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Effect of Different Drying Air Temperatures on Drying Time and Biochemical Qualities of Chillies

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ABSTRACT
Drying of chillies is one of the most important unit operation in its post-harvest processing to increase its shelf life. Generally, farmers adopt open yard sun drying method. But, due to its dependability on weather and due to the risk of contamination of produce, mechanical dryers are suggested. This study was conducted to find out optimum air temperature suitable to varieties and hybrids of chillies and to evaluate the quality of the final dried produce. Variety like LCA 334 had relatively low drying time in comparison to hybrid like wonder hot particularly at high temperatures (55 and 60°C) used in the study. Based on the assessment of quality parameters such as oleoresin and colour value, it can be concluded that 50°C is optimum air temperature to dry hybrids and 55°C is the optimum air temperature to dry variety chilli.
KEYWORDS: Chillies, Mechanical Drying, Drying Time, Temperature, Oleoresin

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INTRODUCTION

India is the world leader in chilli production followed by China. Indian chilli is world-famous for two important commercial qualities- colour and pungency levels. Andhra Pradesh, Tamil Nadu and Karnataka are the major chilli producing states in India. Chilli is a rich source of Vitamin A and C. Chillies at the time of harvest have an initial moisture content of about 70 to 80 % (wb). The moisture content must be reduced to about 10% for increasing the shelf life of chillies and for further processing into products such as chilli powder, oleoresins etc. Green chilli is used to produce oleoresin which is used as an ingredient in processed foods and in the preparation of green chilli sauce.

In India, most of the farmers practice open yard sun drying(OYSD). The farmers expose their chillies to the open sun on a mat, earthen floor, cemented floor or on a tin shed. In this method, drying cannot be controlled and a relatively low-quality dried product is obtained. Drying rate is very slow and takes 7–15 days, depending on the weather conditions [1]. In this traditional sun drying method, chillies become contaminated with dust, dirt, rainfall, animals, birds, rodents, insects and microorganisms. Under these conditions, losses can be as high as 40–60% of total quantity [2]. Usually no pre-treatment is used before the drying of chilli. As a result, the colour of most of the dried chilli becomes dull red.

To overcome the above stated drawbacks in OYSD, solar drying or mechanical drying can be adopted to dry the produce in controlled conditions. A cabinet dryer was used to dry two varieties of ripe chillies (LCA 334 and wonder hot) and one variety of green chilli (Namdhari).

MATERIAL AND METHODS

This experiment was conducted to investigate the effect of air temperature on two different varieties of red chillies and to determine the oleoresin and colour values of dried chillies at different air temperatures.

