International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 26-09-2019; Accepted: 28-10-2019
www.foodsciencejournal.com
Volume 4; Issue 6; November 2019; Page No. 120-123

A study on thermal behavior properties of Purslane leaves using different drying techniques

N Nandini[1], B Mounika[2], Tasleem[3], V Bhasker[4], P Prashanth[5]
[1, 2, 3, 5] M. Tech Food Technology, Department of Food Technology University College of Technology, Osmania University, Osmania University Hyderabad, Telangana, India
[4] Assistant Professor, Food Technology, Department of Food Technology University College of Technology, Osmania University Hyderabad, Telangana, India

Abstract
Dryingis an essential process in the preservation of agricultural products. Various drying methods are employed to dry different agricultural products. Each method has its own advantages and limitations. Choosing the right drying system is thus important in the process of drying agricultural products. Care must be taken in choosing the drying system. Study of comparing traditional drying and other drying methods for the reduction of the drying time and to a significant improvement of the product quality in terms of color texture and taste. Drying reduce the possibilities of the contamination by insects and microorganisms so the product is prevented.
An experimental study was performed to determine the drying characteristics ofPurslane leaves were dried using tray drier and infrared dryer. The drying profile of purslane leaves was determined in the two drying systems by monitoring moisture loss over the drying period. Changes in time, yield were assessed. The rate of moisture removal during infrared drying was faster than tray drying. Yield is higher in infrared heater than tray drying.

Keywords: behavior, properties, purslane, leaves, drying

1. Introduction

Purslane (Portulaca oleracea L.) deserves special attention from agriculturalists as well as nutritionists. Purslane is a common weed in turf grass areas as well as in field crops. Many varieties of purslane under many names grow in a wide range of climates and regions. It is an important component of green salad and its soft stem and leaves are use draw, alone, or with other greens. Purslane is also used for cooking or used as a pickle. Recent research demonstrates that purslane has better nutritional quality than the major cultivated vegetables, with higher beta-carotene, ascorbic acid, and alpha-linolenic acid. Additionally, purslane has been described as a power food because of its high nutritive and antioxidant properties.

Purslane is best known as an invasive weed, but this wild growing succulent plant is also completely edible, and it's delicious, too. Also known as little hogweed, verdolaga, common purslane and pursley adds a slightly tangy note to soups and stir fries, and its juicy leaves can be used to add texture to salads. Culinary aspects aside, purslane is also an all-round healthy food that contains a whole range of health boosting nutrients, including omega-3 fatty acids, antioxidant vitamins, and minerals.

Purslane is one of the best sources of omega-3 fatty acids for vegetarians, and other people who do not or cannot eat fish. In fact, purslane is said to be the richest source of omega-3 fatty acids among cultivated green leafy vegetables. Aside from delivering a hefty dose of vitamins, purslane supplies a slew of minerals. It contains calcium and magnesium which are crucial for keeping your bones, teeth and muscles healthy. It also provides plenty of potassium, important for keeping your blood pressure in check and for avoiding problems associated with a high intake of salty foods. Eating purslane can also supply your body with some extra iron, a mineral that is needed for oxygen transport within your body.

The term drying refers generally to the removal of moisture from a substance. It is one of the oldest, most commonly used and most energy consuming unit operation in the process industries. Drying is one of the oldest forms of food preservation methods known to man and is the most important process for preserving food since it has a great effect on the quality of the dried products. The demand for high-quality dried products is increasing all over the world. Drying is a complicated process involving simultaneous, mass and heat transfer, particularly under transient conditions.

The main purposes of drying are

- To prevent (or inhibit) microorganisms.
- To increase shelf life.
- To simplify the handling, storage andtransport of products.
- To prepare the product to subsequent processes.

Tray dryers usually operate in batch mode, use racks to hold product and circulate air over the material. It consists of a rectangular chamber of sheet metal containing trucks that support racks. Each rack carries a number of trays that are loaded with the material to be dried. Hot air flows through the tunnel over the racks. Sometimes fans are used to on the tunnel wall to blow hot air across the trays. Even baffles are used to distribute the air uniformly over the stack of trays. Some moist air is continuously vented through exhaust duct; makeup fresh air enters through the inlet. The racks with the dried product are taken to a tray-dumping station. These types of dryers are useful when the production rate is small. They are used to dry wide range of materials, but have high labor requirement for loading and unloading the materials, and are expensive to operate. They find most frequent application for drying valuable products. Drying operation in case of such dryers is slow and requires several hours to complete drying of one batch. With indirect heating often the dryers may be operated under vacuum. The trays may rest on hollow plates supplied with steam or hot water or may themselves contain spaces for a heating fluid. Vapor from the solid may be removed by an ejector or vacuum pump.

