

Curcuma AS A NATURAL SOURCE OF STARCH

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Starch is the most widely available carbohydrate and a major component of various rhizomatous perennial tubers/herbs. It is one of the major components of human nutrition and provides about 70-80% of the calories consumed by humans worldwide. Since, most of the conventional sources are being overexploited, exploring the new botanical sources of starch are required to ease the pressure on the traditional sources. Starch is not only known for its nutritional value, but also for its industrial applications. Starch is composed mainly of two polymers - amylose and amylopectin. The proportion of these two polymers in native starch varies from 20 to 30% for amylose and from 70 to 80% of amylopectin. There are many starch rich tuber crops like potato, tapioca and sweet potato. Apart from the common starch rich crops, there are some underutilized starch rich rhizomatic crops with medicinal and nutritive values; they are popularly called as arrow roots. Major types of arrow root used in India are discussed here.

The common arrow root (*Maranta arundinacea* L.): It is the most widely cultivated source of arrow root; a nutritive medicinal herb also known as West Indian arrow root belongs to the family Marantaceae, known as "Bilathi Koova" in Malayalam. It is native to Mexico, Central and South America. *Maranta* is an herbaceous perennial and hardy plant which yields highest amount of starch among the

rhizomatous arrow roots cultivated in India.



Maranta arundinacea

Edible part of the plant is the underground rhizome. The rhizome contains 23% edible starch called arrowroot powder (koovapodi). Aside from being high in protein and several nutrients, arrowroot is very easy to digest, making it ideal for children and elder persons who need gentler food. Arrowroot is boiled and eaten as a nutritive food and as a medicine. Internally, the powder is found to be beneficial in urinary problems, menorrhoea and digestive troubles. Arrowroot powder is given as antidote in case of food poisoning and toxic effect of some herbs; the powder is also used externally on wounds. The rhizomes contain fiber, fat, albumen, sugar and gum apart from starch. Plant rarely produces seeds and reproduction is normally by planting rhizome bits with a bud. Rhizomes are harvested when the aerial part of the plant dries after 10-12 months of growth. The rhizomes are thick, fleshy, creeping, spindle-shaped, long and dull white to creamy coloured and contain fine easily digestible starch. It is

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cultivated throughout the West Indies, Southeast Asia, Australia, and South Africa. In India, arrowroot is mainly cultivated in Uttar Pradesh, Bihar, Orissa, West Bengal, Assam and Kerala. Its powder is one of the nature's finest carbohydrates.

Apart from *Maranta*, some of the *Curcuma* species belongs to the family Zingiberaceae is also used to extract edible starch in various locations in India. *Curcuma* species has been traditionally used as a medicinal crop. The genus *Curcuma* occurs in the tropics of Asia and extends to southern China, Sri Lanka, Indonesia, Philippines, Africa, and Australia. *Curcuma* is reported to be used as a source of an easily digested starch, which is rather similar to that of arrowroot. In India, it is utilized on a cottage industry basis for the preparation of baby foods. Even though the starch yield is lesser and extraction process is difficult compared to *Maranta* species, the starch of *Curcuma* is highly sought offering higher price owing to its unique taste and medicinal value. These species are generally gathered from wild by local people. Due to the shortage in supply and increased demand, some of the entrepreneurs have now taken up commercial cultivation and marketing of arrow root powder from different *Curcuma* species. Current price of *Curcuma* arrow root powder is Rs 1000/- per kg or above.

Major *Curcuma* species used for extraction of arrow root in India are 1. White arrow root or 'Vella Koova' (*Curcuma angustifolia*, *C. haritha*) 2. Yellow arrow root or 'Manja koova' (*C. xanthorrhiza*) and 3. Blue arrow root or 'Neela Koova' (*C. aeruginosa*). Apart from these some other species such as *Curcuma leucorrhiza*, *Curcuma caulina*, *Curcuma pseudomontana*, and

Curcuma rubescens, are also used as sources of arrowroot powder and in local and tribal medicines. Since most of the species are known by different local names in different localities, there is often confusion in the species identity. Common species of *Curcuma* used for extraction of arrow root powder are discussed here

***Curcuma angustifolia* Roxb.**

Curcuma angustifolia is commonly called as East Indian arrow root and Tikhur in Hindi; the rhizomes are rich in starch which is used as food and as a medicine. East Indian Arrowroot is recognized as a medical herb.