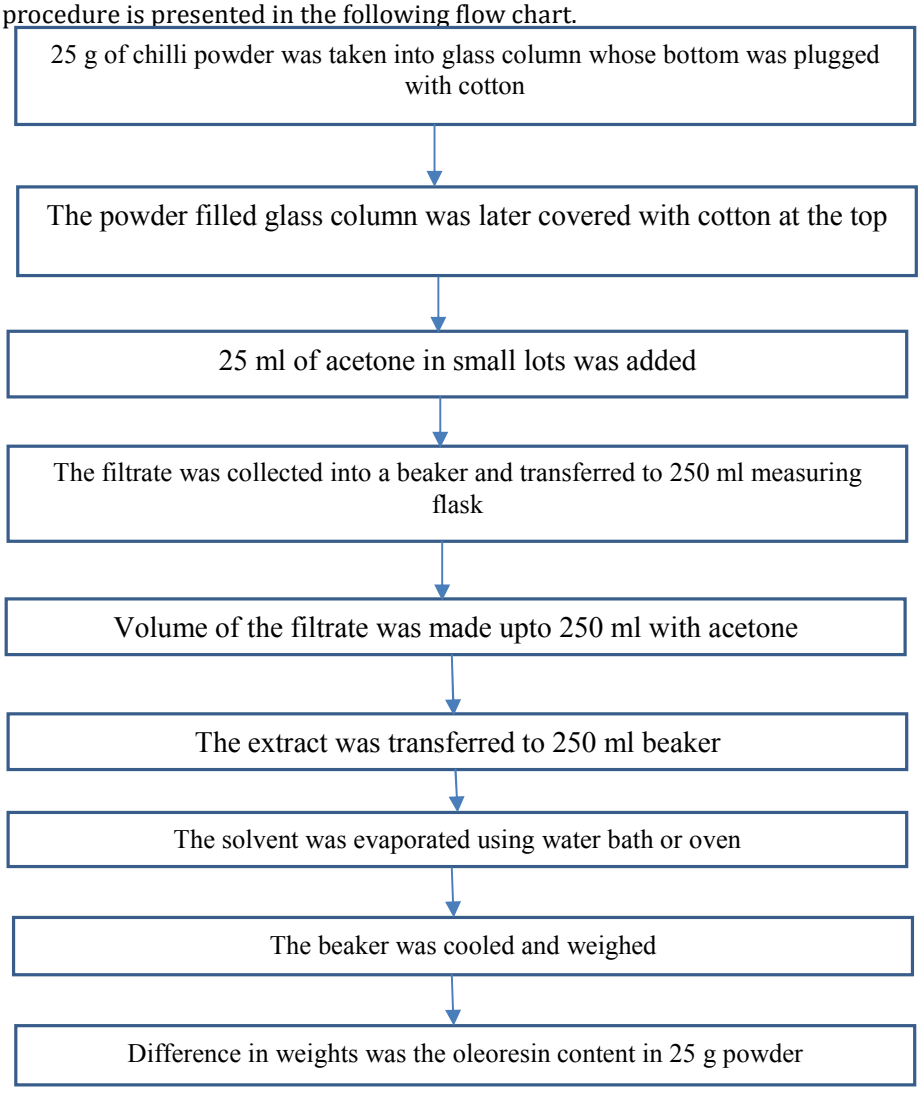
Experimental Procedure:

Two varieties of ripe chillies namely LCA 334, wonder hot and one variety of green chillies (Namdhari), were used to conduct the experiments. The selected varieties of chillies were procured from local farmers. The range of pod length of selected varieties of Namdhari, LCA 334 and Wonder hot varieties are

