

Tapioca is considered an important crop to Thailand economy due to its endurance of drought, easy breeding and low cost for planting. As a result, it is quite popular for planting among agriculturers, in particular, those with low income. Tapioca can be planted in any areas except the area with heavy rainfall or alkaline soil. Therefore, Tapioca is found scattered in every parts of Thailand, in particular, in north-eastern and eastern Thailand, where Tapioca occupies the most planting. The overall tapioca root products of the country account for 16-18 million ton/year. Thailand is considered one of the largest tapioca root producers (The world tapioca root production amounts to 160 million ton). The use of tapioca ranges from primary processing among agriculturers to the use as raw material in large industries.

Benefits of Tapioca

Fresh root

1. Made in various forms of food by means of boiling, steaming, grilling, baking, boiling in syrup, etc.
2. Used as animal feed from fresh root, starch trash, root peel.
3. Used as raw material in the production of tapioca starch, tapioca chips, pellets, etc.

Leaf

1. Cook in different dishes like fresh or boiled vegetable eaten with Thai source, curry and soup.
2. Used as animal feed ingredient in a form of fresh leaf, dried leaf mixed with concentrated veterinary food and mixed feed

Stem

1. Used as varieties for planting.
2. Used as animal feed mixed with the stem tip and fresh leaves.

Major Content of Tapioca Root

Tapioca root	Volume (100 grams/weight)
Water	60-75
Pell	4-14
Flesh(starch)	25-40
Tapioca flesh	Volume(100 grams/weight)
Starch	70-85
Protein	1-5
Pulp	1-3
Ash	0.1-0.5
Fat	3-8

Seed

Good oil extract of tapioca seed can be used in pharmaceuticals.

Tapioca is a plant storing starch in a root. When the plant functions the process of photo synthesis using chlorophyll in a leaf, the starch in a form of Carbohydrate is stored in a root. The process of starch synthesis and starch storage differently emerges in regard to a variety used in planting and planting and harvest conditions.

Usage of Tapioca

1. Food

Tapioca root mostly consumed as food belongs to a sweet type which contains the lowest poisonous acid. Tapioca root can be eaten as dessert such as grilled tapioca, tapioca in syrup. Tapioca generally planted contains high starch content so it takes time in boiling. After being peeled, tapioca root needs cleaning to get rid of its bitter taste before boiling in a pot at least 30 minutes and then make a syrup fill. In case of grilled tapioca, make sure that is cooked before eating. If the bitter taste still remains, avoid eating it as it contains poisonous acid.



2. Tapioca Chip Industry

Tapioca processing close to agriculturers is tapioca chips production. The process of transforming tapioca root starts from cutting fresh root into small pieces and dry all of them. After that it is used as raw material in animal feed and tapioca pellets industries. Presently, tapioca chips is popularly used as animal feed as it is cheap and available all year.

3. Tapioca Pellet Industry

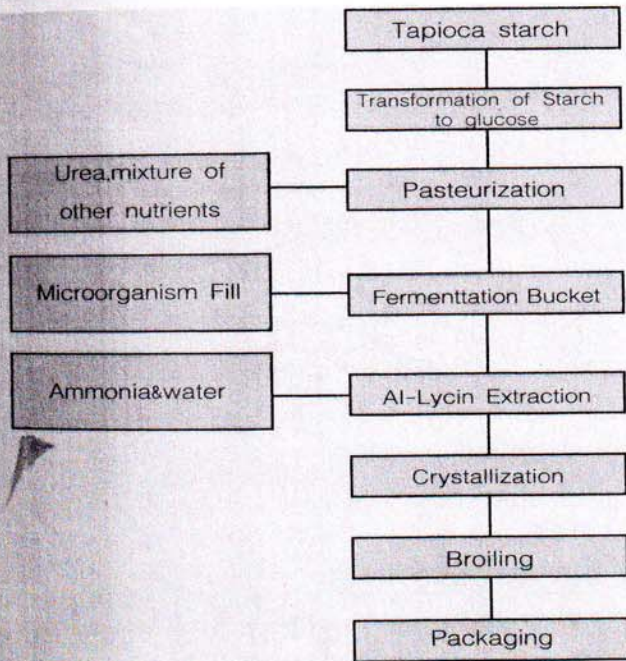
Tapioca pellets are made by pressing tapioca chips with a pressing machine in the condition of heat and pressure. When pressed, tapioca pellets are in a shape of 2-3 centimeters long sections with diameter of 1 centimeter and contain 14% moisture. The pellets are exported for the use as raw material for animals feed due to their high content of starch (more than 65%) which provides calories for animals. Besides, Tapioca pellets are advantageous as they are easily transported with a machine like cereal, and dust-free like chips.

