

Research Paper :

Drying of lemon in M.P.U.A.T. solar tunnel dryer

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ABSTRACT

The experiment was conducted to dry lemon in solar tunnel dryer designed by M.P.U.A.T., Udaipur. The minimum temperature was 38.1°C at 8:00 am while maximum temperature attended in STD was 72.9°C at 2:30 pm. Solar radiations received were increased from 300 W/m² at 8:00 am to more than 700 W/m² at 12:00 pm. The initial moisture content of lemon taken for drying was 80.7 and which was reduced to 5.88 % (wb) in six days drying period, where as open sun drying required ten days. Cost analysis revealed that the cost of dried lemon was Rs. 100/- per kg and break-even point was 27.67%. The profit of STD per year was found to be Rs. 382560/-.

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Key words : Solar tunnel dryer, Lemon

Solar drying is in practice since time im-memorable for preservation of food and agriculture crops. This was done particularly by open sun drying under the open to sky. This process has several disadvantages like spoilage of product due to adverse climatic condition like rain, wind, moist, dust, loss of material due to birds and animals, deterioration of the material by decomposition, insects and fungus growth. Also the process is highly labour intensive, time consuming and requires large area. With cultural and industrial development artificial mechanical drying came in to practice. This process is highly energy intensive and expensive which ultimately increases product cost. Thus solar tunnel dryer may be the best alternative to overcome drawbacks of natural drying and artificial mechanical drying. Solar dryers are used for food and crop drying. In the present study a hemispherical solar tunnel dryer designed at M.P.U.A.T. was used to dry 1.5 tones of lemon. Solar tunnel dryer has become popular due to considerable reduction of drying time and significant improvement of product (Chow *et al.*, 1997). It has been used to dry fruits, vegetables, root crops, medicinal plants and fish (Gauhar, 1998). A solar tunnel dryer is a tunnel like framed structural covered with ultra violet stabilized polythene sheet. The performance and techno- economic feasibility was tested for drying of lemon fruits.

METHODOLOGY

The experiment of drying of lemon in solar tunnel dryer was conducted in organic farm at village Nimkhed bajar in Anjangaon Surji block, Dist. Amravati. This organization was engaged in processing and drying of lemon, onion, pomegranate, rose petals, wheat grass etc.

MPUAT solar tunnel dryer:

The Department of Renewable Energy Sources, College of Technology and Agricultural Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur has designed and developed a solar tunnel dryer of 1.5 MT capacity. The design parameter were decided on the basis of quantity of moisture removed per day and flow rate required for removing moisture in stipulated time (Seveda *et al.*, 2004). The STD consisted of the following structural components:

Hoops foundation, Floor, UV stabilized polythene film, Drying trays, Chimney.

The salient features of STD are given bellow:

- It is hemi-cylindrical shaped with base area of 3.75 m × 21.00 m and maximum ceiling height of 2.0 m. Low cost materials possessing high rigidity, long life and superior thermal characteristics was used for construction.
- The metallic frame structure of the tunnel dryer covered with an UV rays stabilized semi-transparent