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EXTRACTION AND CHARACTERIZATION OF STARCH FROM THE TUBER OF *CRINUM* SPECIES

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ABSTRACT: Starch is a natural polymer and is a group of polysaccharides composed of glucopyranose units joined together by glycosidic linkages. Starch is widely used in the food and pharmaceutical industries for various applications. In plant starch is found in stem, roots, leaves, seeds, fruits and tubers. Hence this study was conducted to isolate and characterize starch from tuber of Crinum species. In this work starch from tuber of Crinum was extracted and various properties like starch yield, amylose and amylopectin content, and granular morphology has been done. The result showed that there was a sufficient amount of starch yield. The amylose content was relatively high as compare to the other plants and amylopectin content was low. It was also observed that the starch granules are oval in shape. Thus starch of Crinum tuber shows good properties and could serve as alternatives for the production of industrial products that may require starch.
Key words: Starch, amylose, Crinum, tuber, starch yield.

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INTRODUCTION

Starch is the most abundant carbohydrate reserve in plants and is found in leaves, flowers, fruits and different types of stems and roots. Starch is used by plants as a source of carbon and energy. Starch consists solely of glucose residues that are linked in two different forms, building up the two polymers amylose and amylopectin. Amylose is basically a linear chain with α-1, 4 linkages, whereas in amylopectin glucose residues are also joined by α-1, 6 linkages. Amylopectin is the main component in starch, comprising 70-80% whereas amylose consists of 15-30% of starch [1]. Starch occurs naturally in the plants and its percentage varies with the plant and also in different parts of the same plant. Corn (maize), wheat, rice, potato, tapioca, arrow root and sago are among the important sources of natural starches. Starches have also been extracted from other sources such as millet, oat, sorghum, lentils, peas, etc. Recently, starches from tuber which were also characterized. The starches were found to possess good physicochemical properties.

One tuber that gave a very good starch was Crinum tuber. The genus Crinum (belongs to family Amaryllidaceae) is an 'eye-catching group' of tropical and sub tropical Lilies distributed in almost every part of the world, mainly in Africa, Asia, Australia and America. Crinum plants are bulbous herbs with quite large globose to ovoid subterranean bulbs which often grow several inches in diameter with long necks up to 30 cm. Bulbs regularly propagate vegetatively and produce large clusters. Plants grow to a height of about 1m, depending on the species, and produce spirally arranged clumps of strap or linear shaped leaves and clusters of fragrant, red, pink, white or bicolor flowers borne terminally on an inflorescence axis about 1-1.5m long. Leaves spirally arranged, sessile, linear, strap-shaped or lanceolate, with smooth or scabrous edges. Seeds few, large, green, and globose or irregularly, compressed [10].

One of the tropical starch resources which have not been utilized for industrial application is Crinum tuber. However, extraction of starch has not been reported previously in the literature, hence the present study is designed with the objective to study the extraction of starch from Crinum species by using its tuber and characterization of starch using standard methods for potential industrial applications.

MATERIALS AND METHODS

1) SAMPLE COLLECTION AND PREPRATION

Fresh and healthy tuber of Crinum species were collected from Songadh, Tapi District of Gujarat. The tuber was peeled and washed thoroughly in water to remove soil and other foreign particles.

2) STARCH EXTRACTION

After the manual peeling and washing of Crinum tuber, the tubers were cut into small pieces and the sample were ground in a laboratory blender with distilled water. The ground slurry was then sieved and filtered using a coarse sieve and filter cloth respectively. Thereafter, the filtrate was allowed to settle for 2 hours, the resulting starch was washed three times with distilled water and allowed to settle for 21 hrs. After 21hrs, supernatant was decanted, the starch (wet) was dewatered manually and then oven dried at a temperature of 55˚C for 4hours. Finally the dried starch was collected in a container for further use.

3) STARCH YIELD

Starch yield was measured in percentage by comparing the weight of obtained starch (dry basis) with the weight of dry matter sample (Crinum tuber). The Starch Yield (SY) was determined by the equation:

$$SY\ (\%) = \frac{W_1}{W_2} \times 100$$

Where W_1 is weight of dried starch and W_2 is the weight of original sample (Crinum tuber) [9].

4) AMYLOSE AND AMYLOPECTIN CONTENT

This was determined by using the method of Williams *et al.* Amylose and Amylopectin content were then calculated using the equations (1) & (2) respectively:

Amylose content (%) = 3.06 × absorbance × 20…… (1)

Amylopectin content (%) = 100 - % of amylose content…… (2)

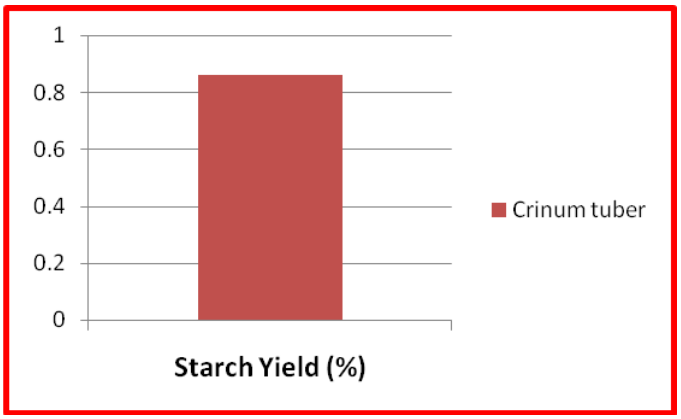
(Where absorbance was read using spectrophotometer at 620nm) [8]

