STUDIES ON STARCHES FROM INDIGENOUS GRAINS AND TUBERS.

PART IV. CASSAVA STARCH.

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Cassava starch is prepared from the tubers of the manioc plant. Manioc is not considered to be a very important crop in India. It grows all over the country, especially in Travancore and other parts of Southern India. There are two varieties of manioc—one sweet (*Manihot aipi*) and the other bitter (*Manihot utilissima*)—that are generally cultivated. The tubers of the sweet variety are generally consumed by the poorer class of people. The bitter variety is poisonous but the tubers are larger and richer in starch than those of the sweet variety (*Bull. Imp. Inst.*, 1934).

At present there are no reliable figures for the yields per acre but about ten tons may be considered to be a reasonable estimate. Bacon (*Phillipine Jour. Sci.*, 1908, **3A**, 93) holds the view that with the introduction of the proper methods of handling cassava, it will furnish the cheapest source of starch in the world.

Archbold (*Jour. Soc. Chem. Ind.*, 1903, **22**, 63) showed by working on a semi-large scale that cassava starch can be used as a very good substitute for maize starch and can be produced at a much cheaper rate.

EXPERIMENTAL.

The tubers (sweet variety) used in the present study were obtained through the courtesy of the Director of Agriculture in Travancore. The fresh materials contained 65–70 per cent. of moisture. They were cut into chips and dried in the sun. The dried product had the following average composition:—moisture, 11.5; crude protein, 2.8; ash, 1.2; and starch, 70.0 per cents. respectively.

For the preparation of starch, the fresh tuber itself was used. The tuber was first washed thoroughly to remove adhering dirt. This operation is very important as the final whiteness of the product depends largely on it. The tubers were then soaked overnight in water so that the skin may be loosened. This was followed by slicing and grinding in the edge-runner until a thick pasty mass was obtained. The paste was screened through a 90-mesh sieve. The debris remaining on the sieve was again ground and screened as before. The milky suspensions obtained from the two operations were mixed together and allowed to settle overnight. The supernatant liquid was then syphoned off

and the thick suspension of crude starch was centrifuged (in a perforated drum) and dried at 50° in a current of air.

The crude starch thus obtained was about 90 per cent. pure. To purify it still further, it was treated with various concentrations of alkali using one part of dry material to 3 parts of alkali solution. The suspension was kept for 24 hours with occasional stirring. They were then washed free from alkali and the starch lixiviated out and allowed to settle. The protein and colouring matter were removed by alkali, while the other non-starchy materials were separated by lixiviation. The purity of the different samples was then determined (*A.O.A.C.*, 1930). The results are given below (Table I) :—

TABLE I.

Alkali per cent.	Yield of starch on fresh weight	Percentage of starch in the preparation
0·2	21·7	94·8
0·3	21·4	95·5
0·4	20·9	96·2
0·5	20·2	96·6

It may be seen from the above that even 0.4 per cent. alkali was quite sufficient for obtaining a useful commercial preparation.

Procedure for the extraction of starch.—The tubers were washed thoroughly and cut into slices. The latter were steeped for a day and ground into fine pulp with water. The pulp was then sieved (90-mesh) and the milky suspension allowed to settle overnight. The following morning the supernatant liquid was syphoned off and treated with dilute alkali in such a way that the final concentration of alkali would correspond to 0.4 per cent. The starch was then lixiviated out as usual, after allowing the alkali to act for 24 hours. In this manner about 14 per cent. of starch was obtained, calculating on the fresh weight of the tubers. The remaining part of the starch (about 8 per cent.) was not recovered by lixiviation as it settled down along with the cellulosic material. This difficulty was not realised in the preliminary studies but was only encountered when the materials were handled on a semi-large scale.

In order to recover the remaining starch, it was essential that the suspension should be centrifuged so as to separate the major part of the starch from the adhering cellulosic material. It was, therefore, spun in a hydro-extractor having a cloth against the drum. Two layers thus separated. The top layer, which was mostly cellulosic, was scraped out. The bottom layer consisted mostly of starchy material and was further purified by lixiviation. Thus, the remaining starch (about 7 per cent.) was recovered. By this process, about 21 lbs. of starch and 10 lbs. of cellulosic pulp was obtained, from 100 lbs. of fresh tuber.

Average composition of pulp.—The pulp gave, on analysis, nitrogen, 0.3 per cent.; ash, 1.2 per cent; and traces of phosphoric acid. This can be fed to cattle, but it does not appear to possess much nutritive value.

The preparation of starch (final product) had the following average composition:—moisture, 12.0; nitrogen, 0.06; starch, 96.0; and ash, 0.35 per cents., respectively. The viscosity approached very near to that of potato starch (commercial). A comparative viscosity study with some of the commercial preparations was then carried out. The results are given below (Table II):—

TABLE II.

Source of starch	Percentages		Rate of flow in secs. in Ostwald's viscometer of 2 per cent. gel, at 26°C.
	Nitrogen	Starch	
Control (distilled water)	..	..	90
Sago	..	96·3	542
Maize (corn)	0·43	95·8	1220
Jowar	0·45	95·6	1215
Bajra	0·40	95·9	1250
Potato	0·08	94·6	2820
Cassava	0·06	95·1	2715

From the table, it may be seen that the cassava starch is better than maize and jowar starches and slightly inferior to potato starch so far as viscosity is concerned. It can, therefore, be used as a suitable substitute for potato starch in textile industry.

The starch has been found to be suitable for use in textile sizing.

SUMMARY.

1. A simple method for the preparation of cassava starch has been outlined.

2. The starch has a viscosity approaching that of potato starch and can be utilized as a substitute for the latter.