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K Kalyan Reddy
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

N Harish
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

B Tejashiwini
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

B Amala
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

R Swamy
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

Corresponding Author:
K Kalyan Reddy
College of Food Science and Technology, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rudrur, Nizamabad, Telangana, India

Effect of different drying techniques on quality of Teja red chilli (MHCP-310) powder

K Kalyan Reddy, N Harish, B Tejashiwini, B Amala and R Swamy

Abstract
Chilli (*Capsicum annum* L.) is a vegetable plant belonging to the family solanaceae chilli is rich in vitamin A, B, C and E with minerals Ca, Mg, P etc. It is mainly used to produce pungency or hotness in foods. The unique characteristics of chilli is due to presence of Capsaicinoids (capsaicin), coloring compounds like capsorubin and capsanthin and other bioactive compounds which have therapeutic properties. The Teja chill (MHCP 310) collected from Nizamabad market yard. The chilli samples were blanched and dried by using Sun drying, Solar and Tray drying techniques. The red chilli samples grounded into fine powder. The prepared red chilli samples, Blanched - sun dried (B- U), solar dried(B-S), tray dried (B-T), Unblanched - sun dried (U-U), solar dried (U-S), tray dried (U-T) were evaluated through the organoleptic test. Based on the scores, 3 samples - B-U, B-S and B-T were selected. The quality parameters are Moisture, pH, Ash content, Oleoresin, Ascorbic acid content, Pungency and ASTA color value were assessed for selected sample. The blanched Sun dried(B-U) and blanched Tray dried (B-T) samples were observed high in Ascorbic acid content (122-165 mg/100g), Pungency (0.77-0.925) and ASTA coloring values (155-157.44 ASTA units). The Oleoresin content of B-U sample 6%, and found lowest in B-S sample 5%. From these investigation it can be concluded that the Blanched Sun dried (B-U) and Blanched Tray dried (B-T) samples are a potential source of Oleoresin, Ascorbic acid with good Pungency and ASTA coloring values. These samples can be used for domestic and export purpose.

Keywords: Red chilies, drying techniques, oleoresin, coloring matter and pungency values

1. Introduction
Chili is a (capsicum annum var. accuminatam Linn) vegetable plant belonging to the family of solanaceae. Chilli is rich in vitamin A, B, C and E with minerals as calcium, magnesium, phosphorus, etc. Chillies are cultivated in all Asian countries, large parts of Africa, U.S.A. and Southern Europe. Chili is generally found to be used in three forms, namely, as fresh green chillies, red chilli powder and raw red. Chili powder is prepared from ripe chili. It is an important spice used as flavorings or condiments, in the tropics and subtropics and an indispensable item in the kitchen for every day cooking. Chilli is dried to make chilli powder and to store it for both short- and long-term storage. The most important quality characteristics in chili are the color and pungency. The red color of chili is mainly due to carotenoid pigments. India is known as the spice bowl of the world and it is not only the largest producer but also the largest exporter and consumer of spices in the world. The net share of Indian spices in world trade is about37 percent. India exported 6, 01,500 tonnes of red chillies, it accounts for 38 per cent of the volume and31 per cent value of all spices exported from India (Spices Board India, 2021). Andhra Pradesh is the leading producer of chili in India followed by Telangana, Madhya Pradesh, Katakana and West Bengal. The Indian spice processing industry has bright future as agro processing units because India may be a big spice basket for majority of countries in the world.
Chilli is a universal spice of India. It is mainly used to produce pungency or hotness in foods. The chemical that causes hotness or burning sensation in chillies belong to a family of chemical compounds called Capsaicinoids. Among these compounds two major capsaicinoids, namely capsaicin(trans-8-methyl-N-vanillyl-6-nonenamide) and dihydrocapsaicin (DHC 8-methyl-N- vanillylnonanamide), and these represent around 80–90% of the total capsaicinoids present in most species of chillies. Other compounds are Nor dihydrocapsaicin (NHDC), Homo dihydrocapsaicin (HDHC), Homocapsaicin (HC) and Noninvasive. Capsaicin and dihydrocapsaicin is approximately twice as pungent as Dihydrocapsaicin and homocapsaicin and they are responsible for the hotness of the pepper.

The pungency of capsaicinoids can be expressed in Scoville Heat Units (SHU), a widely used heat measurement of chilli peppers and the human palate can detect it even diluted in a 1: 17 000000 ratio.

To improve the quality of dried chili, industrial dryers are used to decrease the drying time and provide uniform and hygienic processing conditions. However, drying chili with upon species and stage of maturity. The eventual high temperatures leads to the loss of volatile compounds, nutrients and color. Chillies have a relatively low volatile content, which is dependent volatile-content of the dried powder, however, may be lower and is dependent upon the drying procedure, the duration and condition of storage.

