PROJECT REPORT

On

Extraction of Taro Starch Using Traditional Method and Determination of Quality Parameters.

Submitted To

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Letter of transmittal

Date:
Dr. Nizam Uddin
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Subject: Submission of Thesis Report

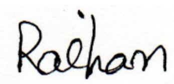
Sir,

I, Md Raihan Hossain, bearing ID No: 183-34-139 would beg to state that, it is a matter of honor and pleasure for me to have this momentum to submit this thesis report as a part of the curriculum of Nutrition and Food Engineering (NFE) program.

I have prepared this report based on the knowledge as well as information I have gathered throughout the period of my product development. This report contains the detailed information of Product Development. Since this was the first time, I was given the chance to develop a product on my own, I tried my level best to learn and work as much as I can within this period of time. This thesis project provided me the opportunity to not only learns how a new product can be developed but also how different laboratory tests are done.

I therefore, would like to present this thesis report to you. Your kind advice and suggestion will guide as well as encourage me to do well in the near future.

Sincerely Yours,



…………………….
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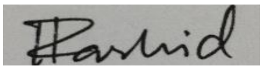
Letter of Recommendation

I am pleased to certify that the project report on "**Extraction of Taro Starch Using Traditional Method and Determination of Quality Parameters**" conducted by Md. Raihan Hossain, bearing respectively ID No: 183-34-139 of the department of Nutrition and Food Engineering has been approved for presentation and Defense/viva-voice.

I am glad to certify that the facts and conclusions contained in the report are the genuine work of Md Raihan Hossain. I strongly recommended the report presented by Md Raihan Hossain for further academic recommendations and defense or viva-voice. Md Raihan Hossain bears a strong moral character and a very pleasant personality. It has indeed a great pleasure working with him. I wish him all success in life.



…………………………

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At last, but not the least, I'd like to thank the entire NFE dept. lab assistant for helping me from moral to material needs as well as enlightening me with their knowledge to improve mine.

Abstract

Tuber and root crops have developed into important food crops especially in tropical and subtropical countries. Taro (*Colocasia esculenta*) is ranked as the fifth-most important root crop due to its use in food preparation, ornamentation, and medicine. In comparison, it stores a considerable quantity of starch even more than potatoes, sweet potatoes, cassava, and other similar crops. There for the aim oft his study was to extract and analyses the proximate composition and physical properties of taro root available in Bangladesh. Taro starch contained 4.06% and 5% moisture and ash respectively. The physical properties of taro starch was as true density is of 1.66 gm/ml, water holding capacity is 2 ml, yield percentage is 1.227%, porosity 69.9% and the bulk density is 0.5 g/cm^3. The yield percentage of taro starch was 1.23%. The yield percentage was too low this is because of higher moisture content of taro and wastage during processing. Further study is required to increase the yield percentage of starch.

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One

Introduction

1.1 Introduction

One of the most prevalent and renewable materials in nature is starch. It is a semi-crystalline carbohydrate that is produced in a variety of plant tissues, such as roots, tubers, rhizomes, and seeds, as rough, spherical and granules. Wheat, maize, rice, potato, cassava, and taro are the main plant sources of starch.

A greater part of our food system and industrial economy are based on starch. Despite being mostly utilized as food, it is easily transformed chemically and biologically into a wide range of beneficial and interesting goods, including paper, textiles, adhesives, drinks, confections, medications, and polymers. For the majority of South Pacific Islanders, taro and cassava are key food and economic crops since they are rich sources of starch.

Taro starch can be utilized directly in a variety of ways or as a starting point for processing in other ways. It is extensively used in infant meals, the diets of those allergic to cereals, and the diets of kids who are lactose intolerant since it is easily digested.

Due to the tiny size of its granules, taro starch has also been employed in industrial settings. Granules' compact size makes them perfect for use in aerosol-dispensing dusting treatments and cosmetic compositions like face powder. Many experts believe that starch may provide a replacement for petroleum-based plastics as the environmental effect of plastic wastes is becoming a significant problem. (Azhar Ahmed, Farukh Khan - March 2013)

Many nations are conducting research on the process of turning starch into biodegradable polymers. Either the starches are chemically modified or they are combined with other polymers to achieve this. Knowing the starch's chemical and physical properties is crucial for each of these procedures.

