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Studies on physico-chemical properties of turmeric powder

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Abstract
Turmeric (*Curcuma longa*) is a rhizome grown in India and use as a spices and also for other domestic purposes like aurvedic medicine, holy occasions *etc.* Turmeric is an economical and important spice of India. Normally, the fresh turmeric rhizomes stored as dried bulbs after processing and consequently grind to make powder as per the requirement. In India, there are different methods of turmeric processing varied with the region. In general there are two common methods of processing i.e. with boiling and without boiling. In the present investigation turmeric powder was prepared by two different methods and stored for 180 days in different packaging materials and the physic-chmeical properties were studied after 30 days each. It was found that with the increase in the storage period of up to 180 days the quality of turmeric powder was deteriorated with respect to time period in both normal and refrigerated conditions. The quality parameters were list affected which are stored in plastic container at refrigerated condition. The overall changes in quality parameter during storage is moisture content increased from 14.60% (db) to 16.98, curcumin content decreased from 2.816 to 0.526 percent and olioresin content decreased from 10.303 to 7.014 percent.

Keywords: Turmeric, olioresin, curcumine, moisture content, physico-chemical properties

Introduction
Turmeric (*Curcuma longa*) is one of the essential elements of the Indian recipes. Besides the taste and aroma, it is also being used for medicinal value since ancient times. It was popular even in Vedic times because of its unique flavour and medicinal properties and its significance in religious ceremonies and auspicious occasions (Jacob, 1995). Turmeric is a spice derived from the rhizomes of *curcuma longa*, which is a member of the ginger family Zingiberaceae. The root or rhizome has a tough brown skin and bright orange flesh. Fresh rootstock has an aromatic and spicy fragrance, which on drying generates a peculiar medicinal aroma. The bright yellow colour of turmeric comes mainly from polyphenolic pigment curcuminoids (Aggarwal *et al*., 2007) [1].

Its centre or origin is believed to be South-East Asia and a few species are naturalized in north-eastern regions of India. India is believed to be the home of turmeric contributing the largest share in production, consumption and export in the world. It accounts for 80 per cent of the world output and 60 per cent of world export. Indian turmeric is considered to be the best in the world market because of its high curcumin content. The important turmeric growing states in India is Andhra Pradesh, Tamil Nadu, Orissa, Maharashtra, Assam, Kerala, Karnataka, West Bengal and Rajasthan. Andhra Pradesh occupies 61 percent of total turmeric area followed by Tamil Nadu and Orissa with 17 percent and 7 percent area respectively. India has 0.65 Lakh hectare areas under turmeric cultivation with a total production of 4.48 lakh tonnes during 2010-11 (Spice Board of India). Other major producers of turmeric are China, Myanmar, Nigeria, Bangladesh, Pakistan, Sri Lanka, Taiwan, Burma and Indonesia *etc*.

The post harvest processing of turmeric involves many units operations such as washing, cleaning, curing or blanching, drying, polishing, size reduction and packaging. Harvested turmeric is washed thoroughly to remove the adhering soil, hairs and roots. The fingers and mothers rhizomes are separated prior to curing. Curing is the process of boiling the raw rhizome in water for the development of attractive colour and characteristic aroma which also destroys the viability of the fresh rhizomes, eliminates the raw odour and reduces the time of drying. Generally curing/boiling is done in alkaline water; also there was some recommendation as per the quality of boiling water. If the water is acidic; 0.05 to 0.1% sodium bicarbonate or carbonate is sometimes added to make it slightly alkaline. Boiling in alkaline water is said to improve the colour of dried powder with orange yellow colour (Pruthi, 1976; Govindarajan, 1980; Velappan *et al*., 1993; Weiss, 2002, Krishnamurthy *et al*., 1975) [5, 3, 7, 2, 4].

Looking towards the different methods of turmeric processing and its effect on quality of turmeric powder the study was undertaken to evaluate the quality of turmeric powder prepared by two different methods.