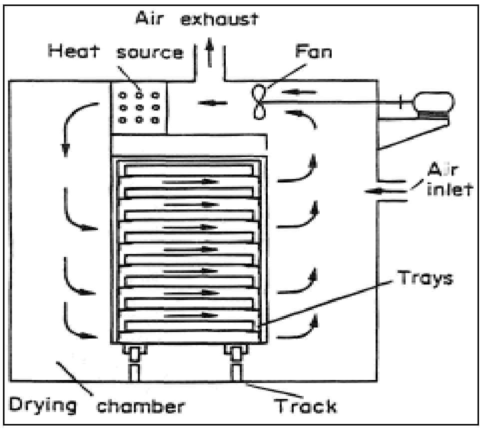

Fig 1: Schematic diagram of Tray drier

Flameless Catalytic Infrared Energy (FCIR) is generated by catalyzing natural gas or propane with a proprietary enhanced platinum catalyst

Natural gas, when combined with air across the platinum catalyst, reacts by oxidation-reduction to yield a controlled bandwidth of infrared energy and small amounts of CO_2 and water vapor. The key to this process is that the bulk of the radiant energy bandwidth generated is in the "far infrared" range, with wavelengths of 3 to 7 microns.Water readily absorbs infrared radiant energy at 3, 4.5 and 6 microns wavelength. The energy delivered by Catalytic Drying Technology (CDT)'s flameless catalytic infrared system perfectly targets the moisture in the substrate.

Gone are the detrimental effects of convection heating (skinning over, high air velocities, high heat differentials in the product). Gone are the moisture gradients and slow drying times associated with conduction heating. The more moisture at a point in the product, the greater the absorption of infrared energy. This reduces stresses and improves both drying times and drying uniformity.

2. Materials and methods

2.1 Tray drying of purslane

Drying experiments were carried out in a tray drier. The samples were dried in the perforated tray. Weight loss of samples was recorded by using a digital balance. The samples of the purslane (stems+ leaves) weighing about 500± 0.5 g were spread on the tray. The drying experiments were conducted at 50, 60 and 70˚C. Air flows parallel to drying surfaces of the samples. Initial weight of the tray and sample was noted. During drying process, the tray was weighed at 30 min intervals. Then, the dried samples were packed into aluminum covers, which were then heat-sealed and stored at ambient temperature. The experiments were replicated three times and the average of the moisture content at each value was used for drawing the drying curves.

2.2Infrared drying of purslane

Drying experiments were carried out in a infrared heater. The samples of purslane (stem + leaves) weighing about 10 gm were spread evenly on the pan of moisture meter. The drying experiments were conducted at 50˚C, 60˚C and 70˚C. During drying process, the readings were taken at 5 min intervals. The experiments were replicated three times and the average of the moisture content at each value was used for drawing the drying curves.

Determination of moisture content:

Moisture content (%) = [(Initial weight – Final weight) ÷ (Initial weight)]*100

Determination of drying rate:

(Initial weight – Final weight)÷ (Time interval)

3. Results and discussion:

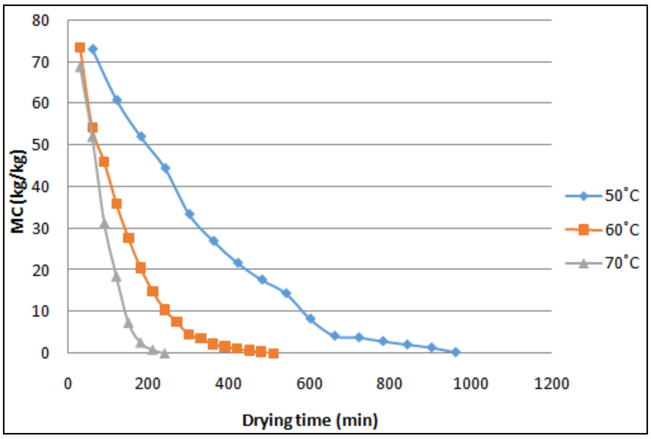

Fig 2: Variation of moisture content with drying time of purslane dried at different temperatures using Tray drier.

