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Prosopis juliflora

An Alternative Source of Guar Gum

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Introduction

Prosopis juliflora (Wartz) DC, locally known as *Vilayati babool*, first introduced in Indian sub-continent during 1877, has been well naturalized and spread over a larger part of arid and semi-arid tropics of India due to its wide ecological amplitude and rapid colonizing ability. *Prosopis juliflora* plays an important role in the arid regions as it helps to retain and stabilize sand dunes, develop ground-carpet vegetation, stabilize water tables, retain moisture, fix nitrogen and improve soils.

In fact *Prosopis* has been one of the main biological resources and common cultural denominators for the inhabitants of desert regions in Southern USA and Mexico, where parts of the plant is used as a source for human and animal food, wood and charcoal, building material, medicine, nectar for apiculture, shadow, and several other uses

In India, *P. juliflora* is presently used as fuel wood or at some places for making charcoal. The utilization of *P. juliflora* as an alternative source of food is envisaging it for replacing a number of traditional food items, such as coffee, bread and others. A variety of edible products may be prepared from different components of the pods, which are composed of mesocarp (56%), endocarp (35%) and seed (9%) (Scheme 1). Seed is further comprised of episperm (20%), cotyledon (48%) and endosperm (32%). Seed endosperm is the source of gum with functional properties that are similar to those of guar gum, thus could be used as an alternative gum for industrial applications.

What is *Prosopis* Seed Gum?

Prosopis seed gums are neutral water-soluble polysaccharides, chemically classified as a Galactomannan. They have a molecular mass of the order of 10^6 and consist of a linear β-(1-4)-D-mannopyranose backbone with branch points from their 6-positions linked to α-D-galactopyranose unit (Fig. 1), although there are few deviations from this basic structure. The *Prosopis* seed gum has close similarity to guar and carob polysaccharides.

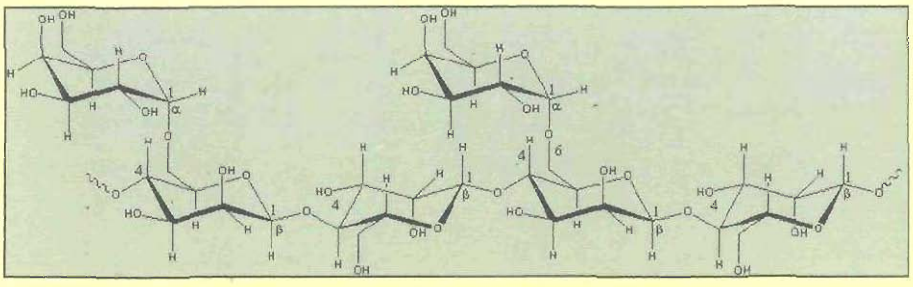


Fig. 1. Chemical structure of *Prosopis* seed gum

They differ from each other in mannose: galactose ratio and fine structure regarding distribution of single galactose branches on the main chain, causing variations in solubility, rheology and other properties. Chemical analyses of *Prosopis* endosperm indicates that it is a galactomannan polysaccharide. The individual constituents of Prosopis seed polysaccharide is shown in Table 1. The main components, galactose and mannose, are present in a 1:1.36 ratio. This ratio is near that of guar gum (1:1.2) but is smaller than the ratio in carob gum (1:1.9).

Table 1. Composition of *Prosopis* endosperm polysaccharide

Component	g/100 g of dry matter
Rhamnose	0.00
Fructose	0.25
Arabinose	1.56
Xylose	0.19
Mannose	46.28
Galactose	33.97
Glucose	0.93

Extraction of Gum

Prosopis juliflora Seeds were mechanically separated and ground to a coarse particle- sized flour in an electric mill. Ground seeds were submitted to lipid extraction with toluene: ethyl alcohol (2:1) mixture in a Soxhlet, for 24 h. Defatted ground seeds were dispersed in water (1:20) and boiled for 10 min for enzyme inactivation. The system was cooled and allowed to rest for 24 h at room temperature. The crude mixture, containing pieces of hull, germ and the galactomannan solution, was filtered and centrifuged at 6500 rpm. The clarified supernatant was retained and mixed with ethyl alcohol (1.5 parts of alcohol for 1 part of supernatant) to obtain a mucilaginous precipitate. It was filtered, dried at 40°C and milled to produce powdered gum (Scheme 2). The yield was 21%.

Properties and Uses

Galactomannan gums are capable of absorbing a great quantity of water that increases its volume several times to form a highly viscous solution. The Viscosity of 1% gum solutions is about 3000 mPa. The solution is stable over a range of pH. These gums are excellent stabilizing and thickening and gelifying agents. The absence of toxicity allow their use in

many food products like ice cream, sauces, cheese, yoghurt, sausages, and bakery products.