Materials and Methods

Preparation of sample

The fresh turmeric rhizome of local variety (*Shillong*) was purchased from the Raipur local market. After cleaning and grading healthy rhizomes were selected for study. The initial moisture content of turmeric rhizomes samples was determined by standard method.

Method of Processing

Improved scientific method of curing

In this method of curing, cleaned fingers (approximately 10 kg) are taken in a perforated trough of size 0.3×0.3 m made of GI sheet with extended parallel handle. The perforated trough containing the fingers immersed in the trough containing water. The sodium bicarbonate (0.05%) is added to make the solution alkaline. Turmeric fingers are immersed in the alkaline solution for boiling. The wholesome is boiled (45 min) or till the fingers become soft. The cooked fingers are taken out of the trough by lifting the trough and draining the water into the pan.

Pre-treatments

The present study was carried out to observe the effect of two different processing techniques (curing and non-curing) on active ingredient properties of dried turmeric powder over a period of storage at different packaging materials during ambient (room temperature) and at refrigerated condition (low temperature, 20 °C). The following pre-treatments were given to the turmeric rhizome i.e. curing and non-curing. In curing, the turmeric rhizomes were boiled with sodium bicarbonate (0.05%) up to 45 min or till the fingers become soft and then dried in the hot air dryer. In non-curing, the fresh turmeric rhizomes were directly cut into slices (10 mm thick) and dried in a hot air dryer. For each treatment the sample handled was 3 kg.

Drying of Turmeric Rhizome

Mechanical tray dryer

The laboratory tray dryer was used for drying of cured and non-cured turmeric samples. It mainly consists of a fan, air-heating chamber, temperature control unit, drying chamber, plenum chamber, hot air inlet, and outlet. Turmeric rhizome of 3 kg for boiled and un-boiled sample respectively were taken and spread uniformly over the trays in single layer.

Polishing of turmeric rhizomes

Polishing of dried turmeric was done manually. Manually polishing consists of rubbing the dried turmeric fingers on a hard surface or trampling them under feet wrapped in gunny bags.

Grinding of Turmeric

A pulveriser was used for grinding dried turmeric rhizomes. Pulveriser consist a hopper for feeding, a grinding unit with hammer type arrangement and an outlet.

Physico-chemical Analysis

Turmeric is mainly used in the form of powder. The commercial value of turmeric is mainly depending upon its characteristics *i.e.* curcumin and oleoresin content. The presence of curcumin and oleoresin content was affected by the various process parameters such as temperature, air velocity and duration of process time. While evaluating the quality of dried product, the effect of these process parameters on oleoresin and curcumin content is essential. Thus, physico-chemical properties of dried product were evaluated *i.e.* moisture content, oleoresin content and curcumin content.

Result and Discussion

The physic-chemical properties of turmeric powder prepared with two different methods are given in the following Table 1.

Table 1: Physico-chemical property of dried turmeric powder

S. No.	Physico-chemical property	Cured turmeric powder	Non-cured turmeric powder
1	Moisture content db (%)	14.60	14.48
2	Curcumin conten t(%)	3.12	2.82
3	Olioresin content (%)	10.30	11.55

Moisture content

The value of final moisture content of turmeric powder prepared by two different methods *i.e.* cured and non-cured was 14.60 percent (db) and 14.48 percent (db) respectively.

Curcumin content

The value of curcumin content of turmeric powder prepared by two different methods *i.e.* cured and non-cured was 3.12 percent and 2.82 percent respectively.

Oleoresin content

The value of oleoresin content of turmeric powder prepared by two different methods *i.e.* cured and non-cured was 10.30 percent and 11.55 percent respectively.

Effect of storage time on quality of turmeric powder

1. Moisture content

The final moisture content of the cured dried turmeric powder was 14.60 percent (db) and after 180 days of storage in ambient condition, the value of moisture content for ambient condition was increased to 16.77 percent (db), 16.65 percent (db), 15.88 percent (db), 15.82 percent (db) and 15.66 percent (db) for LLDPE, LDPE, steel container, glass container and plastic container respectively.

