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RESEARCH PAPER

Studies on the mechanical drying of curry leaf

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SUMMARY :

Drying of aromatic plants must allow the retention of flavour, colour and aroma to a greater extent. The removal of water leads to the restriction in the growth of microorganisms thereby extending its keeping quality. Fresh curry leaf was dried at 40, 45 and 50ºC temperature at 2, 3 and 4 m/s air velocity in a fluidized bed dryer (lab. Model) from an initial moisture content of 184.5 per cent d.b. to a final moisture content of 2 to 5 per cent d.b. Drying could be completed in 40-100 min depending upon the air temperature and velocity. Fluidised bed drying at 45ºC and 4 m/s air velocity preserved the quality in terms of rehydration characteristics and volatile oil content of the end product after drying and storage better than the other drying condition.

KEY WORDS : Fresh curry leaf, Drying, Temperature, Air velocity, Rehydration, Volatile oil

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Curry leaf, *Murraya koeingii* (L.) Spreng of the family Rutaceae is a spicy leafy vegetable used in Asian Indian cuisine. It is cultivated on a commercial scale in large areas in Tamil Nadu, Andhra Pradesh and Karnataka. In Tamil Nadu, it is cultivated in Coimbatore, Salem and Trichy districts. The total area production in Tamil Nadu is 3250 ha and the area production in Coimbatore is 1725 ha (Anonymous, 2012). The leaves have 66.3 per cent moisture, protein 6.1 per cent, carbohydrate 16 per cent, fibre 6.4 per cent, phosphorus 600 mg, iron 0.93 mg and β- carotene (Vit. A) 7.56 mg. (Shankaracharya and Natarajan, 1971). Fresh curry leaves on steam distillation yield 2.5 per cent volatile oil, which is used as a fixative in soap industry (Lathan Kumar *et al.*, 2003). The antioxidant and anticarcinogenic effect of curry leaves have been studied and it has been reported that the curry leaves have a high potential as a reducer of the toxicity of carcinogen (Khanum *et al.*, 2000). The dried leaves are being exported and also used as an ingredient in masala industries. The present system of drying, this crop is under sun or shade where the quality of the end product is inferior. Considering the above gaps in processing of curry leaf, investigation on optimized drying parameters was carried out for developing a dryer for drying of this crop with better retention of colour and aroma.

EXPERIMENTAL METHODS

Sample preparation:

Freshly harvested curry leaf was procured from the experimental farm of Tamil Nadu Agricultural University, Coimbatore to conduct drying studies. The leaves were first washed in water. The leaflets were then separated from the petiole. About 50 g of the sample was taken for each trial during drying.

Dehydration in fluidised bed dryer:

The curry leaf samples were dried in a laboratory model fluidized bed dryer at different air temperature of 40, 45 and 50 degree centigrade and air velocities of 2, 3 and 4 m/s, respectively. The dryer consisted of a built in type blower, run by electric motor. The outlet of the blower is provided with heater to heat the air entering into the dryer. The hot air

enters into the fluidizing chamber from the bottom. A wire mesh is fixed at the bottom of the chamber to hold the material for drying. A removable wire mesh is fixed at the top to prevent the material escaping along with the air during drying. There are two temperature sensors in the inlet and outlet and a timer to put the unit to off at desired set time.

The weight of the sample during drying was recorded periodically at hourly interval using a top pan balance having a least count of 0.001 mg. The samples were dried to moisture content of 2 – 5 per cent (db) approximately. The experiment was replicated three times.

Quality analysis of curry leaf:

Moisture content of fresh curry leaf was estimated by drying the leaves in hot air oven at 65^0 C till constant weight was achieved. The volatile oil content of the dried samples was estimated by Clevenger distillation method. The dried samples were packed in polyethylene bags and kept for storage under ambient condition for a month. The changes in the colour of the sample, volatile oil content of the samples were recorded at the end of storage.

Rehydration of dried curry leaf:

Initial trials were carried out to standardize the rehydration time of dried curry leaf. There was no weight gain of the samples after 15 minutes time. About 5 g of dried curry leaf samples were dipped in boiling water (98^0 C) for 15 minutes. The excess moisture was removed through Watman No.4 filter paper. The samples were then weighed. The rehydration ratio (RR) was computed using the following equation (Ranganna, 1986):

$$RR = WR/WD$$

where,

RR= rehydration ratio

WR= Weight of rehydrated curry leaf, g

WD= Weight of dehydrated curry leaf, g.

Statistical analysis:

Data were statistically analysed as per the procedure of two way ANOVA using computer software AGRes to compare among different treatments at 5 per cent probability. The treatments were replicated three times.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

Drying characteristics of curry leaf:

The moisture content of the curry leaf decreased with drying time irrespective of the drying temperature and air velocity. The drying time for drying from initial moisture content of 184.5 per cent (d.b) to the final moisture content 2.4 to 5.2 per cent (d.b) varied from 40 to 100 minutes, generally decreasing with increase in drying air temperature and air velocity (Fig.1). The moisture-time relationship was found to be non-linear, the decrease in moisture being larger initially as compared to the later part of drying. The drying rate decreased with the decrease in the moisture content at all drying temperatures. Among the dried samples, curry leaf dried at low temperature of 40^0 C at different air velocities was most unstable with respect to its keeping quality, since they were infested with fungus after a week and, therefore, considered to be undesirable. This may be due the fact that if the temperature is too low in the beginning, microorganisms may survive and even grow before the food is adequately dried. Though the samples dried faster at higher temperature of 50^0C, the quality of the samples in terms of its colour and volatile oil was found to be inferior to those dried at 45^0C.

