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

Pigeonpea drying based on heat pipe principle utilizing agricultural waste as fuel

C.J. RAGHUPATI, T.N. TULASIDAS, G. NAGARAJ AND H.N. RAMYA

Received : 16.08.2011; Revised : 20.10.2011; Accepted : 25.02.2012

See end of the Paper for authors' affiliations

Correspondence to:

C.J. RAHGUPATI
Department of Agricultural Engineering, University of Agricultural Sciences, G.K.V.K., BENGALURU (KARNATAKA) INDIA

Abstract **:** Pigeonpea (*i.e.* Toor seed) is the fourth most important pulse crop in the world with almost all production coming from the developing countries. There are several ways of preserving pigeonpea for later use. Drying is a traditional method for preserving pigeonpea. Drying of pigeonpea seeds prevents germination and growth of fungi and bacteria. The traditional age old practice of drying food crops in developing countries is by spreading food grains in open sun which may be termed as open sun drying. A heat pipe incorporated biomass dryer has been designed for small-scale commercial producers of agricultural products in non-electrified locations. Experiments have been conducted to test the performance of dryer and pigeonpea has been dried under natural and forced convection conditions. The rate of moisture removal from pigeonpea and efficiency of the dryer for various thicknesses of pigeonpea grain and at different air velocities have been estimated. The biomass based dryer was very much useful to dry grains more quickly without any damage for grains and the grains obtained after drying were good in quality as compared to open sum drying and natural convection conditions.

Key words **:** Agricultural waste (Biomass), Heat pipe, Pigeonpea, Drying, Moisture content

How to cite this paper **:** Raghupati C.J., Tulasidas, T.N., Nagaraj, G. and Ramya, H.N. (2012). Pigeonpea drying based on heat pipe principle utilizing agricultural waste as fuel. *Internat. J. Agric. Engg.*, **5**(1) : 1-5.

Pigeonpea is the most versatile food legume with diversified uses as food, fodder and fuel. It has been recognized as a valuable source of protein particularly in the developing countries and its significance is comparatively more among Indians due to their reliance in vegetarian diets besides limited buying capacity of more than 27 per cent people living below the poverty line.

Drying is a thermo-physical and physico-chemical operation by which the excess moisture from a product is removed to a safe storage level of 10-14 per cent of moisture on wet basis. Drying of agricultural products is an important unit operation under post harvest phase. It has been found by several experiments that harvesting of crops at higher moisture content and subsequent drying to safe moisture levels leads towards saving of grains to the tune of 6-7 per cent. Therefore, in modern agriculture the importance of timely drying is an important operation.

The heat pipe is a device of very high thermal conductance. The idea of the heat pipe was suggested by Gaugler and Grover (1982). The heat pipe is similar in some respects to the thermal siphon system. A small quantity of water is placed in a tube from which the air is then evacuated and the tube sealed. The lower end of the tube is heated causing the liquid to vapourize and the vapour to move to the cold end of the tube where it is condensed. The condensate is returned to the hot end by gravity, since the latent heat of evaporation is large, considerable quantities of heat can be transported with a very small temperature difference from end to end. The thermal siphon has been used for many years and various working fluid have been employed, one limitation of the thermal siphon is that in order the condensate to be return to the evaporator region by gravitational force, the latter must be situated at the lower point.

In the heat pipe the evaporator position is not restricted and it may be used in any orientation. If the heat pipe evaporator happens to be in the lowest position gravitational forces will assist the capillary forces (Dunn and Reay, 1978).

The hypothesis entertained in this paper is that it is possible to produce high rate of drying of pigeonpea using agricultural waste (biomass) as fuel needed for heat and mass transfer with in the material by adopting heat pipe