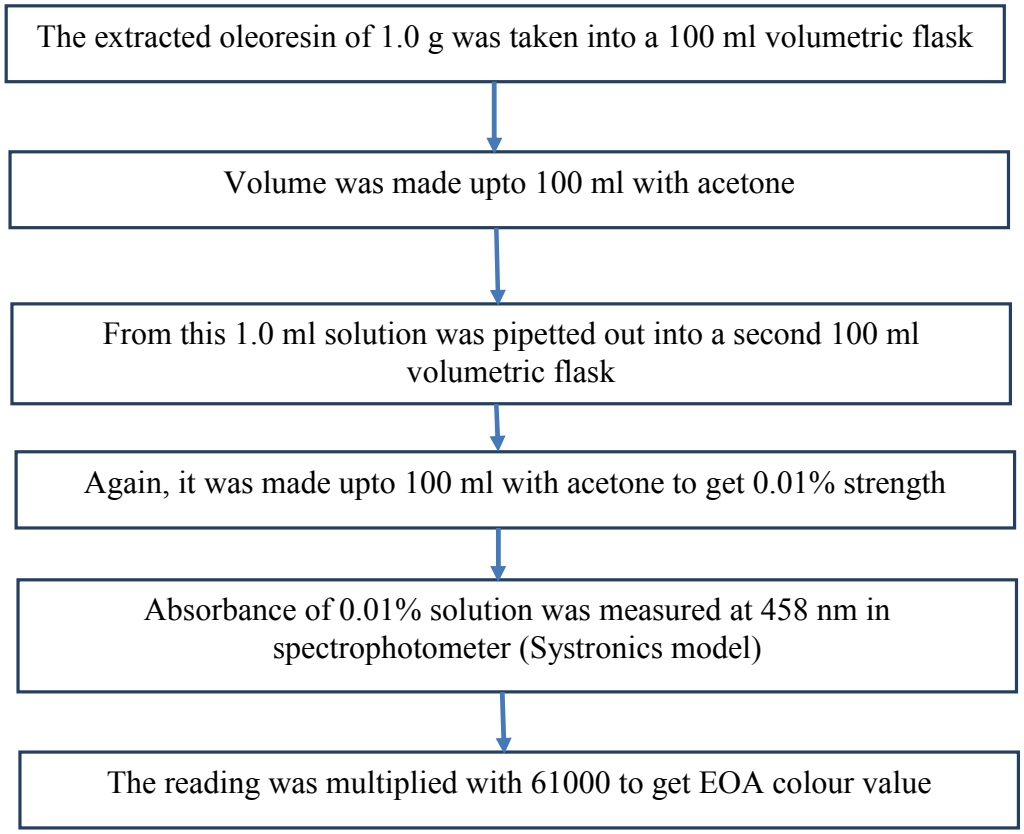
5-6 cm, 7-8 cm and 12- 13 cm respectively. Each variety was again sub divided into 3 groups namely with stem, without stem whole pod and without stem flakes (25 to 30 mm) to get a total of nine samples.
All these samples were weighed exactly 200 grams and placed separately in small trays fabricated with GI wire mesh. These trays were placed in the cabinet dryer in the perforated trays with about 5 cm spacing in between the small trays. Experiments were conducted at different drying air temperatures of 40°C, 50°C, 55°C and 60°C. Kuppuswamy, 1974 suggested that there was no darkening of chillies at temperatures up to 60 to 66°C. During drying, the weights of samples were taken for every two hours to determine the moisture content. Temperature and relative humidity were simultaneously recorded. Average air velocities maintained inside the cabinet dryer at 40°C, 50°C, 55°C and 60°C are 0.7 m/s, 1.0 m/s, 1.3 m/s and 1.6 m/s respectively.

Fig 1: Experimental Setup to extract Oleoresin

Determination of oleoresin was estimated as per the procedure outlined by Roser brook *et al.* (1968) (Fig. 1) and the procedure is presented in the following flow chart.



Determination of Capsanthin (EOA colousr value):
The capsanthin content was estimated as per the procedures outlined by Roser Brook *et al.,* [4] and the procedure is presented in the following flow chart.



Measurement of Colour
The colour value of dried red chillies was measured by using UV spectrophotometer at 458 nm. The colour value of dried green chillies was measured in terms of absorbance at 540 nm as outlined by Ranganna [3]. The oleoresin of green chilli samples was diluted as per the above procedure, except the final dilution was not performed to keep the absorbance in the range of 0 to 1.

RESULTS AND DISCUSSION
The objective of this study is to investigate the effect of different drying air temperatures on drying time and Biochemical qualities of Chillies. The study also compares the effect of mechanical drying and open yard sun drying on the oleoresin content and EOA colour value of chillies. Finally, optimum air temperature is recommended to dry different varieties and hybrids of chillies.
Effect of Different Drying Air Temperature on Drying Time of Chillies
The three varieties of chillies (Namdhari, LCA 334 and wonder hot) initial moisture contents were determined by standard oven method. Each variety of chillies was subdivided to get 3 samples to make them into three forms i.e. 1) Whole chilli 2) Stem less 3) Flaked chilli. The effect of drying air temperature ranging from 40^{o}C to 60^{o}C on drying time of different forms of each variety of chilli was studied.
As the drying air temperature increased drying time of green chillies (with stem) decreased (fig. 2). This may be due to effective removal of moisture from the surface of chillies at high temperatures. Similar trends were observed for green chillies without stem and for green chilli flakes (fig. 3 and fig. 4). Drying time was relatively less at 55^{o}C in comparison to 60^{o}C for green chilli flakes (fig. 4).This may be due to slightly lower initial moisture content at 55^{o}C.