Curcuma angustifolia

It is nutritive and well suited for infants instead of breast milk or for a short time after having weaned them. The starch has cooling effect on the body, gives relief in irritation and inflammation and it is given to heal peptic ulcers and dysentery. It is also used as tonic and nutritious food in case of weakness, chronic diseases, jaundice and excessive thirst. The plant is a perennial rhizomatous herb endemic to India distributed in North Western and Central Himalayas, Bihar, West Bengal and South India at higher elevations. It produces a small spiked inflorescence with three or four yellow, funnel-shaped flowers within tufts of pink coma bracts. Inflorescences are usually produced at the

beginning of the monsoon even before the emergence of leaves have and it may continue to flower even after the leaves have fully developed. Leaves are simple, green, glabrous, and lanceolate, with entire margins. They display fine parallel venation from the central midrib. The leaves smell and taste like turmeric. It is propagated from rhizomes and harvested when the leaves show wilting after 8-10 months of growth. The rhizome is processed to obtain the edible starch which has properties similar to arrowroot and corn starch. In India, this is mainly cultivated in Bihar, West Bengal, Maharashtra, Kerala, Tamil Nadu, Karnataka and Andhra Pradesh.

***Curcuma xanthorrhiza* Rosc.**

Curcuma xanthorrhiza is commonly used in medicine and it is rich in edible starch. It is native to Southeast Asia. This species occurs mainly in the North Eastern and West coastal regions of India, extending to the hills. It has also been



Curcuma xanthorrhiza



Curcuma aeruginosa

under cultivation in earlier times for extracting arrowroot powder. The plant is an annual or biennial, aromatic, rhizomatous, tall herb. Rhizomes are large with yellow colour inside like turmeric. It is used in traditional and local medicines as a, cardio-tonic, carminative, diuretic, and anti-spasmodic.

This was reported to have cosmetic properties. The species is semi-domesticated and is found in the forests of eastern Himalayas, Bengal, and Kerala. It is cultivated in Kerala, Karnataka, Tamil Nadu. This species is often misidentified and sold as 'Kasturi Manjal' in place of *Curcuma aromatica* in some places.

Curcuma aeruginosa

Curcuma aeruginosa is known as 'neela koova', a nutritive medicinal herb used for extraction of starch from the underground rhizome; the plant has got numerous pendulous tubers, oblong with pearl white colour inside. Leaves are broad, lanceolate, uniformly green.



It is propagated from rhizomes and harvested when the leaves show wilting (8-10 months). It is naturally distributed through the hilly areas of Orissa, West Bengal, Jharkhand and Chhattisgarh. It is grown in Kerala and many parts of Western Ghats.

Neelakoova powder has high antioxidant and antimicrobial qualities. It is excellent for reproductive systems and enhances the semen quantity and quality. It is extremely good for dysuria and leucorrhoea. Koovapodi cools the body, reduces urinary trouble and prevents stone formation. It also has calcium, manganese, potassium, phosphorus and other minerals. Koovapodi can also be used as a weaning food as it can be easily digested by the body. The natives prepare many herbal dishes using the starch extracted from the rhizomes. In tribal belts of Chattisgarh and Orissa people prefer dishes made from rhizomes in hot summer.

It is believed that the rhizomes remove extra heat from the body and develops resistance against common diseases. It is used specially during observing fast as a part of ritual. Tubers are cleaned and scraped after harvesting and then it is washed. After that it is rubbed on a rough rock surface to produce pulp, the pulp is washed with water; the fibre is discarded and kept for sedimentation of starch. After the starch settles in the water, water is discarded, and fresh water is added. This process continuous till the residue is pure white. The extracted starch is sun dried to get the arrow root powder.

Method of starch extraction from *Curcuma*

Traditional starch extraction technique by garnishing of rhizomes on back side of sieve

followed by filtration using cloth and sedimentation. The improved starch extraction technique involved grinding of rhizomes in grinding machine. The improved method of starch extraction is 20 times more efficient as compare to traditional method of starch extraction from rhizomes. Multipurpose starch extraction machine was developed in ICAR-Central Tuber Crops Research Institute (CTCRI), Sreekariyam, Thiruvanthapuram, Kerala for the purpose of starch extraction from other tuber crops.

Compared to starches from other raw materials, *Curcuma* starches show a characteristic grain profile, with higher viscosity values. The viscosity profiles showed that these *Curcuma* starches have high thickening and gelling properties, and high stability when agitated. Thus, it can be a potential source of starch for food industry. The above-mentioned *Curcuma* species have been collected from different places is conserved at National Active Germplasm Site (NAGS) of ICAR Indian Institute of Spices Research, Kozhikode, Kerala.

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