5) STARCH GRANULAR MORPHOLOGY

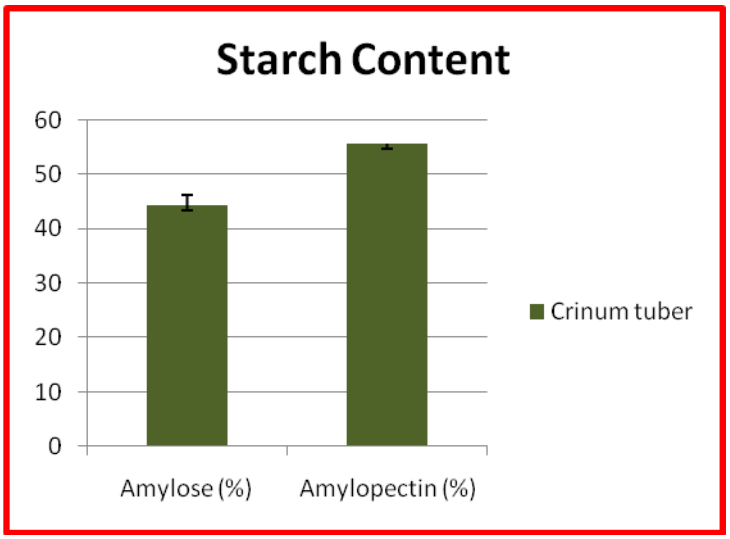
Granular morphology was determined using an optical microscope. The starch sample was suspended in glycerin to ensure uniformity of the test sample. One drop of the suspension was placed on a slide and then viewed under microscope at magnification of 100x [4].

RESULT AND DISCUSSION

As studies says tuberous plants contains a starch in a sufficient amount and Crinum is one of the tuberous plant hence its tuber is rich in starch. When the starch was extracted from Crinum tuber then it gives white powdered starch.



Graph-1: Showing Starch Yield (%)



Graph-2: Showing Amylose and Amylopectin Content (%)

Graph1 shows that when starch was extracted from Crinum tuber then the total starch yield was 0.86%±0.18. Graph 2 shows that starch is made up of amylose and amylopectin hence in starch of Crinum tuber the amount of amylose is 44.37% ±1.76 and amylopectin content is 55.63% ± 1.74.

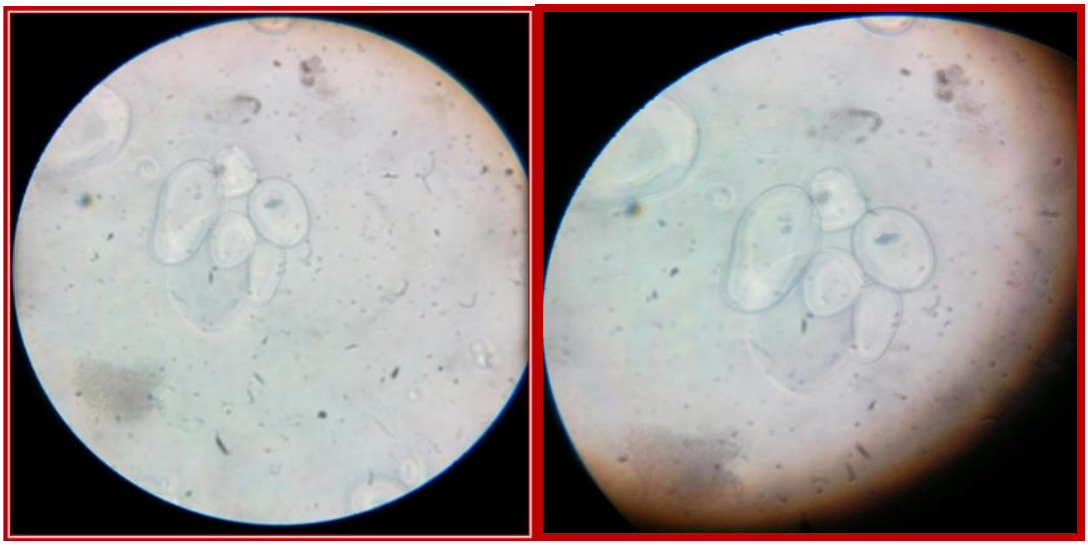


PLATE 1: Optical image of Crinum starch showing granular shapes at 100x magnification.

The optical image in plate 1 shows the presence of starch granules which are oval in shapes.

DISCUSSION

Our experiment shows that starch could be extracted from the Crinum tuber and it gives a sufficient amount of starch. The amylose content of starch determines its properties (water binding capacity, thickening, gelling etc.) and as a result dictates most of its uses. The result obtained shows significant variations. The amylose contents for all isolated starches were lower than the values reported for Crinum. According to Uttapap *et.al,* mung had 28%, cassava 18%, canna 25% of amylose content [7] but Crinum starch had 44.37% and as compare to other starch amylopectin content of Crinum starch was low. Crinum starch shows the presence of starch granules which are oval in shapes. The starch granules of Crinum tuber compare well with the result of Hassan *et al.* and were observed to be similar to mango seeds but different from corn, rice, jackfruit seed, wheat, potato starch granules [4].

CONCLUSION

This study has shown that the chemical process is a promising method for extraction of starch from Crinum tuber. It is relatively simple and low cost process and it produces good quality of starch. The starch also exhibited some physicochemical properties such as starch yield, amylose and amylopectin content, granular morphology. The crinum starch shows good properties and could serve as alternatives for the production of industrial products.

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