4. Tapioca Chip Industry

Of all the countries with high planting of tapioca such as Brazil, Nigeria, Indonesia, Thailand is the only country using the most tapioca in tapioca starch industry. Thus, Thailand becomes the largest tapioca starch manufacturers in the world with production capacity of more than 2 million ton/year. With advanced technology of production higher than many countries, Thailand has carried out technology transfer to neighboring countries. Tapioca starch in general is considered "Thai starch" as it is a product made by THAI in the greatest volume with high quality and the cheapest price.

4.1 Properties of tapioca starch

The special properties of tapioca starch lies in its shining white look. When mixed with water and heated, it turns to be a transparent gum. In other words, "Thai starch" is a clear white type without smell, taste and color, which is suitable for the use as a food ingredient.



Picture 2: Production Process of Al-Lycine

4.2 Usage of tapioca starch

1. Daily food

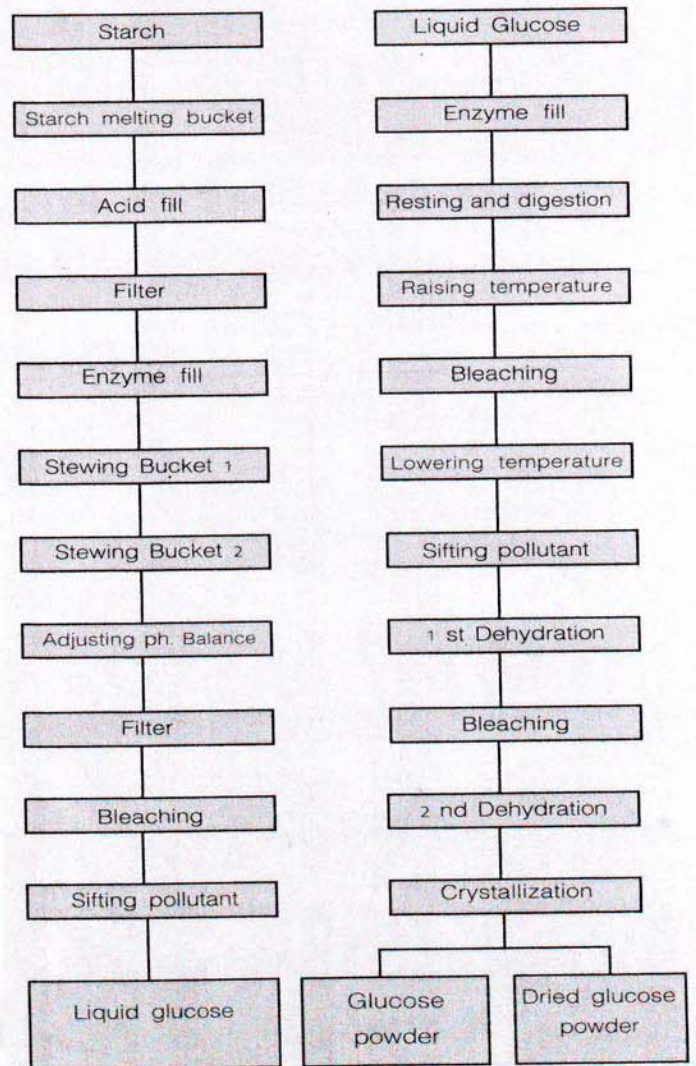
Tapioca starch is mostly consumed in a household. Each of Thai people consumes tapioca starch approximately 7 kilograms/year as a food ingredient in houses or shops. In case of recipe improvement or higher consumption of the starch in a household, the volume of tapioca starch use will be increasing.

2. Modified starch industry

Most tapioca starch is brought into use as raw material for modified starch via chemical reaction to create the starch with special properties of higher stickiness and more resistance to heat and acid. Thai Tapioca starch fits the production of modified starch due to its pure content (little content of pollutant like Protein, ash, etc.)

3. Seasoning powder and Lycin Industry

Seasoning powder and Lycin are amino acid which is main content of Protein. Thailand is the largest producer of these products in the world. The seasoning powder industry consumes the greatest tapioca starch of the other industries. While Lycin is used as an ingredient of animal feed. The production process of Lycin is shown in Picture 2.



Picture 3: Production Process of Liquid Glucose and Glucose Powder from Tapioca Starch

4. Sweetening agent Industry

Sweetening agents like glucose syrup, fructose syrup, Sorbitol and others are needed in candy and toothpaste industries and pharmaceuticals. The production process of fructose syrup and Sorbitol from tapioca is shown in Pictures 4 and 5.

