Tamarind Seeds—an Indigenous Material

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TAMARIND trees (*Tamarindus indica, Linn*) are found in abundance throughout India, Burma and Ceylon. The fruit of the tree contains a sour pulp. The pulp consisting of pectin,[1] tartaric acid and reducing sugars is mainly used as an article of diet. Efforts have been directed to utilise this pulp[2] as a source of pectin and tartaric acid.[3-5] The reducing sugars present in the pulp could be fermented to alcohol[2-4] or to lactic acid.[6]

The estimated quantity[7] of tamarind seeds (a by-product of tamarind pulp industry) in India is about 1.32 lakh tons. The seed consists of a cream-coloured kernel surrounded by a dark reddish brown husk (nearly 30-40% of the whole seed) called the testa. Decortication of the seeds is usually carried out by two methods. In the first method, the testa is softened and detached by steeping the seeds in boiling water or in cold water. In the second method, the seeds are parched or fried at temperatures above 100°C and the testa subsequently removed by pounding and winnowing. Dutt and Chatterji[8] report a high yield of good quality kernels by an improved process of decortication taking advantage of the lesser density and finer state of subdivision of the testa. A patent by Bhathena[9] claims a clean, white and more wholesome material. According to this method tamarind seeds are subjected to the action of a saline bath in order to increase the moisture content followed by a treatment in molten wax or vegetable oil whereby the seeds get dehydrated. The separation of the kernels from the testa is carried out as usual.

The testa contains a reddish purple dye[10] which can be used for dyeing wool,[11] cotton and paper.

A typical composition[12] of tamarind kernel powder (TKP) is as follows: Moisture—10.2%, Albuminoids—15.2%, Oil—6.4%, Crude fibre—4.0%, Sugars—2.7%, Tannins—1.5%, Ash—3.0% and Polysaccharide—57.0%.

The kernel contains a polysaccharide or polyose (nearly 60%) originally called "pectin" and now known as gluco-galacto-xylan[13,14]. Damodaran and Rangachari[15] identified arabinose and glucose whereas Savur and Sreenivasan[13,14] and Ghose *et al.*[16] reported xylose, galactose and glucose among the products of hydrolysis of TKP. Although Sarkar and Mazumdar[17] could detect only xylose and glucose on paper chromatograms, the presence of the three sugars was confirmed by Rao and Beri[18] who carried out degradation of TKP under the action of *Cladosporium herbarum* (Pers.) Link., and more recently by Lewis and Johar[1] using paper chromatographic technique.

Krishna and Ghose[19] were the first to establish the utility of TKP as a sizing material for grey cotton yarn and as a source of commercial pectin[20]. They found that TKP is as satisfactory a sizing material as starch and in certain respects superior to gum karaya. The powder has also been consumed as a sizing material in the jute industry [7,16,21]. The tensile and abrasion resistance properties of jute yarn sized with TKP compare favourably with those sized with starches and flours. The quantity of TKP required to give satisfactory results is about half that of the starches

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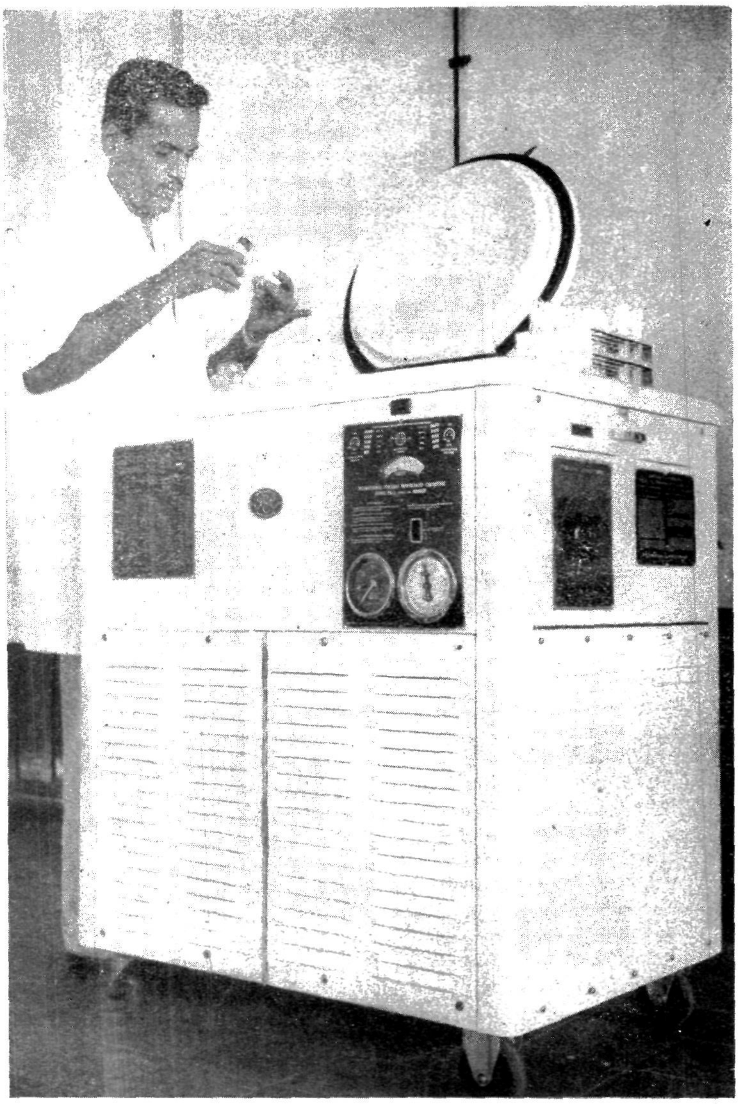