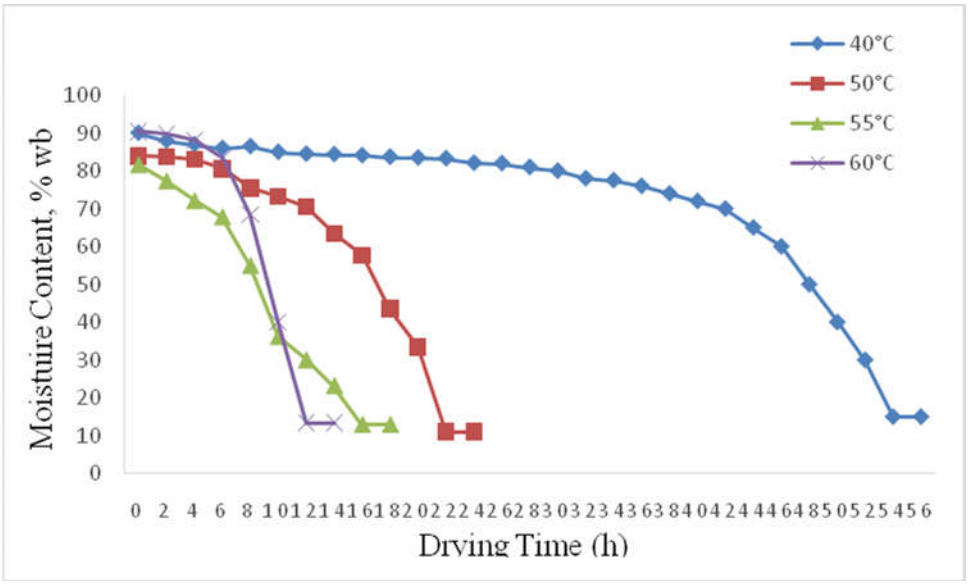


Fig2: Effect of drying air temperature on drying time of Green chillies (with stem) at different temperatures

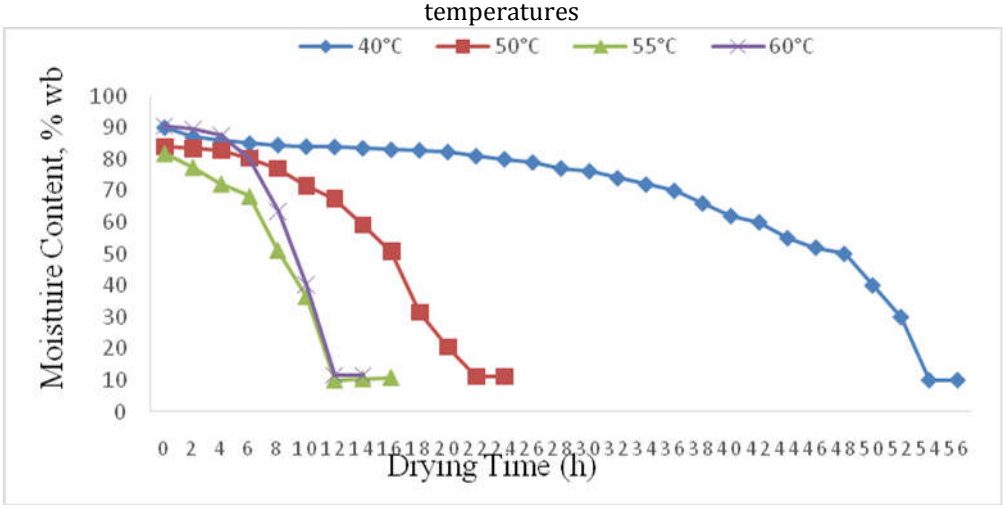


Fig 3: Effect of drying air temperature on drying time of Green chillies (without stem) at different temperatures