A carbohydrate called starch is made up of many glucose molecules connected by glycosidic linkages. All green plants synthesize this polysaccharide as a form of energy storage. It is the most prevalent kind of carbohydrate in the average person's diet and is found in high quantities in common foods including potatoes, wheat, maize (corn), rice, and taro. It is either utilized as it is harvested from the plant and is referred to as "native starch" or it is changed to achieve features and is referred to as "modified starch." (Sturkie's Avian Physiology 'Sixth Edition', 2015)

A white, flavorless, and odorless powder known as pure starch is insoluble in both cold water and alcohol. It is made up of two different kinds of molecules: branching amylopectin and linear and helical amylose. Starch typically comprises 20 to 25 percent amylose and 75 to 80 percent amylopectin, depending on the plant (Wikipedia, 2022).

1.2 Application of Starch

It is clear that starch has transitioned from its original use as a food to that of an essential medication. Based on its sticky, thickening, gelling, swelling, and film-forming qualities as well as its global availability, cheap cost, and regulated quality, starch is widely used in medicine. Given the aforementioned, it is ignorant of the role that starch plays in the therapeutic success of bioactive moieties to believe that it is still just a typical inactive excipient. The starch content of taro corms can reach over 85% of the total dry mass. It is anticipated that the starch, amylose, and dry matter quality of taro products would all have a favorable impact on the product's quality features. Additionally, it serves as a component in many culinary and pharmaceutical products, which supports its economic viability.

Starches are currently being used in a wide range of culinary and non-food applications, which is mostly due to their affordability, accessibility, biodegradability, and neutral behavior. Due to their physicochemical properties and low processing appropriateness, native starches are deemed unsuitable for industrial usage. Native starch granules have a limited usage in industrial applications because they are inert, incapable of being digested by enzymes, retrograded with concomitant syneresis, and sensitive to changes in temperature, pH, and shear stress.

1.3 Botanical Classification of Taro

Table 1: Classification of Taro Root.

Rank	Scienticfic Name
Kingdom	Plantae (Plants)
Subkingdom	Tracheobionta (Vascular plants)
Super division	Spermatophytes (Seed plants)
Division	Magnoliophyta (Flowering plants)
Class	Liliopsida (Monocotyledons)
Subclass	Arecidae
Order	Arales
Family	Araceae (Arum family)
Genus	Colocasia Schott (colocasia)
Species	*Colocasia esculenta* (L.) Schott (Coco yam)
Synonyms	Alocasia dussil Dammer Alocasia illustris W. Bull

1.4 Health Benefits of Taro Root

Taro has lots of health benefit, such as -

- ✓ It contains a lot of fiber and other vital nutrients like Manganese, Vitamin B6, Vitamin E, Potassium, Copper, Vitamin C.
- ✓ May lower blood sugar levels in persons with type 2 diabetes by about 10 mg/dl.
- ✓ It helps to decrease the risk of heart disease and also reduces the risk of cancer.
- ✓ It also helps to lose body weight.

- ✓ Short-chain fatty acids are produced when stomach bacteria digest taro fibers as a result it nourishing and fortifying the intestinal lining cells.
- ✓ Taro is good for those people who has allergic to milk or cereals.

Source: **(**healthline taro-root-benefits)

1.5 Composition of Taro Root

One cup of taro root has:

- ✓ Calories: 187
- ✓ Protein: 1 gram
- ✓ Fat: 0.1 grams
- ✓ Carbohydrates: 39 grams
- ✓ Fiber: 7 grams
- ✓ Sugar: 1 gram

*Source****: webmd./diet/health-benefits-taro.***

Figure 1: Taro root

1.6 Objective of the study

The aim of this work is to extract the starch from Taro (*Colocasia esculenta*) and evaluate its physicochemical properties. The specific objective was

- To analyze the proximate composition like ash content, moisture content etc.
- To determine yield %, water holding capacity, porosity of taro starch, bulk density, true density

Chapter Two

Materials & Methods

2.1.1 Raw Materials (Rm) Collection

The list of raw materials is given below:

- ✓ Taro
- ✓ Distill Water

2.1.2 Chemicals/Reagents Used

No chemicals or reagents has been used in this product development.