Health Benefits

Gums are regarded as soluble fibre and have also been used as fat replacers in various low-calorie products. They act like a sponge and absorb water in the intestine, mix the food into gel and thereby, slow down the rate of digestion and absorption. Gums have been used to reduce blood cholesterol and to promote fermentation in the large bowel. The latter yields short-chain fatty acids, mainly acetate, propionate and butyrate, which have beneficial effects on the colon through stimulation of blood flow and enhancement of electrolyte and fluid absorption and muscular activity.

These seed gums play an important part in the facilitating slow absorption of glucose, hence may be used for control of diabetes. It reduces the rate of glucose absorption by slowing gastric emptying and nutrient absorption, thereby leading to a decrease in blood sugar spikes following a meal. In USA, diabetic supplements from Prosopis seed are being marketed.

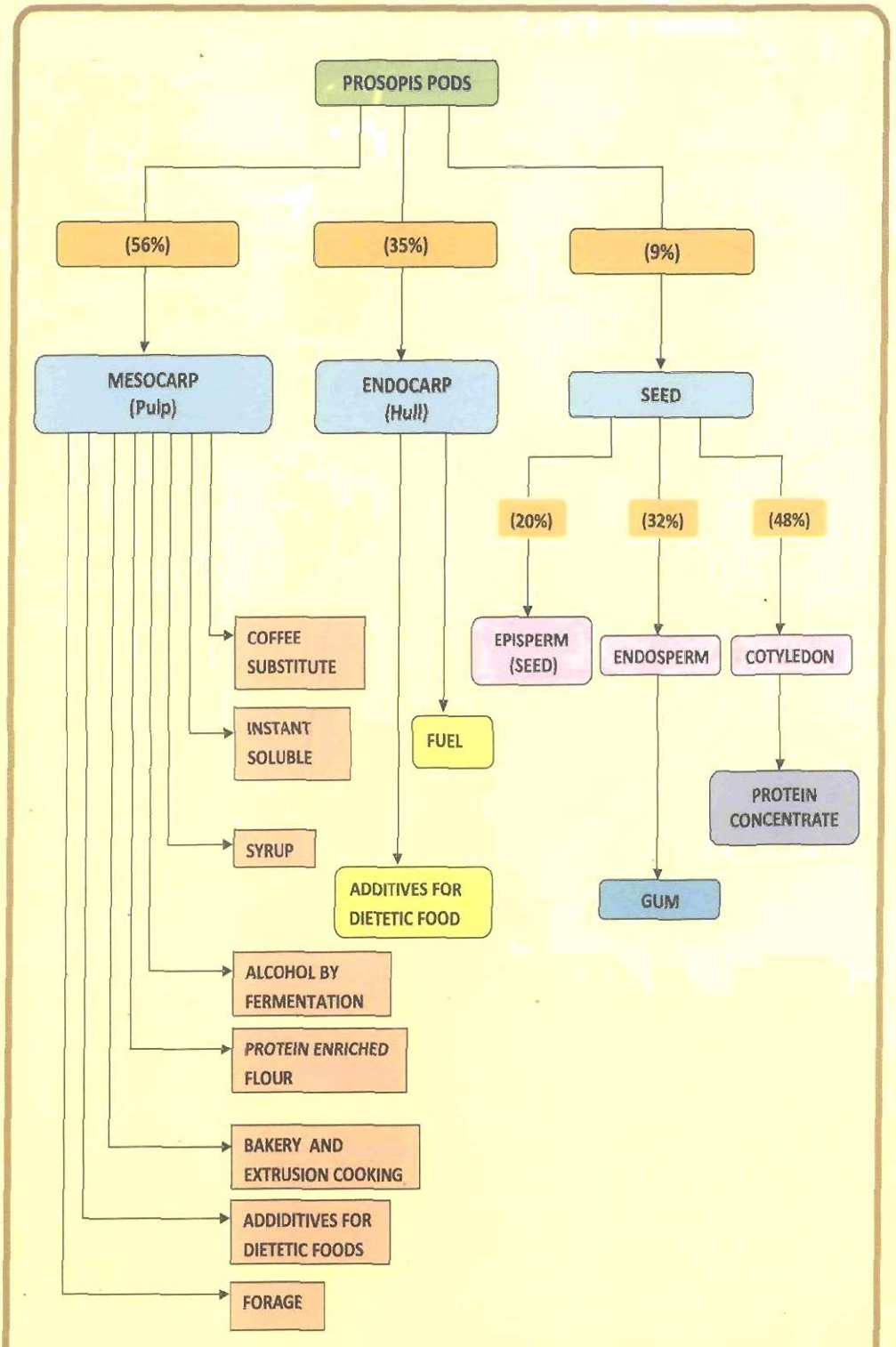
Slowed gastric emptying causes a feeling of fullness and suppresses appetite, which can help reducing weight loss.