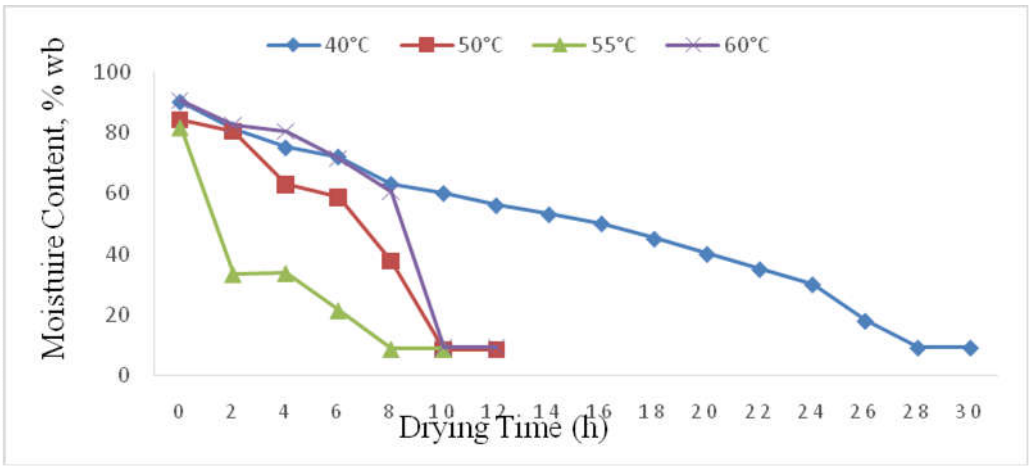


Fig 4: Effect of drying air temperature on drying time of Green chillies (flakes) at different temperatures

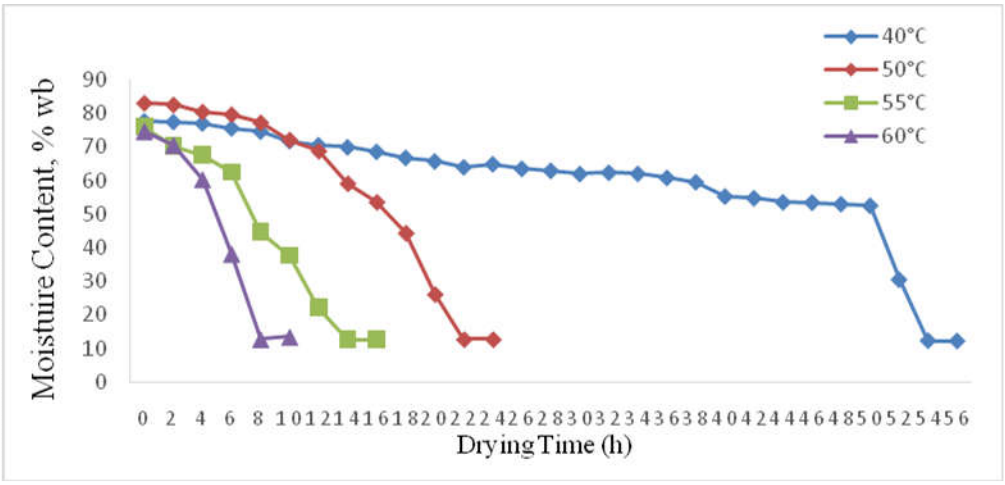


Fig 5 Effect of drying air temperature on drying time of LCA 334 (with stem) at different temperatures

Similar trends of decreasing drying time with increase in drying air temperature were observed with different forms of LCA 334 variety (fig. 5 to fig. 7). However drying time was relatively reduced at 55°C in comparison to 60°C for LCA 334 flakes (fig. 7).