Fig.2 represents the variations of moisture content (MC) with drying time for tray drying of purslane at 50, 60 and 70˚C. It is clear that the moisture content decreases continuously with drying time. The drying air temperature had a significant effect on the moisture content of samples. The rate of moisture loss was higher at higher temperatures, and the total drying time reduced substantially with the increase in air temperature. The drying time reduced from 990 to 510 min when the air temperature is increased from 50˚C to 60˚C and the time reduced from 510 min to 270 min when the air temperature was increased from 60˚C to 70˚C.

The drying rates defined as the quantity of water removed per unit time versus moisture content are shown in Fig.5. It is apparent that drying rate decreased continuously with moisture content. At the beginning of the drying process, drying rate was very high, and drying rate continued to decrease as moisture content approached to equilibrium moisture content. Constant drying rate period was not observed in the drying curves and the whole drying process take place in the falling rate period. Similar results were observed by Doymaz, 2013.

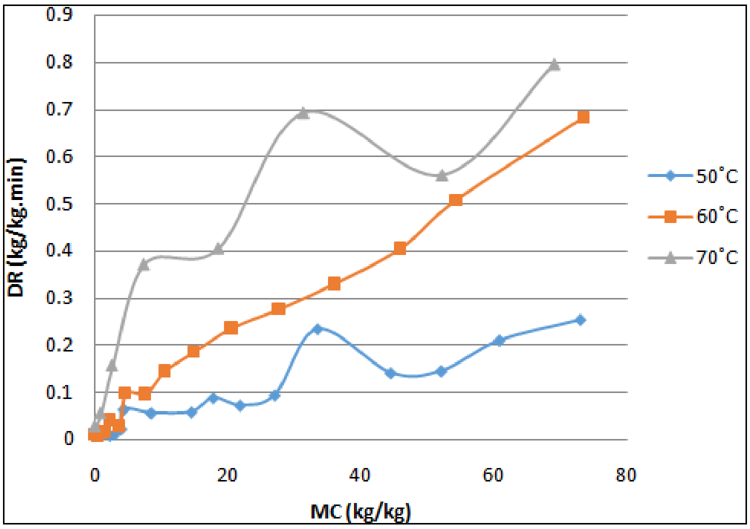

Fig 3: Variation of drying rate with moisture content of purslane dried at different temperatures using Tray drier.

Fig.4 represents the variations of moisture content (MC) with drying time for infrared drying of purslane at 50, 60 and 70˚C. It is clear that the moisture content decreases continuously with drying time. Temperature had a significant effect on the moisture content of samples. The rate of moisture loss was higher at higher temperatures, and the total drying time reduced substantially with the increase in air temperature. The drying time reduced from 100 to 60 min when the airtemperature is increased from 60˚C to 70˚C.

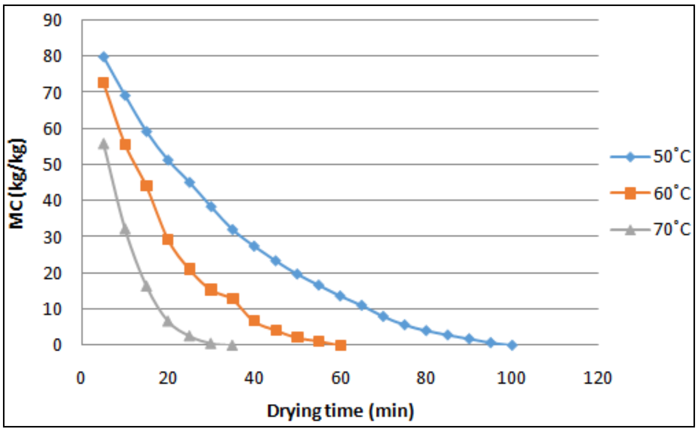

Fig 4: Variation of moisture content with drying time of purslane dried at different temperatures using Infrared moisture meter.