The final moisture content of non-cured dried turmeric powder was 14.48 percent (db) and after 180 days storage in ambient condition, the value of moisture content for was increased to 16.99 percent (db), 16.88 percent (db), 16.80 percent (db), 16.35 percent (db) and 16.02 percent (db) for LLDPE, LDPE, plastic container, steel container and glass container respectively.

The same cured and non-cured dried turmeric powder was stored in low temperature condition and the moisture increased after 180 days in cured sample was 16.99 percent (db), 16.87 percent (db), 15.96 percent (db), 15.91 percent (db), and 15.08 percent (db) for LLDPE, LDPE, plastic container, steel container, and glass container respectively. In case of non-cured turmeric powder the values of moisture content was increased to 17.23 percent (db), 17.12 percent (db), 15.97 percent (db), 15.78 percent (db), and 15.56 percent (db) for LLDPE, LDPE, glass container, steel container and plastic container respectively.

2. Curcumin content

The curcumin content of the pre-treated (cured) fresh turmeric powder was 3.11 percent and after 180 days storage in

ambient condition (room temperature) the content was decreased over a period of time and the values were 1.72 percent, 1.72 percent, 2.39 percent, 2.40 percent and 2.67 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively. In case of non-treated (non-cured) turmeric powder, the initial curcumin content was 2.82 percent and after 180 days, value of curcumin content for ambient condition was 0.526 percent, 0.654 percent, 1.746 percent, 1.887 percent and 1.876 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively.

In case of storage in low temperature condition, the initial curcumin content of the pre-treated (cured) fresh turmeric powder was 3.123 percent and after 180 days storage the values were 1.772 percent, 1.96 percent, 2.436 percent, 2.772 percent, and 2.778 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively and for non-treated (non-cured) fresh turmeric powder curcumin content was 2.816 percent and after 180 days of storage the values were 1.392 percent, 1.445 percent, 2.166 percent, 2.393 percent and 2.654 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively.

3. Oleoresin content

The oleoresin content of the pre-treated (cured) dried turmeric powder was 10.30 percent and was decreased over a period of storage. The oleoresin content after 180 for storage at ambient condition was 7.01 percent, 7.33 percent, 8.67 percent, 8.84 percent and 9.34 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively. For non-treated (non-cured) dried turmeric powder, the oleoresin content (11.55 percent) was higher than pre-treated (cured) sample and the content was decreased to 9.78 percent, 9.85 percent, 10.23 percent, 10.43 percent and 10.44 percent for LLDPE, LDPE, glass container, steel container and plastic container respectively after 180 days of storage at ambient condition.

In case of low temperature storage condition, oleoresin content of pre-treated (cured) dried turmeric powder was decreased after 180 days and the values were 8.06 percent, 8.24 percent, 9.34 percent, 9.35 percent and 9.45 percent for LLDPE, LDPE, glass container, plastic container and steel container respectively. For non-treated (non-cured) sample, initial value of curcumin content was 11.55 percent and which was decreased after 180 days of low temperature storage. The value of oleoresin content was 9.89 percent, 9.99 percent, 10.39 percent, 10.41 percent, and 10.56 percent for LLDPE, LDPE, steel container, glass container and plastic container respectively.

From this result it was observed that the initial oleoresin content was higher in case of non-treated (non-cured) turmeric dried powder than pre-treated (cured) turmeric powder and it may be because of boiling process. During boiling, oleoresin may dissolve with hot water and leach out from rhizomes. But in case of non-treated sample boiling was skipping and hence the initial value of oleoresin was higher in case non-treated (non-cured) dried turmeric powder.

Conclusion

With the increase in the storage period of up to 180 days the quality of turmeric powder was deteriorated with respect to time period in both normal and refrigerated conditions. The quality parameters were list affected which are stored in plastic container at refrigerated condition. The overall changes in quality parameter during storage is moisture content increased from 14.60% (db) to 16.98, curcumin content decreased from 2.816 to 0.526 percent and olioresin content decreased from 10.303 to 7.014 percent.

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