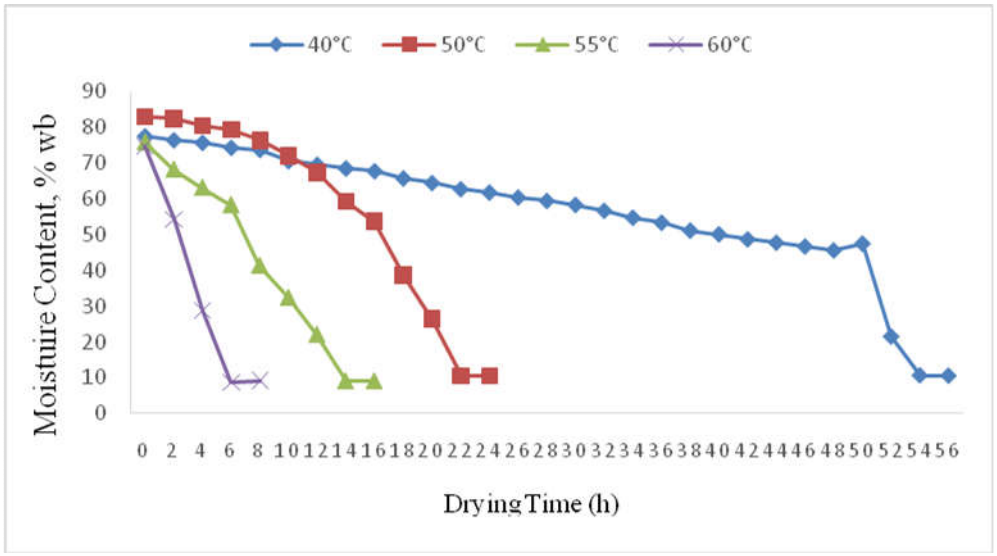


Fig 6: Effect of drying air temperature on drying time of LCA 334 (without stem) at different temperatures

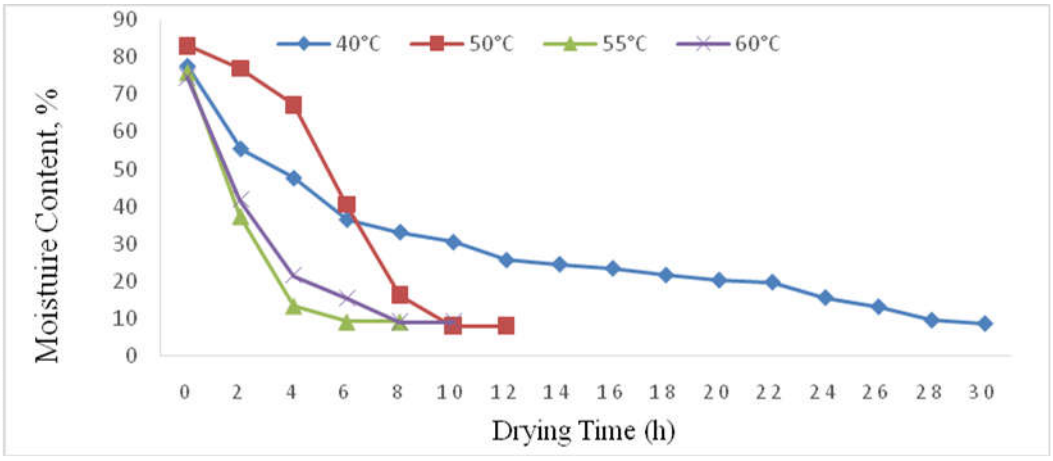


Fig7: Effect of drying air temperature on drying time of LCA 334 (flakes) at different temperatures

Similar trends of decreasing drying time with increase in drying air temperature were also observed with different forms of wonder hot hybrids (fig. 8 to fig.10). However drying time was observed to be same for wonder hot flakes at both the temperature of 55°C and 60°C (fig. 10). From this we can infer that the effect of increased temperature on drying of flakes is marginal particularly at drying air temperatures of 55°C and 60°C.