2.1.3 Apparatus/Equipment's Used

List of apparatus that has been used in making the product:

- ✓ Measuring Balance and Bowl
- ✓ Blender machine
- ✓ Tray and Spatula
- ✓ Zipped bag
- ✓ Beaker
- ✓ Measuring Cylinder
- ✓ Aluminum Foil paper
- ✓ Drying oven
- ✓ Knife
- ✓ Chopping Broad
- ✓ Muslin cloth

2.1.4 Preparation

The Taro starch has been extracted as mentioned by Hasmadi, M., Harlina, L., Jau-Shya, Lee, Mansoor, A.H., Jahurul, M.H A. and Zainol, M.K. 2 May 2021. The whole process is describe below

- ✓ First, I have collected 1 kg taro.
- ✓ After that I peeled the taro by using knife. The waste amount was 185gm.
- ✓ Then I weighed the taro by using a measuring balance.
- ✓ I cut the taro into small pieces by using knife and chopping board.
- ✓ I took 10-liter water in a beaker.
- ✓ I blended the taro pieces with required amount of water.
- ✓ I have mixed taro paste in 10-liter water.
- ✓ I filtered the taro paste water five times by using a muslin cloth (2 layers)
- ✓ After that I removed the filtered fiber and placed it in dustbin.
- ✓ I stored the mixture in a beaker for 3 hours to form sediment.
- ✓ After the sedimentation process is completed, I removed the water from the beaker.
- ✓ I poured the sediment in tray which was wrapped by aluminum foil paper.
- ✓ I placed the tray into oven for drying for 24 hours at 45 degree C continuous (For starch extraction).

- ✓ After drying was completed, I again blended for producing starch powder.
- ✓ Finally, I stored the extracted starch powder at room temperature into air tight zip lock bag to save it from moisture absorption and contamination.

2.1.5 Process Diagram

Figure 2: Extraction of taro starch

2.2.1 Determination Of Water Holding Capacity

Principle

The amount of water that a certain sample can hold against the pull of gravity is known as its water holding capacity. The main factors affecting taro starch's ability to hold water are its texture and its organic content. Smaller particle size taro starch has a larger surface area and may contain more water than larger particle size taro starch, which has a smaller surface area. The ability of any sample to hold onto its own water content when exposed to outside pressures like cutting, heating, grinding, or pressing is known as water holding capacity. Determination of water holding capacity according to the method (2-F.B. Ganongo-Po, L. Matos, A. Kimbonguila, C.B. Ndangui, J.M. Nzikou and J. Scher CHAIRE) with Slight change.

Materials

- ✓ Taro starch: 1 gram
- ✓ Centrifuge tube and Distill Water 10 ml
- ✓ Centrifugal machine
- ✓ Magnetic stirrer
- ✓ Measuring Balance

Calculation

Water holding capacity = (Initial – Final) amount of liquid

Procedure

- ✓ First, I took 1 gram of sample in the centrifuge tube.
- ✓ After that, I added 10 ml of water in the same tube
- ✓ Then, I put the tube in magnetic stirrer for 25 minutes at room temperature.
- ✓ Next, I placed the tube in the centrifugal machine.
- ✓ I centrifuged the sample at 1500 rpm for 20 minutes.
- ✓ Finally, I observed and calculated the result.

Flow chart

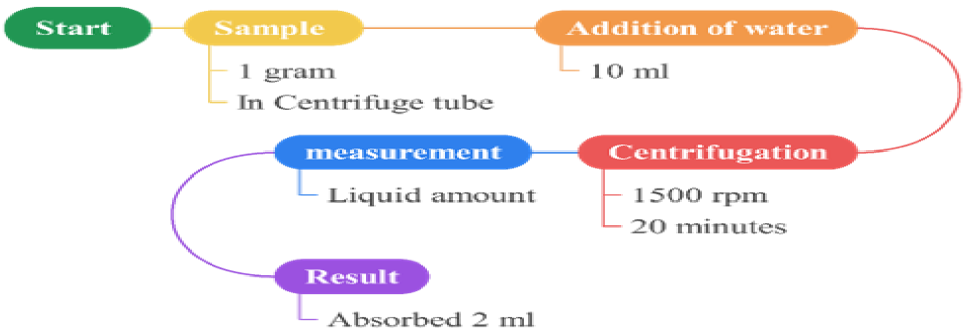

Figure 3: Water holding capacity of taro starch

2.2.2 Determination of Bulk Density

Principle

A dry sample's bulk density is calculated by dividing its mass in solids by its volume. If the sample is taken from a container with a known volume, calculating the bulk density and the sample's volume are simple affairs of dividing the dry mass by the volume.