REFRIGERATED SUPERSPEED CENTRIFUGE
(FOOD TECHNOLOGY SECTION)

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or flours normally employed[22]. The viscosity of TKP paste remains the same during continued heating and agitation and thus differs from starches, which progressively thin down under these conditions. This may be due to a basic difference in the mechanism of swelling and dispersion of the granules of the two types of sizing materials[22]. A 5.0% solution of TKP in water gives a size having the same consistency as that of a 7.5% solution of tapioca starch[23]. The advantages of TKP as a sizing material[19] are : (i) absorption of size on the yarn, (ii) increase in strength of the sized yarn and (iii) smoothness of working in weaving. All these properties compare favourably with standard starch size.

Desai *et al.*[24] reported slightly higher susceptibility of TKP to mildew as compared with maize starch or farina but a lesser susceptibility as compared with wheat flour. Later, Macmillan *et al.* [25,26] confirmed that commercial grades of TKP and wheat flour are more prone to mildew attack than maize starch. The partial removal of albuminoids and soluble matter from TKP appreciably lowers its mildew susceptibility but the elimination of fat does not appear to have any significant effect on microbial growth.[26]

Savur and Sreenivasan[14] studied several methods for the separation of proteins from TKP. The most effective method of removal of proteins was found to be by dilution of the seed meal extract with water (1:6) and allowing it to stand over-night. Puri[27] has patented a process whereby a residue containing protein is obtained when a solution of TKP in a non-polar, non-hydrolysing solvent is passed through a sieve of 200 mesh.

There are certain drawbacks with TKP.[12] Firstly, unlike starch, the powder is not white in colour. This is partly due to the presence of testa which is not completely removed during the decortication process. The testa imparts a pink colour to the paste when the powder is boiled with water. The tannin material present in the testa produces a blue colouration when it comes in contact with the iron parts of the machinery. Hence, the testa content should be reduced to a minimum.

Secondly, TKP contains 6-8% oil or fat on account of which the powder possesses a sticky appearance and disagreeable odour. It cannot also be ground to a very fine powder. Bhathena[28] has patented a process for defatting TKP whereby a product is obtained that could be ground to the finest mesh and is devoid of offensive odour. This powder is superior to the undefatted one.

Tamarind seed oil has been examined[29,30] and the reported component fatty acids[31] are palmitic, stearic, arachidic, behenic, oleic and linoleic. Sitosterol[31] is present in the unsaponifiable matter of the oil.

The original confusion in regard to the tamarind seed polysaccharide being termed a pectin[32] (now shown to differ fundamentally from the class of fruit pectins [15, 17, 33-38]) arose out of the fact that it possesses the characteristic property of forming sugar-acid-jellies[32, 39] even in neutral media.[40] Unlike fruit or other sources of pectin, the seeds comprise nearly 60% of the gel-forming polyose. The gel strength is so high that it is not suitable for use as such in food industries. Pithawala and Sreenivasan's patent[41] relates to a modification in the gel-forming constituent of TKP so as to give a product comparable to fruit pectin in its jellying properties and thus provides a cheap substitute for fruit pectins. The degraded polyose can be easily prepared for use in food industries, especially in jam and jelly making and as soft centres in confectionery. Recently a cold process for the manufacture of tamarind seed polyose has been patented by Savur.[49]

In addition to its major applications in textile[48] and food industries, TKP finds use as a creaming agent for rubber latex[12] and as a substitute for gums of the tragacanth type [43, 44]. Besides, it can be employed for emulsifying cosmetic and medicinal preparations and for finishing of leather.[23] TKP yields metallic compounds[16] with cupric ammonium sulphate, Fehling's solution, potassium plumbate and hydroxides of strontium, barium and calcium. These compounds appear as gelatinous precipitates.

The tamarind seed contains proteins of high biological value[45] but lacks in certain dietary essentials which can be supplemented with available carbohydrates and mineral mixtures.[46] The powder could be used as a partial substitute for concentrates in cattle feed.[47]

TKP has thus become a commercial commodity. Standard specifications for the commercial product are published by Krishna and Rao[43] and more recently by the Indian Standards Institution for use in the cotton textile (IS: 189-1951) and jute (IS : 511-1954) industries. Doubtless, standardized procedures for its more extensive use in other industries will be developed in due course.

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