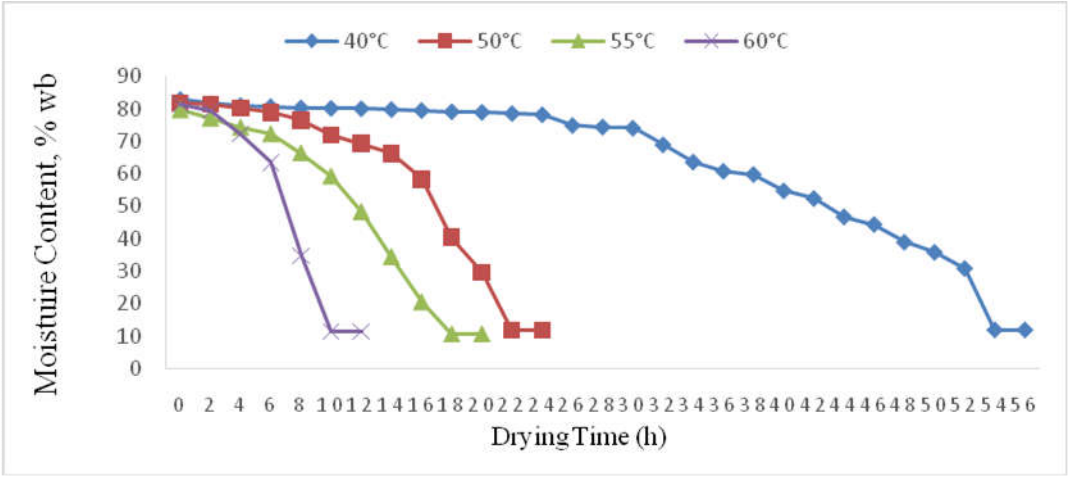


Fig 8: Effect of drying air temperature on drying time of wonder hot (with stem) at different temperatures

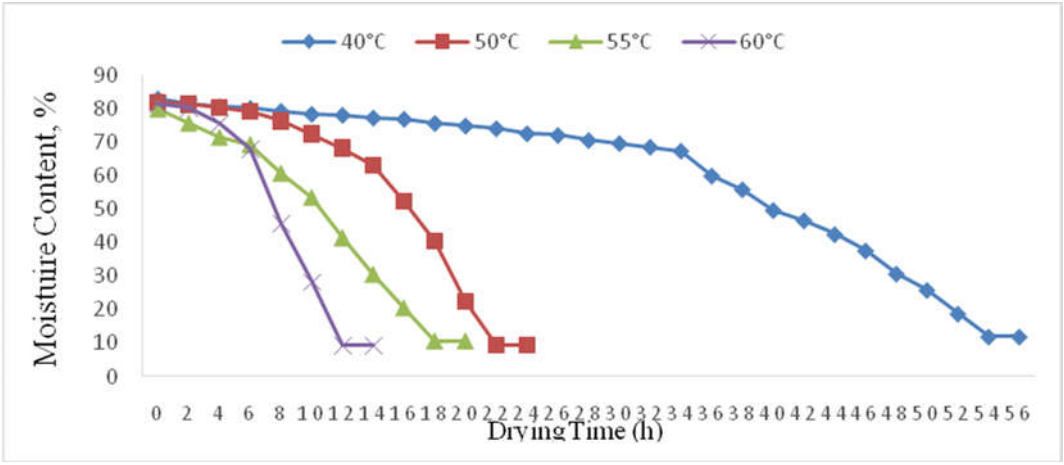


Fig 9: Effect of drying air temperature on drying time of wonder hot (without stem) at different temperatures

