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Different Pre-curing and drying techniques in Turmeric (*Curcu longa* L.) – A Review

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Introduction

Turmeric is a beautiful bright yellow root having nicknames “the golden spice” and “Indian saffron.” Turmeric is the dried rhizome of *Curcuma longa* L. of the *Zingiberaceae* family. It has been traditionally used as food preservatives, spices, and for coloring; and are highly significant for their therapeutic potential in south and southeast asia especially in the Indian sub-continent.

Turmeric can be grown as a monocrop or with other plantation crops as an intercrop. India has the honour of producing nearly the world’s entire turmeric crop and its population consumes 80% of it. Nearly 1 billion people throughout the world consume it on a daily basis. In the state of Tamil Nadu, in South India, the city of Erode is the world’s largest producer of turmeric, followed by Sangli, a city in the state of Maharashtra. Erode is also known as the “yellow city” or “turmeric city”. The most valued constituent of turmeric is yellow pigment i.e., curcumin as it is an important factor in sensory and consumer acceptance of products.

Uses

It has anti-inflammatory, anti-oxidative, anti-Alzheimer, and anti-cancer activities, hypocholestraemic, choleratic, antimicrobial, insect repellent, anti-rheumatic, anti-fibrotic, antivenomous, antiviral, antidiabetic, anti-hepatotoxic and anthelminthic properties.

Essential oil is another major ingredient in turmeric, which accounts for its spicy and aromatic flavor and proved their anti-microbial, anti-oxidative, anti-inflammatory activity, and anti-cancer potentials, the quality of turmeric depends mainly on postharvest handling and processing practices.

Stage of Harvesting

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Depending on the variety Turmeric is harvested when the plants are between 7 and 10 months of age, when the stems and leaves start to yellowing and dry up. Land is ploughed or dug with a spade and the whole clump is lifted with the plant, including the base of the stem. While doing so, taking care not to cut or bruise the rhizomes**.**

Harvested rhizomes

Processing of Turmeric

The postharvest processing of turmeric involves many units operations such as washing, cleaning, curing or blanching, drying, polishing, size reduction and packaging. The duration when boiling is stopped significantly affect the colour and aroma of the final product. Over-cooking spoils the colour of the final product while under-cooking renders the dried product brittle.

It has been demonstrated that curing and drying methods have a serious effect on physicochemical quality attributes of turmeric powder. Freshly harvested turmeric rhizomes are subjected to several postharvest operations, including curing, drying, polishing, and milling, before entering the market as a stable commodity. It has been demonstrated that curing and drying methods have a serious effect on physicochemical quality attributes of turmeric powder.

Cleaning

The leaves are removed from the plant and the roots carefully washed to remove soil. Any leaf scales and long roots are trimmed off. The side (lateral) branches (which are known as the fingers) of the rhizomes are removed from the main central bulb (known as the mother). The mothers and fingers are heaped separately, covered in leaves and left to sweat for one day. The 'mothers' are the preferred material for planting the following year.

Curing

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Curing after harvesting is an important postharvest processing operation that involves cooking fresh turmeric rhizomes in boiling water. Fingers are separated from mother rhizomes and are usually kept as seed material. The fresh turmeric is cured before marketing. Curing involves boiling of fresh rhizomes in water and drying in the sun.

It is an essential operation before drying to avoid the raw odor, destroy the vitality of fresh rhizomes, yield uniformly coloured product, and reduce the drying time. The method of curing turmeric varies from place to place. There are conventional and improved methods of curing turmeric; however, during the conventional method of boiling turmeric, contents might be leached along with water, which in turn lowers curcumin, oleoresin and essential oil contents.

Wet blanching methods, viz. hot water or steam blanching have drawbacks such as leaching of nutrients and colour and quality deterioration. Some studies reported that high temperatures, such as experienced in blanching because thermal degradation of curcumin, while other studies have shown that blanching protects the bioactive ingredients from the effects of drying

Traditional method of curing

In the traditional method, the cleaned rhizomes are boiled in copper or galvanized iron or earthen vessels, with water just enough to soak them.

Boiling rhizomes with added cow dung

In certain places, cow dung slurry is used as boiling medium. From hygienic point of view, such rhizomes fetch poor market value. Boiling is stopped when froth comes out and white fumes appear giving out a typical odour. The boiling lasts for 45 to 60 minutes when the rhizomes are soft. Over cooking spoils, the colour of the final product. While under cooking renders the dried product brittle. Rhizomes are subjected to boiling in plain water with added freshly collected cow dung (1kg) of desi cow with (8.5 pH) per liter of plain water in aluminium vessel of 5 kg holding capacity, for about duration of 45 minutes with medium supply of flame.

Improved scientific method of curing

Boiling of rhizomes with added alkali

In this method of curing the cleaned fingers (approximately 50 kg) are taken in a perforated trough of size 0.9×0.55×0.4 m, made of GI or MS sheet with extended parallel

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handle. The perforated trough containing the fingers is then immersed in the pan. The alkaline solution (0.1% sodium carbonate or sodium bicarbonate) is poured into the trough so as to immerse the turmeric fingers. The wholesome is boiled till the fingers become soft. The cooked fingers are taken out of the pan by lifting the trough and draining the solution into the pan. Alkalinity of the boiling water helps in imparting orange yellow tinge to the core of turmeric.