5. Food and sago industries

In food industry, tapioca starch is generally used to create stickiness, shining shading and weight of food content. Meanwhile, sago is made by forming the starch in a small round shape with a vibrating machine and sifting to choose a needed size. Then, the selected sago is further roasted and broiled to make sago pellets (Sago pellets originally made of sago palms).

6. Paper industry

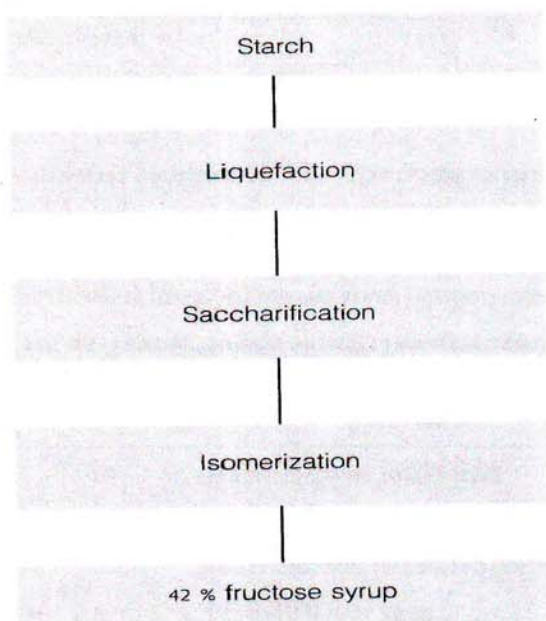
Tapioca starch is used as paper content about 5% of paper weight (except toilet paper). In each year, the use of paper is rising; thus, a greater amount of modified starch is needed in the paper industry.

7. Textile industry

In textile industry, modified starch of 1% in weight is necessarily used to coat thread.

8. Plywood and glue industry

In the production of glue, tapioca starch is used to mix with chemicals to create paper glue. Besides, a piece of plywood contains 0.4 kilo of the starch.

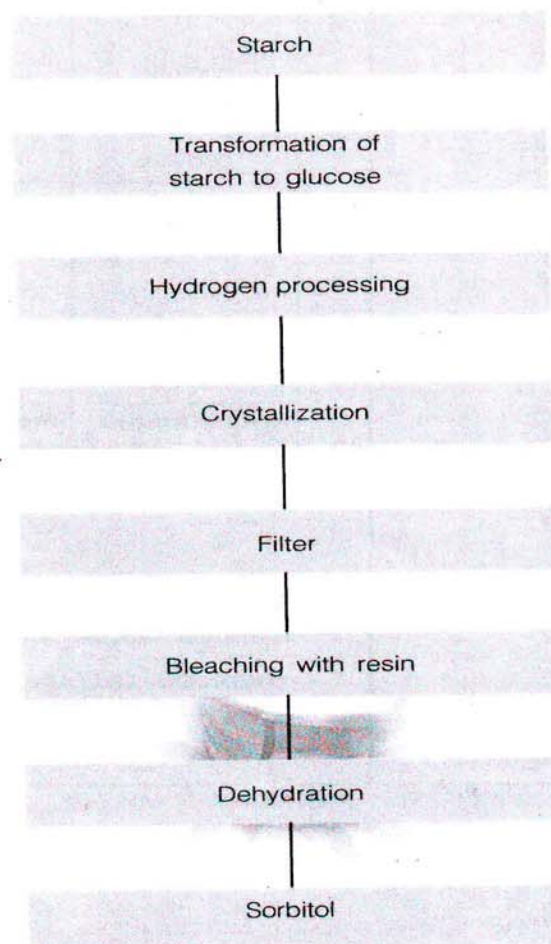


Picture 4: Production Process of Fructose Syrup from Tapioca Starch

9. Alcohol industry

Alcohol is made by turning starch of the raw material into glucose and then fermenting with yeast to transform the glucose into alcohol. The created alcohol is processed to be filtered and distilled to yield 99.5% Pure alcohol. Pure alcohol of 10–15% can be used as a blend with gasoline to raise octane, which is used to substitute unleaded gasoline or the so-called Gasohol. The Gasohol can be used as fuel oil with general automobiles with no requirement of modified engines and with unleaded quality, it is considered environmentally friendly fuel oil.

Moreover, tapioca is widely used in other industries for example, in the production of pills, it is used as a content increasing agent and in animal feed industry, it is used as an agent holding the content. The outlook of tapioca use in industries is likely to be continually increasing.



Picture 5: Production Process of Sorbitol from Tapioca Starch