The drying rates defined as the quantity of water removed per unit time versus moisture content are shown in Fig.7. It is apparent that drying rate decreased continuously with moisture content. At the beginning of the drying process, drying rate was very high, and drying rate continued to decrease as moisture content approached to equilibrium moisture content. Constant drying rate period was not observed in the drying curves and the whole drying process take place in the falling drying rate period.

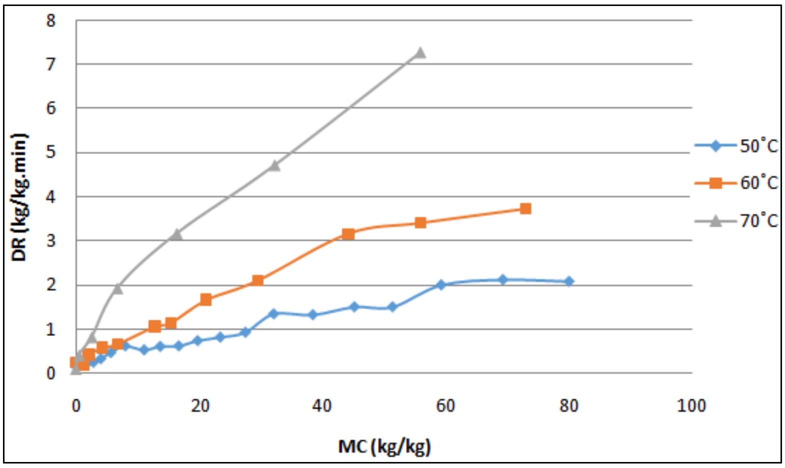

Fig 5: Variation of drying rate with moisture content of purslane dried at different temperatures using Infrared moisture meter.

Table 1: Comparison between Tray drier and Infrared drier at 50ºC.

Type of drying at 50ºC	Time (min)	Moisture removed (%)	Yield (%)
Tray drying	990	92.9	7
Infrared drying	100	90.33	11.6

Table 2: Comparison between Tray drier and Infrared drier at 60ºC.

Type of drying at 60ºC	Time (min)	Moisture removed (%)	Yield (%)
Tray drying	510	93.5	6.7
Infrared drying	60	91.46	7.6

Table 3: Comparison between Tray drier and Infrared drier at 70ºC.

Type of drying at 70ºC	Time (min)	Moisture removed (%)	Yield (%)
Tray drying	270	93.9	6.4
Infrared drying	35	92.26	7

4. Conclusion

- Infrared heating took lesser time for drying when compared to tray drying.
- Yield in Infrared heater is higher when compared to tray drier.

References

1. Derya Arslan. “Evaluation of drying methods with respect to drying kinetics, mineral content and color characteristics of rosemary leaves.” In Energy Conversion and Management 2008.
2. Ibrahim Doymaz. “Hot air drying of purslane (*Portulaca oleracea* L.), 2013.
3. Ibrahim Doymaz. “Thin layer drying of spinach leaves in a convective dryer, 2007.
4. J Ahmed, *et al*. Drying characteristics and product quality of coriander leaves” Department of Food Science and Technology, Guru Nanak Dev University, India, 2001.
5. Li Y, *et al*. Thin-layer drying rates and quality of cultivated American ginseng.” Transactions of the ASAE. 1987; 30:842–847.
6. Lewicki PP, *et al*. Effect of drying mode on drying kinetics of onion.” Drying Technology. 1998; 16(1&2):59-81.
7. Md. Kamal Uddin, *et al*. Purslane Weed (*Portulaca oleracea):* A Prospective Plant Source of Nutrition, Omega-3 Fatty Acid, and Antioxidant attributes,” The Scientific World Journal, Volume 2014, Article ID 951019.
8. Maria Gonnella, *et al*. Purslane: A review of its Potential for Health and Agricultural aspects.” A European Journal of Plant Science and Biotechnology, 2010.
9. M Kashaninejad, LG Tabil. Drying Characteristics of Purslane (Portulaca oleraceae L.), 2007.
10. Rocha T, *et al*. Effect of drying conditions and of blanching on drying kinetics of mint (MenthaspicataHuds.) and basil (Ocimumbasilicum).” In Drying ’92; Mujumdar, A.S., Ed.; Elsevier Science, 1992, 1360-1368.