The drained solution in the pan can also be used for boiling another lot of turmeric along with the fresh solution prepared for the purpose. The cooking of turmeric is to be done within two or three days after harvesting.

The mother rhizomes and the fingers are generally cured separately. The cooked fingers are dried in the sun by spreading 5 to 7 cm thick layers on bamboo mat or drying floor. A thinner layer is not desirable, as the colour of the dried product may be adversely affected. During night time, the materials should be heaped or covered. It may take 10 to 15 days for the rhizomes to become completely dry. The yield of the dry product varies from 20 to 30 percent depending upon the location where the crop is grown.

Other different methods of curing

Boiling and slicing

The rhizomes were firstly subjected to boiling with plain water in aluminum vessel for duration of 45 min. After boiling rhizomes were sliced with sterilized stainless steel chopping knife.

Slicing of raw rhizomes

The turmeric rhizomes were sliced to a thickness of 1 cm, using sterilized stainless-steel chopping knife.

Slicing and alkali treatment (@0.1 %NaHCO3)

One-centimeter-thick slices of rhizomes were made using sterilized stainless steel chopping knife. Then sliced turmeric rhizomes were treated with NaHCO3 @ 0.1% (8.3 pH) by dipping in mentioned alkali solution for 30 min

Sweating in black polythene bags

The turmeric rhizome samples were packed in black polythene bags and exposed to hot sun for two to four hours daily, till the rhizomes got soften due to cooking effect brought by heating and sweating inside (Black polythene)

Sweating in transparent polythene bags

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The turmeric rhizomes samples were packed in transparent polythene bags and exposed to hot sun for two to four hours daily, till the rhizomes got soften due to cooking effect brought by heating and sweating inside the (Transparent) polybag.

Boiling with citric acid

Rhizomes are subjected to boiling in plain water with added Citric acid @ 2% in aluminium vessel of 5 kg holding capacity, for about duration of 45 minutes with medium supply of flame

Drying of turmeric fingers

Cured and uncured turmeric fingers of 5 cm thick were dried by three different drying methods i.e. sun, shade-net and mechanical. The completion of drying was indicated when fingers become hard, brittle and would break with metallic sound.

a) Sun drying

Traditionally sun drying of turmeric is extremely weather dependent and requires unduly long processing times and to some extent leads to prone to infestation, which is not acceptable for industry. The traditional open sun-drying widely practiced by rural farmers has inherent limitations; of high crop losses due to inadequate drying, fungi attacks, insects, birds, rodent encroachment and unpredictable weather effects.

Traditional drying method could result in the loss of volatile oil (up to 25%) by evaporation, and in the destruction of some of the light-sensitive oil constituents. Fingers were spread on the drying yard and exposed to the sun light for about 10 days and dried to about 10 % moisture content.

b) Shade net drying

The drying yard was covered with shade-net made up of HDPE. Fingers were spread on the drying yard and exposed to sunlight for about 12 days and dried to about 10 % moisture content.

c) Mechanical drying

Fingers were spread on aluminum trays in a cross flow drier and dried at 60±2ºC for 48 hrs and dried to 10% moisture content

Polishing and grinding

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The dried turmeric fingers were subjected to a mechanical polisher and polished fingers were powdered with the help of a laboratory pulverizer.

Dried turmeric has poor appearance and a rough dull outer surface with scales and root bits. The appearance is improved by smoothening and polishing outer surface by manual or mechanical rubbing.

- **Manual polishing**: It consists of rubbing the dried turmeric fingers on a hard surface or trampling them under feet, wrapping in gunny bags.
- **Improved method**: The improved method is by using hand operated barrel or drum mounted on a central axis, the sides of which are made of expanded metal mesh. When the drum filled with turmeric is rotated at 30 rpm, polishing is effected by abrasion of the surface against the mesh as well as by mutual rubbing against each other as they roll inside the drum. The turmeric is also polished in power- operated drums. The yield of polished turmeric from the raw materials varies from 15 to 25 percent.

Colouring

It is done to give a good appearance and better finish to the product. This is done to half polished rhizomes in two ways, known as dry and wet colouring.

- **Dry colouring**: Turmeric powder is added to the polishing drum in the last 10 minutes in dry process.
- **Wet colouring**: In this process, turmeric powder is suspended in water and mixed by sprinkling inside the polishing basket. For giving a brighter colour the boiled, dried and half polished fingers are taken in baskets which are shaken continuously when an emulsion is poured in. When the fingers are uniformly coated with the emulsion, they may be dried in the sun. The composition of the emulsion required for coating, 100 kg of half boiled turmeric is as follows, Alum 0.04 kg, Sodium bisulphate 30 g, Turmeric powder 2.00 kg, Conc. HCl 30 ml and Castor seed oil 0.14 kg.

Conclusion:

There are various conventional and improved methods for the processing of rhizomes as we mentioned above. Conventionally rhizomes were boiled in water and dried under sun which results in large amount of heat loss, low curcumin content and essential oil. Curcumin

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is medicinally most important constituent of turmeric but it is heat and light sensitive. Direct sunlight affects the curcumin concentration significantly followed by drying temperature then drying duration. Processing time of turmeric rhizomes is also very large in conventional system. Therefore, improved methods are developed for processing of turmeric which consumes less time, high essential oil and curcumin content in rhizomes compare to conventional system.