Apparatus/Materials

- ✓ Measuring Balance
- ✓ Measuring Cylinder
- ✓ Sample 2 gram

Procedure

- ✓ First, I took 2 grams of sample by using measuring balance.

- ✓ I pour the sample into measuring cylinder.
- ✓ I observe and took the reading from the measuring cylinder.

Calculation

$$\text{Bulk density} = \frac{weight\ of\ sample\ (gram)}{Volume\ of\ sample\ (\text{cm3})}$$

Flow chart

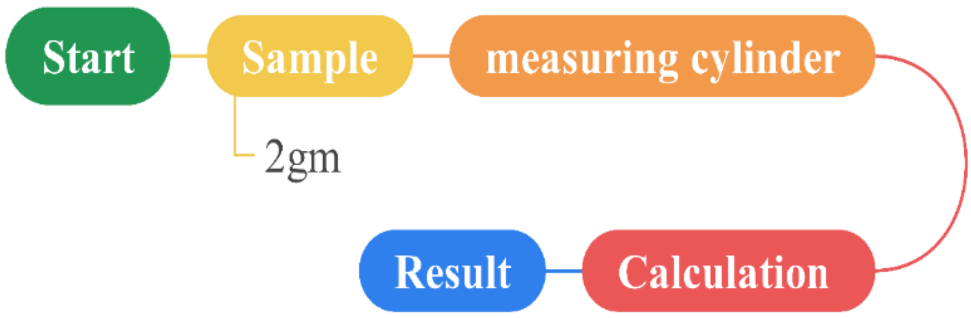

Figure 4: Bulk Density of Taro Starch

2.2.3 Determination of True Density

Principle

True density is the ratio of mass to volume of a sample, calculated without taking into account the material's pores (true volume). Particle volume and density are concepts used to describe granular materials. Determination of True density according to the method (3) Dr. Shilpi Prasad.

Materials

- ✓ Piceno meter
- ✓ Sample
- ✓ Measuring Cylinder
- ✓ Distill Water
- ✓ Measuring Balance
- ✓ Measuring Cylinder

Procedure

- ✓ First, I took the weight of the Piceno meter.
- ✓ Then, I took the sample weight as 1 gram
- ✓ Next, I poured the water in Piceno meter and took the weight
- ✓ Again, I took the weight of Piceno meter containing water and sample.

Calculation

Weight of Piceno meter, a = 12.5 gm
Weight of Piceno meter + sample, c = 13.5 gm
Weight of Piceno meter + water, b = 48.5 gm
Weight of Piceno meter + sample + water, d = 48.9 gm
True density = $\frac{c-a}{(b-a)-(d-c)} \times density\ of\ water$

Flow chart

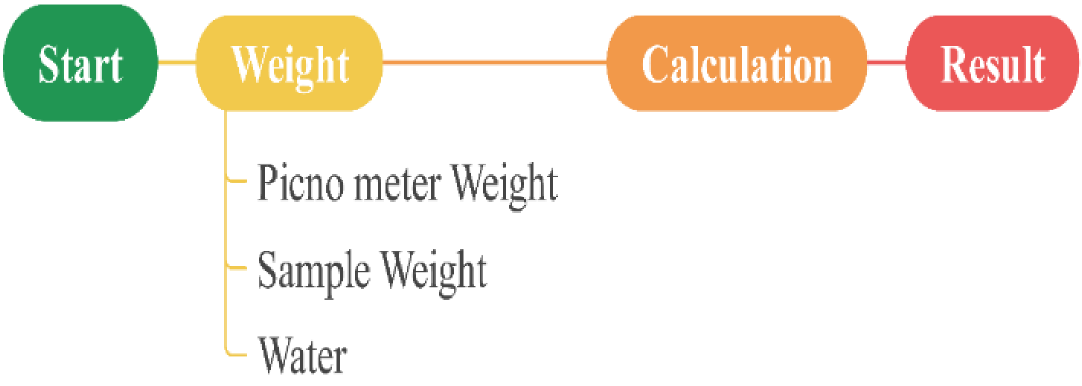

Figure 5: True Density of Taro Starch

2.2.4 Determination of Porosity

Principle

Food samples often develop pores as a result of the physical processes of dehydration. The physical characteristics and quality of dried foods are substantially impacted by the pore development during drying. In order to accurately anticipate the transport processes in the drying sample, it should be taken into account. A solid sample's porosity is determined by how much (or how much volume) of the solid sample is made up of empty space. Determination of Porosity according to the method (3) Dr. Shilpi Prasad.