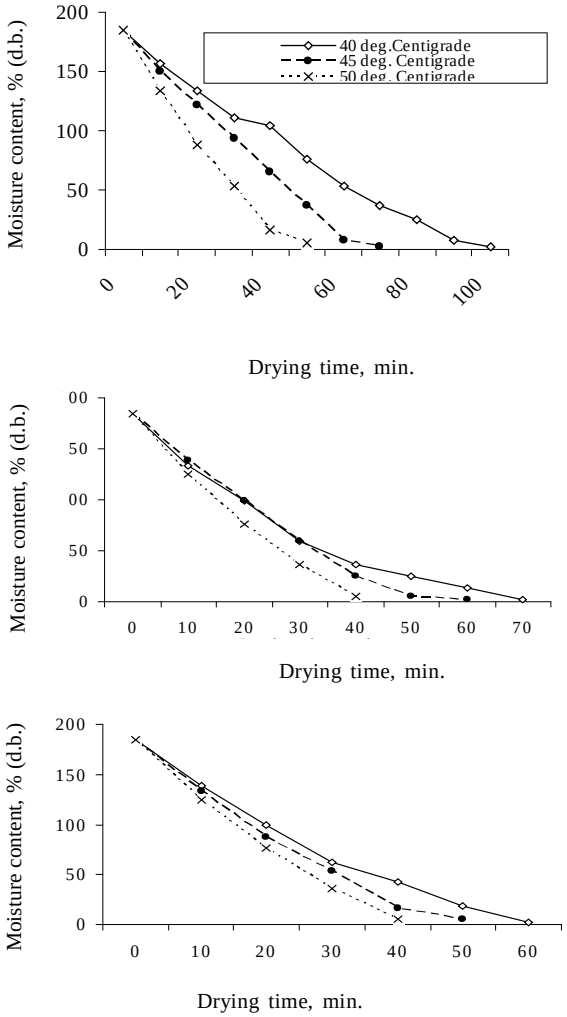

Fig. 1: Drying characteristics of curry leaf at a) 2m/s b) 3m/s and c) 4 m/s air velocity at different temperatures (n=3)

Effect of drying on the quality of curry leaf:

The effect of drying at different temperature and air velocity on the volatile oil and rehydration ratio of the samples is presented in Table 1. The volatile oil content influences the flavour of curry leaf. At 50º C temperature, the loss of volatile oil was greater at all the different drying air velocities. Similarly drying at lower air velocity at lower temperature resulted in less volatile oil content. Drying at 45º C temperature and 4 m/s air velocity resulted in maximum retention of volatile oil content. Similar findings have been reported for drying of bay leaves (Consuelo Diaz-Maroto *et al*., 2002). Statistical analysis showed that the treatments *i.e.* drying air temperature and velocity differed significantly as regard to the volatile oil content of the samples at 5 per cent level of significance.

Rehydration ratio is also considered as a quality index, because they could indicate the physical and chemical changes of the product during drying. The leaves regained their original shape once rehydrated. The colour of the rehydrated leaves was dark green compared to the lush green when fresh. The effect of drying on the rehydration ratio showed that the samples dried at 45ºC drying air temperature and 4 m/s air velocity had a good rehydration capability compared to other samples. The values of rehydration ratio at different air velocities at 50ºC were almost the same. However, from the statistical analysis of the rehydrated samples at 5 per cent level of significance it was observed that there was no significant difference among the treatments *i.e.* drying air temperature and air velocity.

Effect of storage on the quality of dried curry leaf:

Dried curry leaf samples were packaged in polyethylene bag of 38 micron thickness and stored under ambient condition (30±2°C) for a period of one month. Based on visual observation on the colour of the samples and the volatile oil content, the quality of the samples was assessed during storage. The observation was in triplicates. It was found that that the samples dried at 40^0 C were spoiled due to fungal infections at all the three levels of air velocity. Similarly the sample dried at 45^0C and 2 m/s air velocity also spoilted after a month. The samples at 3 and 4 m/s air velocity were in good condition without change in their volatile oil content (1.6± 0.05). Though the colour of the sample was found to be better at 50^0 C temperature at different air velocities, there was changes in the volatile oil content of the samples. Volatile oil content of 1.20± 0.08 was present in samples dried at 50^0 C and at 4 m/s air velocity. At 2 m/s and 3 m/s air velocities, the oil content was 0.5 0±.03 and 1.15± 0.04, respectively.

Conclusion:

Correct drying of aromatic plants is essential for high quality products, with the final moisture content being 5-10 per cent. Among the different drying air condition such as temperature

Table 1: Effect of drying on the volatile oil content and rehydration ratio of dried curry leaf

Drying condition	Volatile oil (% v/w)	Rehydration ratio
40 deg. C		
2 m/s	1.33± 0.07	1.96± 0.24
3 m/s	1.46± 0.10	2.08± 0.15
4 m/s	1.46± 0.09	2.11± 0.17
45 deg. C		
2 m/s	1.6± 0.08	2.05± 0.12
3 m/s	1.6± 0.03	2.07± 0.16
4 m/s	1.76± 0.06	2.59± 0.36
50 deg. C		
2 m/s	1.2± 0.07	2.21± 0.21
3 m/s	1.3± 0.04	2.35± 0.22
4 m/s	1.3± 0.05	2.49± 0.15
S.E.±	0.05759	0.17083
C.D. (0.05)	0.12098	0.35890
C.V. %	5.31	9.9

Each observation is a mean ± S.D. (n=3)

and air velocity showed that 45^0 C drying time and 4 m/s drying air velocity resulted in maximum volatile oil content and rehydration ratio compared to other samples in terms of quality. The samples at the above condition were found to maintain their quality even after one month of storage period.

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