RESEARCH PAPER | International Journal of Agricultural Engineering | Volume 5 | Issue 1 | April, 2012 | 73 – 76

Fabrication and performance study of a photovoltaic integrated solar dryer

M.K. GHOSAL

Received : 10.11.2011; Revised : 11.01.2012; Accepted : 25.02.2012

Correspondence to:
M.K. GHOSAL
Department of Farm Machinery and Power, College of Agricultural Engineering and Technology, Orissa University of Agriculture and Techonology, BHUBANESWAR (ODISHA) INDIA
Email : mkghosal1@rediffmail.com

Abstract **:** Drying or dehydration is a simple, low-cost way to preserve food that might otherwise be spoiled. Drying removes water and thus prevents fermentation or the growth of molds. In ancient times, fruits and vegetables were exposed to direct sun light for drying. However, in this method, there are several drawbacks. In the present work, a photovoltaic integrated solar dryer has been fabricated and tested for drying of fruits and vegetables. A D.C. fan powered by photovoltaic cell has been incorporated in the system to create forced air circulation in transferring thermal energy for drying without the use of grid connected power supplies. The dryer has been coupled to a solar air heater having a sun-tracking facility and blackened absorber for enhancing solar energy absorption. The system consisted of a photovoltaic panel, solar air heater and a drying chamber with chimney. This system can be used for drying various agricultural products like fruits and vegetables. In this work, the experimental study was conducted for the forced mode of drying under no load conditions.

Key words **:** Drying, Open sun drying, Solar dryer, Photovoltaic cell

How to cite this paper **:** Ghosal, M.K. (2012). Fabrication and performance study of a photovoltaic integrated solar dryer. *Internat. J. Agric. Engg.*, **5**(1) : 73-76.

Drying is one of the most frequently used operations for preservation of agricultural products (Majumdar, 2004). It is essentially a technique for preservation of food materials by reducing the activity of water to a level for enhancing length of desired self-life (Mohapatra and Imre, 1989). In several cases, the drying process is connected to some physical and chemical processes inducing proper internal biochemical and/or microbiological changes, which should take place simultaneously to ensure the characteristic quality features of the product like colour, smell, taste, consistence and shape (Sharma *et al.*, 1986). Drying is an energy intensive process and generally it is defined as the removal of moisture by the application of heat and it is practiced to maintain the quality of product during storage (Purohit and Kandpal, 2005). Fruits and vegetables are seasonal and are highly perishable food products. Preservation of fruits and vegetables is essential for long-term storage without further deterioration in the quality of the products. Various methods such as canning, refrigeration, chemical treatment, controlled atmosphere storage, dehydration etc., are available for their preservation. In rural areas, drying is done only in the direct sunlight without commercial energy consumption; however, it is susceptible to contamination. Solar dryer appears to be a viable and promising way for the preservation of fruits and vegetables (Jain and Tiwari, 2002). The basic principle behind drying fruits and vegetables is to remove about 80-90 per cent of the water from the products thereby creating an environment that cannot support microbial life in them. When water is removed from the plant tissues, salt, sugar, protein and other solutes are increased in concentration. This is an additional factor that prevents the growth and reproduction of microorganisms in these products that may cause spoilage. The objectives of the present investigation are to fabricate a simple dryer coupled with a photovoltaic system and to test its performance for drying fruits and vegetables.

METHODOLOGY

An indirect forced convection PV based solar dryer (Fig. A) was fabricated and installed at IITD. It consisted of an air heater and drying chamber with chimney and a supporting stand. The air heater consisted of an absorber (black painted), plain glass, PV panels, insulation and frame. The air duct beneath the absorber was made from an aluminium sheet (0.5 mm thick and 2.2m × 0.65m × 0.5m in size) through which air was passed. The air duct was made of leak proof and with a good quality sealing material. This unit consists of PV panel (Glass-to-glass) for converting solar radiation into electricity. This panel has been integrated with flat plate collector at of