Materials

- ✓ Piceno meter
- ✓ sample 1 gram
- ✓ Measuring Cylinder
- ✓ Distill Water
- ✓ Measuring Balance

Procedure

- ✓ First, I had determined the bulk density which is 0.5g/cm^3(From experiment 3.2)
- ✓ Next, I had determined the true density which is 1.66 gm/ml (from experiment 3.3)

Calculation

$$\text{Porosity} = 1 - \frac{\textit{Bulk density}}{\textit{True density}} \times 100$$

Flow chart

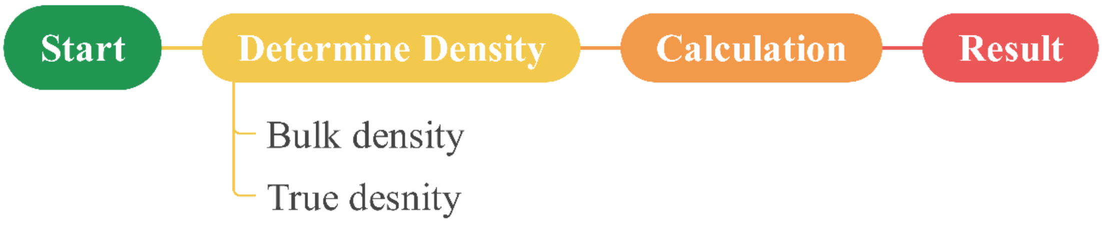

Figure 6: Porosity of Taro Starch

2.2.5 Determination of Moisture Content

Principle

One of the most significant and often used metrics in the preparation and testing of meals is moisture determination. Moisture content is directly important economically to both the processor and the customer since it is inversely correlated with the amount of dry matter in a product. This test is done by **automatic moisture** analyzer.

Materials

- ✓ Sample 1.1 gram
- ✓ Moisture analyzer
- ✓ Measuring Balance

Procedure

- ✓ First, I turned on the moisture analyzer.
- ✓ Then I calibrated the moisture analyzer
- ✓ I took 1.1 gram of sample in the moisture analyzer.
- ✓ Then I pressed the start button.
- ✓ After 3 minutes 10 sec, it gave an alarm.
- ✓ I observed the moisture analyzer display for information.

Flow chart

Figure 7: Moisture Content of Taro Starch

2.2.6 Determination of Ash Content

Principle

The inorganic residue (minerals) left over after the complete oxidation of organic matter is represented by the ash content. The sample is heated at 600 °C in a muffle furnace during dry ashing. Determination of ash content according to the method of (4) MicroChem's Experiments.

Materials

- ✓ Sample 2 gm
- ✓ Crucible
- ✓ Electric Muffle Furnace
- ✓ Measuring balance
- ✓ Desiccator
- ✓ Spatula
- ✓ Metal tong
- ✓ Heat resistant gloves

Procedure

- ✓ First, I weighed the empty crucible.
- ✓ then I took 2-gram sample into the crucible.
- ✓ I placed the crucible inside the muffle furnace at 600 degree C for 6 hours.
- ✓ After six hours, I waited 1 hour for decreasing the temperature.
- ✓ placed the crucible into the desiccator for cooling.
- ✓ I took the weight and did the calculation.

Calculation

Weight of empty crucible, W 1 = 24.1 gram
Weight of sample, W s = 2 gram
Weight of crucible with ash, W 2 = 24.12 gram