Economic Potential

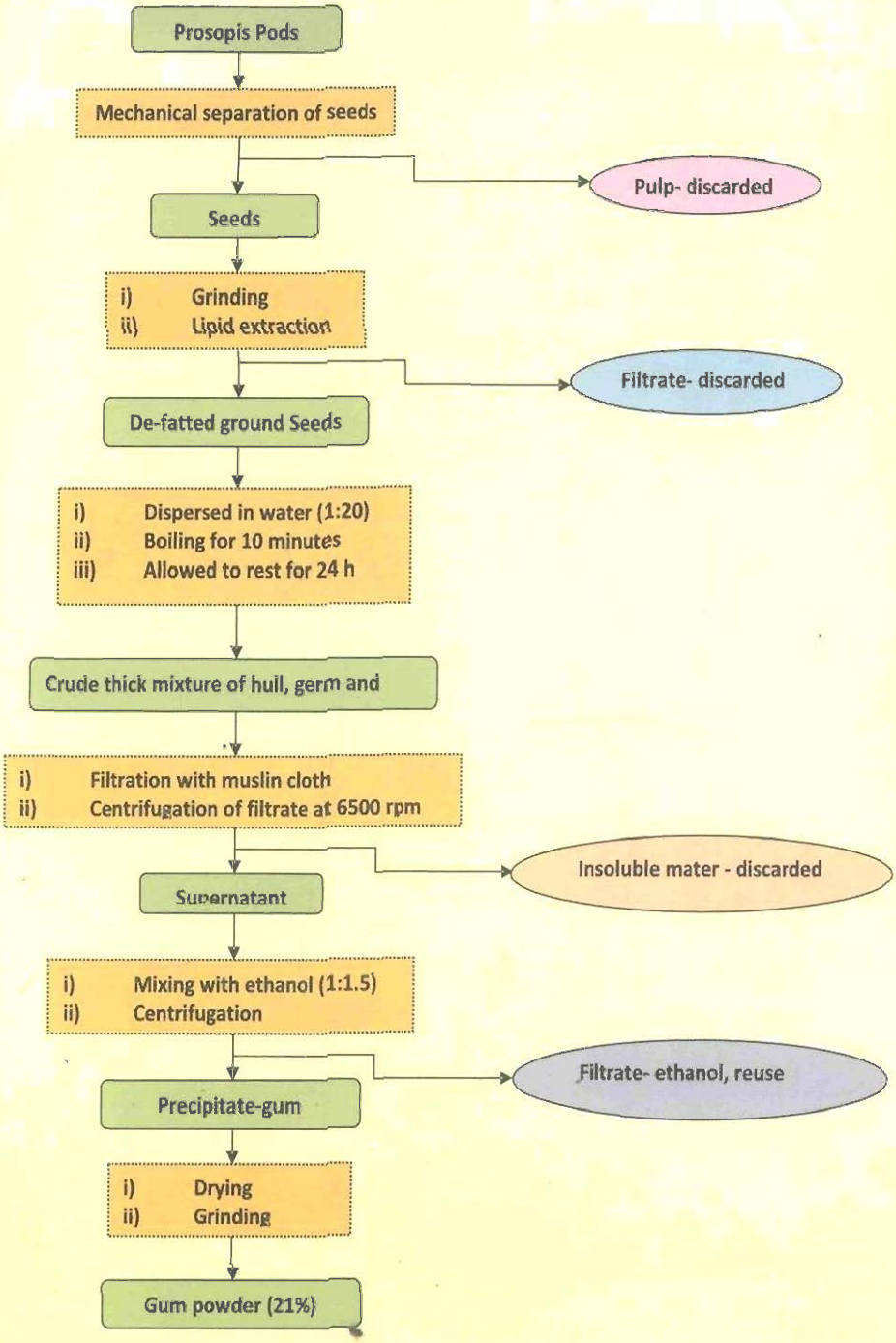
There would be several benefits to accrue from the use of Prosopis for seed gum production. It would give an additional source of cash income from the same crop. Yields of *Prosopis* pods vary from 4-10 t ha^{-1} y^{-1} equivalent to a yield of 0.4 to 1 t ha^{-1} of seeds or 40 to 300 kg ha^{-1} of gum (endosperm).

Summing-up

There is a steady rise in the use of galactomannan gums in different food products because of the rapid increase in the consumption of ready-made meals and novelty foods, and also because of the consumers' growing awareness of the need to increase the amount of fibre and reduce the amount of fat in the diet. Thus, gums from leguminous seeds like that of *Prosopis,* have good market potential. In the present scenario, production of gum from *Prosopis* seed which are considered as worthless would be an additional source of income generation. There is still scope to improve the quality and yield of this gum. The economics of the gum production may become favourable enough if endosperm is mechanically separated, the purity and yield of the gum isolated will automatically improve.



Scheme 1. Compositions and different uses of *Prosopis* Pods



Scheme 2. Extraction procedure of *Prosopis* seed gum

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