

# STUDIES ON STARCHES FROM INDIGENOUS GRAINS AND TUBERS. PART III. RAGI STARCH.

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Ragi or Marua (*Eleusine coracana*) is grown extensively in Mysore and in the drier parts of the Madras Presidency, and serves as a staple food for a large section of people in those areas. It is also grown to smaller extents in Bombay, Bengal, and other provinces. The grain is available in great abundance and, especially in certain seasons, it is fairly cheap. Its starch content is fairly high, some varieties containing as much as 65 per cent. The grain seems, therefore, to be eminently suitable for the manufacture of starch.

## EXPERIMENTAL.

The specimen of ragi used in the present study was obtained locally. The proximate composition of the grain as determined, by the A.O.A.C. (1930) methods, was as follows:—Moisture, 11.6; Protein, 7.8; Fat, 1.5; Sugar (as glucose), 1.7; Ash, 2.3 and Starch 58.6 per cents. respectively. The grains were ground dry and passed through a 90-mesh sieve. The sieving was, however, very difficult, the pores getting rapidly choked up. It was found desirable, therefore, to grind the grains after soaking in water. The grains were steeped in sulphurous acid (approximately 1 per cent.  $\text{SO}_2$ ) for two days so as to render them soft for grinding. They were then ground in the edge-runner and screened through the 90-mesh sieve. The residue left on the screen was merely skin with negligible quantity of starch adhering to it. The suspension which was dull red in colour was then centrifuged. The centrifuge was of the perforated drum type with a cloth filter. Two layers which formed against the drum were then separated. The top layer consisted of fat and protein admixed with starch. The bottom layer was mostly starch. It was not so much coloured as the top one and was about 89.5 per cent. pure.

*Purification of the bottom layer.*—This was treated with dilute caustic alkali solutions of different concentrations, using 4 parts of alkali for one part of the flour. The suspensions were allowed to stand for 24 hours and then washed free from alkali and dried. The starch contents of final products are given in Table I.

TABLE I.

Concentration of alkali as per cent.	0.5	0.6	0.7	0.8
Percentage of starch in the preparation	91.6	92.0	95.3	95.5

The preparation obtained by treatment with 0.7 per cent. of alkali was sufficiently pure for commercial purposes, though the colour of the preparation was slightly reddish. The yield of starch thus obtained was, however, only 45 per cent. A considerable portion of the starch was carried away with the top layer. The starch can be extracted from this layer by treatment with alkali, but since centrifuging involves an extra expenditure of energy, an attempt was made to extract all the starch in one single operation.

*Procedure.*—The suspension obtained after grinding and screening was allowed to stand overnight to settle. The supernatant liquid was then syphoned off and the thick suspension thus obtained then treated with dilute caustic soda solution having a calculated amount of caustic soda in it, so that the total alkalinity of the suspension corresponds to 0.8 per cent. This was allowed to stand for 24 hours with occasional stirring. When the starch had settled down, the highly coloured supernatant liquid was syphoned off. The precipitate was repeatedly washed and allowed to settle till it became free from alkali and water soluble colouring matter. The starch was then partially dried by centrifuging. The product was finally dried at 50°C. The starch finally obtained was fairly white in appearance and was about 95 per cent. pure. Bleaching improved the colour, but this was avoided since the viscosity of the starch was affected by this treatment. The viscosity of the gel of the unbleached starch, thus prepared, was found to be even less than that of the rice starch itself. A comparative flow of the gels of ragi and rice starches are given in the following table (Table II):—

TABLE II.

Source of starch	Percentages		Rate of flow in secs. in Ostwald's viscometer of 2 per cent. gel, at 28° C.
	Nitrogen	Starch	
Control (distilled water)	..	..	90
Rice	0.30	96.6	330
Ragi (unbleached)	0.36	96.2	300
Ragi (bleached)	..	..	285

Starting with 100 lbs. of ragi, 56 lbs. of starch and 14 lbs. of mixed feed containing bran and glutinous starch were obtained. Experiments with a number of samples of ragi showed that a yield of starch corresponding to 56-60 per cent. on the weight of the grains and 12-15 per cent. of mixed feed may be expected.

Some quantity of the ragi starch was sent to a big firm of cotton manufacturers in South India for their trial. They have reported that the material is quite suitable for textile purposes.

### SUMMARY.

1. A simple method for the preparation of ragi (*Eleusine coracana*) starch has been described. The product thus obtained is about 95 per cent. pure and is fairly white.

2. Ragi starch has a low viscosity, even lower than that of rice. The viscosity is further lowered by bleaching.

3. The starch has been found to be suitable for use in the textile industry.

### APPENDIX: A NOTE ON BAJRA STARCH.

Bajra or spiked millet (*Pennisetum typhodium*) is counted amongst the less important cereals. Although it covers an area of 13 million acres of land, it is considered as a poor food and a poorer fodder too and consequently fetches a very low price. Manufacture of starch out of the grain would probably give a very good return.

In the present study the grains were obtained from the local market. Starch was prepared from them by adopting the same procedure as in the case of Ragi starch.

The starch, thus obtained, was perfectly white in appearance, and unlike Ragi starch, was very smooth to the feel. The purity of the preparation was about 96 per cent. The viscosity of the gel approaches that of commercial corn starch. Calculating on the weight of the grains about 53 per cent. of starch was obtained.

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