$$\%Ash = \frac{w2 - w1}{ws} \times 100$$

Flow chart

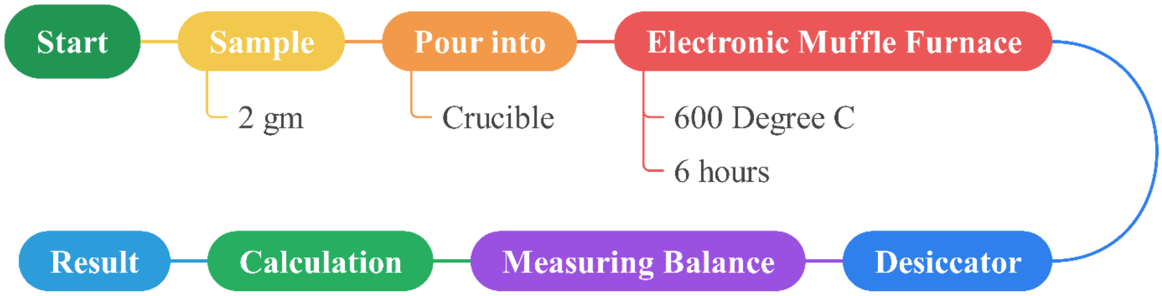

Figure 8: Ash Content of Taro Starch

2.2.7 Determination of Yield Percentage

Principle

The formula for percentage yield is determined by dividing experimental yield by theoretical yield and multiplying the result by 100. The percent yield is 100 percent if the theoretical and actual yields are equal. Because the actual yield is frequently lower than the theoretical value, the percent yield is typically lower than 100%. The method is according to the 1. (Hasmadi, M., Harlina, L., Jau-Shya, Lee, Mansoor, A.H., Jahurul, M.H A. and Zainol, M.K. 2 May 2021)

Materials

- ✓ Raw taro
- ✓ Sample- Taro starch
- ✓ Measuring Balance

Procedure

- ✓ First, I took the raw taro weight (w1 = 815 gram)
- ✓ Then I took taro sample weight (w2 =10gram)
- ✓ I did the calculation

Calculation

$$\% \text{ yield} = \frac{w2}{w1} \times 100$$

Flow chart

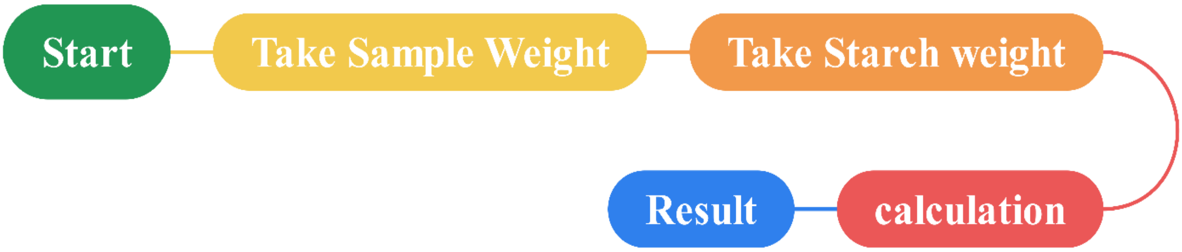

Figure 9: Yield Percentage of Taro Starch

Chapter Three
Result
&
Discussion

3.1 Results and discussion

The taro starch has been extracted following traditional way and obtained starch proximate composition as well as physical quality has also been analyzed in the NFE laboratory. As proximate composition moisture content and ash content are analyzed. Water holding capacity, bulk density, true density and porosity are analyzed for the physical quality. Finally the % yields also determine. The proximate compositions are shown in the table 2.

Table 2: Proximate composition of taro starch.

Sl No.	Parameters	Results
1.	Moisture content	4.06 %
2.	Ash content	5 %

Taro starch contained around 4.06% moisture which comply with the study of (Galicia *et.al.,* 2022). The ash percentage was 5. This ash percentage indicates that the taro starch is also a good source of minerals.

Table 3: Physical properties and yield percentage of taro starch.

Sl No.	Parameters	Results
1	Water holding capacity	2 ml
2	Bulk density	0.5 g/cm ^{3}
3	True density	1.66 gm/ml
4	Porosity	69.9%
5	% Yield	1.23%

The physical properties of taro starch are shown in the table 3. The obtained starch has a true density is of 1.66 gm/ml. The water holding capacity of taro starch is 2 ml, yield percentage is 1.227%, porosity 69.9% and the bulk density of taro starch is 0.5 g/cm ^{3}. The yield percentage of taro starch was 1.23%.

Chapter Four Conclusion

Conclusion

Taro starch has been extracted traditional way from raw taro root. Taro starch contained 4.06% and 5% moisture and ash respectively. The physical properties of taro starch was as true density is of 1.66 gm/ml, water holding capacity is 2 ml, yield percentage is 1.227%, porosity 69.9% and the bulk density is 0.5 g/cm^3. The yield percentage of taro starch was 1.23%. The yield percentage was too low this is because of higher moisture content of taro and wastage during processing. Further study is required to increase the yield percentage of starch.

Chapter Five
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