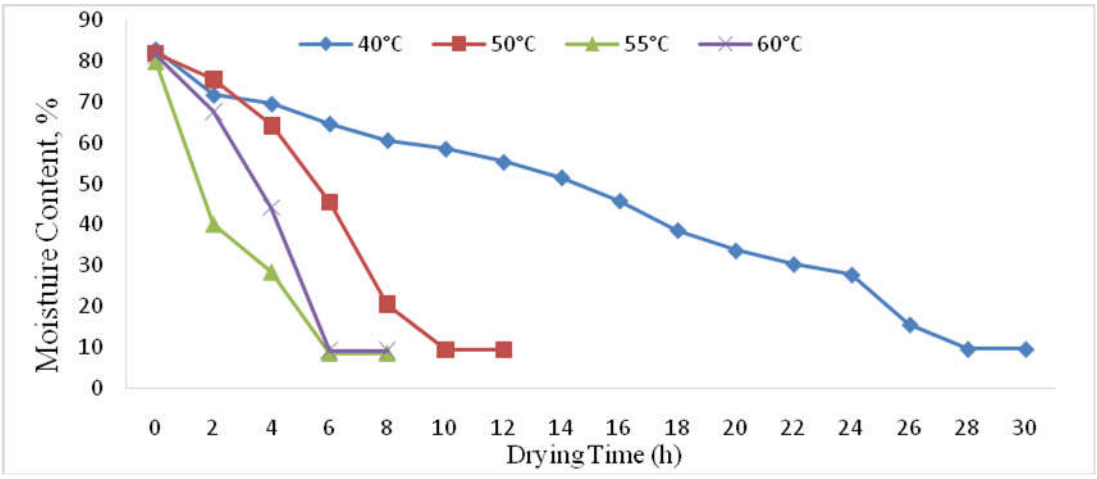


Fig 10: Effect of drying air temperature on drying time of wonder hot (flakes) at different temperatures

Effect of Drying Air Temperature on Biochemical Qualities of Chillies

The oleoresin content of chillies varied depending upon variety of chilli and also at different drying air temperatures for the same variety (table. 1).

Table 1: Oleoresin content of chillies at different drying air temperatures

S. No	Variety of Chilli	40°C	50°C	55°C	60°C
1	Green (with stem)	12.3	13.6	10.1	14
2	Green (without stem)	10.9	8.2	10.8	12.1
3	Green (flakes)	9.5	9.3	9.5	10.2
4	LCA 334 (with stem)	14.3	12.1	10.1	10
5	LCA 334 (without stem)	10.1	14.1	9.5	14.3
6	LCA 334 (flakes)	12.2	13.7	10.8	14.3
7	Wonder hot (with stem)	10.1	7.6	7.7	11.3
8	Wonder hot (without stem)	12.2	7.5	7.1	9.7
9	Wonder hot (flakes)	15.8	9.6	8.2	11.7

Quality Comparison of Mechanical Drying (M.D) with open Yard Sun Drying (OYSD)

Whole chilli pods of three different varieties were simultaneously dried in OYSD (farmer's method) to compare the different methods of drying. The data is shown in table. 2.

Table 2 : Comparison of mechanical drying (M.D) with open yard sun drying (OYSD) of different varieties of Chillies

S. No.	Variety	Optimum Drying Air Temperature		Drying Time		Oleoresin Content (%)		Colour Value	
		M.D	OYSD	M.D	OYSD	M.D	OYSD	M.D	OYSD
1	Namdhari	50	…….	56 h	13 days	13.6	8.2	0.761*	0.051*
2	LCA 334	55	…..	16h	10 days	10.1	10.9	19320	15296
3	Wonder hot	50	……	56h	13 days	7.6	7.1	29615	23424

* Absorbance of green colour at 540 nm

CONCLUSIONS

From the experiments, mechanical drying can reduce drying time significantly. Also colour retention is more compared to OYSD. Also, mechanical drying can reduce contamination and risk of unforeseen rains as drying is performed inside an enclosure. Thus, mechanical drying can be good alternative to OYSD as significant quality improvement can be achieved. Variety like LCA 334 had relatively low drying time in comparison to hybrid like wonder hot particularly at high temperatures (55 and 60°C) used in the study. Based on the assessment of quality parameters such as oleoresin and colour value, it can be concluded that 50°C is optimum air temperature to dry hybrids and 55°C is the optimum air temperature to dry variety chilli.

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