Fifteenth Indian Expedition to Antarctica, Scientific Report, 1999
Department of Ocean Development, Technical Publication No. 13, pp 123-127

SOLAR DRYING IN ANTARCTIC ENVIRONMENT

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Abstract

Solar drying of apples was studied in Antarctica at Indian Station "Maitri" during Jan 1996 in an indigenously fabricated solar dryer. About 90.8% of the moisture was reduced in solar dryer after 21 hrs, while the corresponding moisture loss in open was 70.8%. The rate of drying was very high in the first two hours in the dryer, while a uniform drying rate was observed in the open. The average temperature in the dryer was 50.5°C while the ambient temperature was 6.3°C.

Introduction

Antarctica is an isolated glacial continent having an area of 14 million km^2 . About 2% of this area is free from ice. Antarctica experiences extremely low temperatures, strong winds, increased ultraviolet radiation, high albedo and blizzards coupled with six-month long day-night cycle. The temperature in polar summer ranges from -5°C along the coast to -20°C in high interiors. The corresponding values for winter range from -20°C to -55°C. A large amount of solar energy received by Antarctica, is reflected by ice cover resulting in a heat deficit environment.

Increased scientific activity in the continent has resulted in a.large volume of scientific information. More and more areas are being explored. Application of solar energy has been attempted by Ramkrishna (1990) and Dhaulakhandi *et al.* (1994) for improvement in logistics and greenhouse crop production. In order to study the solar drying in Antarctic environment, an experiment was planned during the 15th expedition to study drying rate of apples in an indigenously built solar dryer. The results of this experiment are reported here.

Materials and Methods

The experiment was conducted at Maitri, Indian Antarctica Station, (latitude 70° 47' S, longitude 11° 44' E) during polar summer in January 1996.

The solar dryer was based on the design of Thanvi (1994). The dryer comprised of a rectangular box of size 110 cm x 90 cm x 23 cm, made of an iron frame and aluminium sheet-16 gauge (Fig.3). Thermocol sheet of one inch thickness was used for insulation. Six aluminium pipes (diameter 1.8 cm, length 8 cm) were fixed on front wall of the dryer to induct fresh air at the base. Two tapered slits were made on both sides of the dryer for hot moist air to escape. A wooden frame was fixed at the top of aluminium box. A prefabricated sheet was fixed at the front of the box. Aluminium wire-mesh trays were placed on the iron frame inside the dryer through a door which could be opened and closed. Four partitions were made in the dryer.

The drying trial for dehydrating three samples of apples weighing 650 gm each was conducted by cutting these into pieces. The dryer was kept at an optimum tilt. The climatic parameters viz. solar radiation, temperature and humidity inside dryer and the ambient temperature and humidity were recorded hourly. Loss of moisture content of the samples after each hour was computed from the different in their weights.

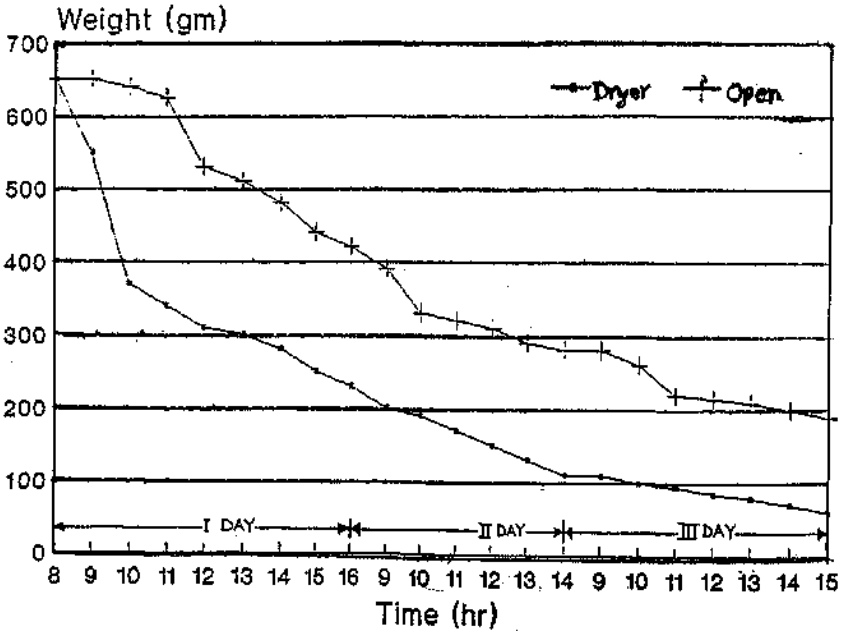

Fig. 1: Variation of weight with time

Results and Discussion

The variation in the weight of samples with time in dryer and open is presented in **Fig.1.** Loss of moisture was 64.6% after first 8 hrs, 83.0% after 14 hrs and 90.8% after 21 hrs of drying; the corresponding values for open air drying were 35.3%, 56.9% and 70.8%, respectively. The rate of loss of moisture was maximum in dryer in first two hours. After 21 hrs of drying, the moisture was reduced upto 90,8% in the dryer while it was 70.8% in the open.

The average air temperature inside the dryer was 50.5°C, which was 44.2°C higher than the ambient temperature **(Fig.2).** The ambient solar radiation during drying period varied from 354.52 cal/cm^2/minute to 413 cal/cm^2/minute.

Thanvi (1994) has studied drying of okra and reported that moisture content can be reduced from 88.8% to 5.8% within 21 hrs of drying. Yadav and Ahlawat (1994) studied drying of grapes in solar dryers and observed that moisture

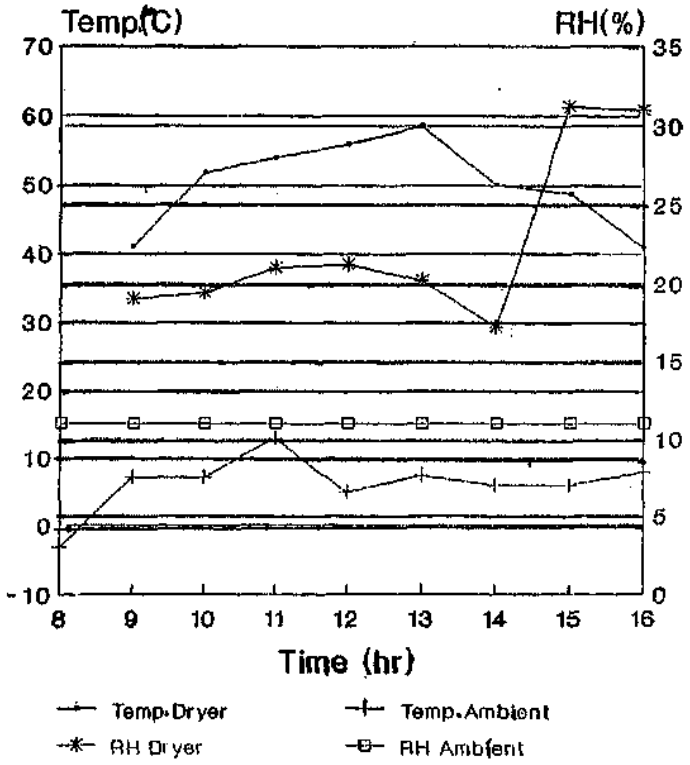

Fig. 2: Temperature and humidity variation

Fig. 3: Solar drying of Apples and Spinach in Antarctica

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