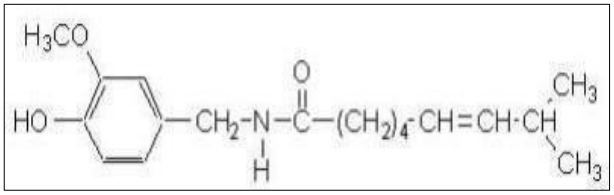


Fig 1: Chemical Structure of Capsaicin

Drying is one of the essential unit operations performed to increase the shelf life of agricultural/ horticultural produce and it is one of the most practical methods of preserving food and the quality of horticultural produce. If the drying process is not completed fast enough, growth of microorganisms will take place as a result of the high relative humidity. Open sun drying also requires a large space. Drying is usually conducted by vaporizing water in the product. In this case, drying at low temperature and humidity is required to maintain the fresh color of the product using the desiccant system. The same product dried with different techniques produces different levels of product quality. Drying is a common technique for preservation of food and other products; including fruits and vegetables. The major advantage of drying food products is the reduction of moisture content to a safe level that allows extending the shelf life of dried products. The removal of water from foods provides microbiological stability and reduces decorative chemical reactions. Also, the process allows a substantial reduction in terms of mass, volume, packaging requirement, storage and transportation costs with more convenience.

Capsaicin is an active component of chilli peppers. It is a volatile phenol chemical similar in structure to vanillin, present in the placenta that bears the seeds in the chilli pepper. The amount of capsaicin in hot peppers varies very significantly between varieties. Capsaicin are being used in prevention of ulcers in stomach, which are mostly caused by bacteria and its antibacterial action kills such bacteria. It has beneficial effect on the circulatory system and reduces platelet aggregation, thus reducing the risk of heart attacks and strokes. It also lowers high blood pressure and increase peripheral circulation.

2. Material and Methods

Raw materials: Teja red chillies were purchased from local market of Dhramabad, Nizamabad (Dist), India.

Processing Equipment: The equipments such as Solar dryer, Tray dryer, Pulvarizer, hot air oven, Muffle furnace, Soxhlet apparatus, Ultraviolet– visible Spectrophotometer, Sieves, Weighing balance and other equipment obtained from Department of Food Process Technology, Department of Food Safety and Quality Assurance and Department of Food Process Engineering, College of Food Science and Technology, Rudrur.

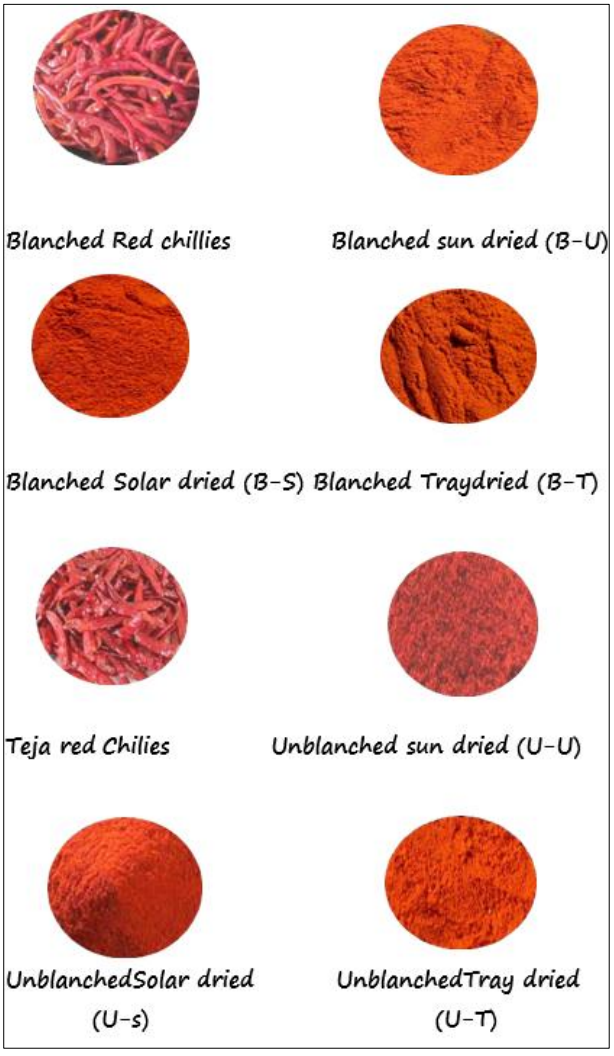
3. Methods of drying

Pretreatment of red chillies (Blanching) Blanched Red chillies were pretreated before the drying process to improve the quality of final product.Blanching was done by immersing red chilies in 10% Nacl at 90°C for 3 minutes.

