yam flour into simpler sugar. Therefore, its ability to bind water was better. The starch content of elephant foot yam flour control was 69%, while the starch content of pre-gelatinization elephant foot yam flour was in the range between 44% - 56%. The pre- gelatinized elephant foot yam flour had a sweeter taste and a shorter polysaccharide chain than that of the untreated flour elephant foot yam (control) (Table 1.)

Ash content and protein content of the pre - gelatinized Elephant foot yam flour and controlled Elephant foot yam flour were relatively the same, where the ash content ranged from 5%, while the protein content ranged from 8%. The pre-gelatinization did not degrade the protein content of the elephant foot yam flour. Crude fiber content of the pre - gelatinization and controlled elephant foot yam flour did not have much difference which was 2%. Meanwhile, the pre - gelatinized treatment of the elephant foot yam flour was able to lower the fat content of flour from the control condition (0.24%) to (0.14%) on elephant foot yam flour which was under pre-gelatinization treatment with a temperature of 70 ^{0}C with heating times of 60 minutes (Table 1.). Water absorption of a material was influenced by the presence of fiber, because fiber properties can easily absorb water **[9].**

Table 1. Test Results of Chemical Ingredients of Pre – gelatinized and controlled elephant foot yam Flour

SAMPLE	PARAMETER					
	Water content (%)	Ash content (%)	Fat (%)	Protein (%)	Crude fiber (%)	Starch Content (%)
A1	8,0036	5,2604	0,1724	9,1808	2,3564	56,6770
A2	8,4128	5,0904	0,1345	8,2508	2,2373	44,6077
A3	8,8242	5,2127	0,1565	8,4784	2,2832	50,2793
A4	9,1965	5,1332	0,12	8,1253	2,1033	53,4397
A5	9,4516	5,4277	0,1778	9,0036	2,4322	46,4585
A6	8,0455	5,0231	0,1456	8,3958	2,3740	52,7769
K	7,8275	5,2691	0,2479	8,4402	2,1419	69,1504

Information:
Flour elephant foot yam Modification Method of Pre-gelatinization:
A1 : Elephant foot yam flour under heating at the temperature at 60 ° C for 10 minutes.
A2 : Elephant foot yam flour under heating at the temperature at 60 ° C for 30 minutes.
A3 : Elephant foot yam flour under heating at the temperature at 60 ° C for 60 minutes.
A4 : Elephant foot yam flour under heating at the temperature at 70 ° C for 10 minutes.
A5 : Elephant foot yam flour under heating at the temperature at 70 ° C for 30 minutes.
A6 : Elephant foot yam flour under heating at the temperature at 70 ° C for 60 minutes.
K : Elephant foot yam flour without treatment (control)

Flour with a high protein causes starch viscosity decreases which leads to decreasing starch quality. Therefore, it was not expected. Protein and starch will form a complex with the surface of the granules and causes the viscosity to decrease [5]. If the starch content of the yam has reached optimum, then the starch in the yam continues to decline slowly and the starch begins to change into fiber [10].

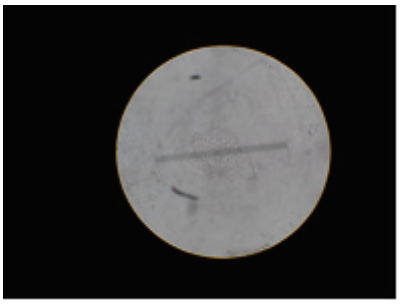
The treatment of pre-gelatinization on elephant foot yam flour which degraded polysaccharides of the starch and fat of elephant foot yam flour into simpler structure, was also suspected to have been the cause of discoloration elephant foot yam flour. The discoloration causes the flour brighter after the treatment of pre-gelatinization (from the range of L = 62 into L = 70) (Table 2). The reddish color of Elephant foot yam flour which came from the image of the fat content, was faded with pre-gelatinization treatment (of the value of a = 8 be a = 6). Meanwhile, the increase in yellow colour from blue of elephant foot yam flour was the representation of polysaccharide degradation of flour into simple carbohydrates (Table 2).

Table 2. Test Results Color Level Flour elephant foot yam Experimental Results and Controls

SAMPLE	ANALYSIS RESULTS		
	L (Dark 0 - White 100)	A ((-)Green – (+)Red)	B ((-)Blue – (+)Yellow)
A1	70,93	6,495	12,385
A2	70,66	6,495	12,68
A3	65,31	6,88	13,1
A4	68,125	7,375	14,32
A5	62,525	7,562	14,13
A6	68,65	6,39	9,99
K	62,49	8,12	10,785

Figure 1 shows that the treatment of pre-gelatinization caused profile photo of elephant foot yam flour granules became more turbid than the original condition of elephant foot yam flour (control). The profile of elephant foot yam flour granules prior to pre-gelatinization treatment tended to be transparent, rigid and non-porous. However, after being subjected to pre- gelatinization, pores in the flour granules emerged and the size of the starch granules swelled and fragile. The treatment of pre- gelatinization at 60 ^{0}C and 70 ^{0}C managed to alter the carbohydrate structure of flour elephant foot yam granules and hydrolysed it into oligosaccharides which led to the decreasing starch content, the increasing penetration of water levels, the increasing sugar levels, the brighter colors, the more fragile and softer texture. The flour can be more easily processed because the granular structure was brittle and expanding. Water absorption of the flour is related to the granule composition and physical properties of the starch after being added to the water, As a consequence, the water absorption also determined the amount of water required for the process of starch gelatinization during cooking. Gelling could not be optimum if only less amount of water was added [2]. There is no real correlation between gelatinization with the size of the starch granules. However, gelatinization temperature has correlated with the compactness granules, amylose and amylopectin levels [4].

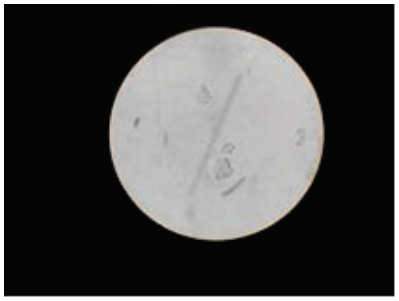
SAMPLE A1 (60 ^{0}C, 10 MINUTES)



SAMPLE A2 (60 ^{0}C, 30 MINUTES)

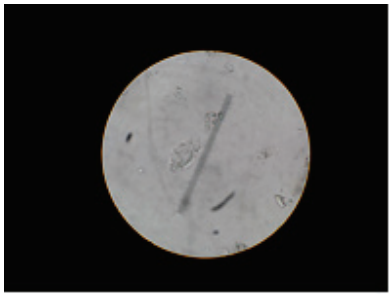
SAMPLE A3 (60 ^{0}C, 60 MINUTES)

SAMPLE A4 (70 ^{0}C, 10 MINUTES)



SAMPLE A5 (70 ^{0}C, 30 MINUTES)

SAMPLE A6 (70 ^{0}C, 60 MINUTES)



CONTROL

Figure 1. Figure starch granules elephant foot yam flour post treatment pre- gelatinized and control

CONCLUSION

The pre-gelatinization as chemical treatment on elephant foot yam flour was able to change the functional properties of elephant foot yam flour towards a better processing as characterized by a brighter color (L = 70, a = 6 and b = 12), the hydrolysis of polysaccharides starch into shorter chain (starch fell to 44%), the expanding of elephant foot yam flour granules so that it was more ready to be processed, and better monolayer water content of 9%. The content of protein and fiber on elephant foot yam flour also can be maintained at a level of 9% and 2.1% levels.

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