They were cooled by dipping in normal water and drained the excess water. Then the chilies were chemical treated with 1% CaCl2 solution. The treatment can increase the rate of drying by removing the surface resistance, retains the color and firmness in chili, afterwards the sample was subjected to drying process.

UnBlanched

Red chilis were not treated with any chemicals. The sample were sorted and cleaned and subjected to drying.



Estimation of Moisture content

Moisture is done by oven drying method (AOAC, 2005). In oven drying method, the sample is heated under specified conditions, and the loss of weight is used to calculate the moisture content of the sample. Weigh the empty Petri dish. Take 5 g of the sample and place in weighed empty Petri dish. Note the weight (Petri dish + sample) (w1). Pre heat the oven

to 100°C. Now place the sample in the oven at 105ºC± 2°C for 3 to 4 hours. Take the sample from the hot air oven which is shown in Fig 3.12 and place it in desiccators for some time. Weigh the sample (dried sample + Petri dish) (W2).

Estimation of Ash content

The finely ground sample of 5g was weighed in pre- weighed silica crucible and ignited till smokeless. Then it was transferred to muffle furnace and heated at 550℃ for 4 hours for complete oxidation of organic matter and resultant ash content was calculated.

Oleoresin content

The oleoresin was extracted in a Soxhlet apparatus using acetone as a solvent by Weso³owska *et al.* (2011). Approximately, 20gm powder of the dried chillies was taken into a thimble and placed in a Soxhlet apparatus. The apparatus was set up with acetone solvent and extraction was carried out for 6 hours. After completion of extraction the dark red extract was obtained and then it was cooled, filtered, and concentrated. The volume of dark red concentrated extract was recorded and 5 ml of the extract was poured into a Petri dish.The excess methanol was allowed to evaporate from the Petri dish at room temperature to obtain a thick sticky dark brown mass. This crude dried mass was weighed and the oleoresin content was estimated using the formula:

$$\text{Oleoresin Content} = \frac{D*V*}{5*20}100$$

Where, C = Oleoresin content (%), D= Weight of oleoresin obtained from 5ml of extract and V = Total volume of extract obtained (ml).

Estimation of Ascorbic acid

The ascorbic acid content was measured by using the standard method as given by AOAC (1975). 5 gram powder of dried chilies was taken and extracted with 50 ml of 3% meta phosphoric acid solution. This solution was then filtered. 2 ml of this filtered solution was titrate against 2,6-dichlorophenol indophenol dye. Ascorbic acid content w a s calculated by

$$\text{Ascorbic acid (mg / 100)} = \frac{1*25*100*V}{D*5*2}$$

Where, D=Standard dye (volume of dye used for 1 mg of ascorbic acid) V=volume of dye used sample (ml)

Coloring matter

The colouring matter was measured by using the method as given by Rosebrook *et al.* (1968). 25 mg powder of the dried chillies was taken in a volumetric flask. The volume was made 100 ml by taking acetone. The sample was kept in dark for about 4 hours.The optical density of this sample was read from the Spectrophotometer (Spectronic 20) at 460 nm wavelength. Colouring matter was evaluated using the following formula:

$$\text{Colouring matter (ASTA Units)} = \frac{O.D*16.4}{\text{Sample wt}}$$

Where, ASTA units=American Spice Trade Association units and O.D. = Optical density

Estimation of pungency in chili powder Extraction of green chilli

Capsaicinoids in Red chilli is extracted in solvent methanol and diluted to required concentration for measuring the absorbance10 gram red chilli is ground to a paste. One gram of the paste is taken for extraction. 25 ml of methanol solvent is added to 1gram of paste and stirred for 10 minutes using magnetic stirrer at room temperature This solution is homogenize for 20min.The resulting solution is filtered into a glass flask and finally made up to 20ml by adding methanol

Measurement of spectrum

UV spectrum measured at different analyte concentrations; 3 ml methanol is taken in a cuvette to which different amounts of stock solution is added; like 20µL, 40µL, 60µL, 100µL, and 150µL for UV absorbance analysis.

Sensory analysis

The sensory evaluation of prepared samples were carried out a 10 member trained panel comprised of UG students and academic staff members of the faculty who had some previous experience in sensory evaluation. The panel members were requested in measuring the terms identifying sensory characteristics and in use of the score. Judgment were made through rating products on a 9 points Hedonic Scale with corresponding descriptive terms ranging from 9 'like extremely to 1 'dislike extremely.

Result and Discussion

Moisture content

The final moisture content ranged from 4.53%db to 5.78%. The higher moisture content was observed for sample (B-U) is 5.78% and lowest for the sample (B- S is 4.53%. For the sample(B-T) the moisture content is in between 4.53% to 5.78% i.e 4.9%. It was also found that improved and mechanical dried chillies contains lower moisture content than sun dried chillies. The change in moisture content of those samples due to effect of time and temperature. Sharma *et al.* got the moisture values ranges from 1.74% to 6.06%

Ash content

Ash content ranged from 5% to 6% being lowest in sample B-S i.e.,5% and highest in Sample B-T I.e., 6%. The reason behind the variation of ash percentages was due to reduction of water level from chilies through different drying techniques. According to Indian standards, maximum value of ash content of chili powder is 8%. Mamum *et al.* (2016) revealed that the ash content in red chilli powder samples were <8.5%.

Oleoresin content

S. No	Parameter	Sample (B-S)	Sample (B-T)	Sample (B-U)
1	Moisture%	4.53	4.92	5.78
2	pH	6.3	6.9	6.8
3	Ash%	5	6	5.5
4	Coloring Matter (100g) (ASTA Units)	154.816	157.44	155.24
5	Ascorbic Acid (100 g)	138mg	122mg	165mg
6	Oleoresin %	5	6	5.5
7	Pungency (Absorbance values)	0.77	0.57	0.925

The oleoresin content of all three samples were relatively ranging from 5% to 6% being lowest for sample B-S i.e., 5% and highest for sample B-T i.e., 6%. The higher oleoresin content was observed for the sample B-T than B-S, and lower for the sample B-U. This variation was on the basis of physical treatment and drying techniques used for drying of red chilli samples. Sun dried chilies has less oleoresin content as compared to improved sun drying and mechanical drying. Mechanical dried chilies dried at 600C had highest oleoresin content compared to other methods of drying.

Coloring matter

The coloring matter ranges from 154 to 155.5 ASTA (American spice trade Association Units) on chili powder as shown in Fig. The maximum coloring matter was absorbed in the sample B-T is 157.816 ASTA units and the lowest coloring in sample B-S is 154.86 ASTA units. The tray dried red chilli powder sample scored high in coloring matter compared to sun dried and solar dried samples. The variation of color was found due to decreasing of the coloring compounds when exposed to heat during drying process. Babu *et al*. stated that the coloring matter of Teja chili powders were in between 48.708 to155.44 ASTA units.

Ascorbic acid

The ascorbic acid is an important component present in chillies. The chilli peppers are very high in vitamin C, which is an immune-boosting nutrient. Ascorbic Acid values ranges from122mg/100g to 165mg/100g. The highest Ascorbic acid value comes from the sample B-U is 165mg/100g and the lowest value comes from the sample B-S 138mg/100g.here we have absorbed that highest vitamin C content present in sun dried sample compared to other drying techniques. The reason behind this is gradual decreasing of vitamin C occurs by amount of heat applied on the sample (drying temperature and time). Uma Fadzilla at al.. said that dradual decrease of vitamin C from the sample while drying. Omk Anil kumar *et al.* were analyzed for ascorbic acid content of among eight genotypes 231±0.66 to 173.74.

Pungency of chilli (Heat level)

The highest value recorded from the Sample B-U is 0.925 and the lowest for sample B-T 0.5 Figure shows absorbance peaks at different wavelengths for Sample B-U chili extract over a concentration range of 20µL to 150µL. All peaks do not appear at all concentrations except at 80µL and 100µL concentrations. However, two peaks one in the range 369.5 – 370nm and are seen at all concentrations. Also it may be observed that the peaks observed at wavelengths other than those contribute to less than 10% of the total absorbance and less than 1% of saturation value of absorption. Hence, they have been neglected. It is reported that absorbance peak for capsaicin occurs at 370nm It has also been reported that the wave lengths at which absorbance peak occurs is affected by presence of other compounds. Thus the peak at 370nm is most probably due to capsaicin and other due to presence of benzene derivative, an aromatic compound.

Conclusion

The present investigation focused on preparation of red chilli powder samples by using different drying techniques. The red chillies (MHCP 310) were blanched, dried and grounded into fine powder. The color of samples were improved by blanching. The sun dried and tray dried Teja red chilli samples (MHCP-310) are a potential source of Oleoresin, Ascorbic acid values with good amount of ASTA coloring units. These samples are having good pungency values and can be used for domestic and export purpose.

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