



Research Article

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Solar Tunnel Dryer for Rural Area

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ABSTRACT

The paper presents the innovation of solar tunnel dryer; it is a walk in type semi-cylindrical poly house framed structure with UV-stabilized polythene sheet, where products on large scale could be dried under controlled environment. Chilly drying in solar tunnel dryer to reduce the moisture content from 83.4 % (w.b.) to about 9 % (w.b.) and Aonla pulp from moisture content of 81 % (w.b.) to safe moisture content 9.5 % (w.b.) successfully dried. 20-30 °C of higher temperature was obtained in solar tunnel dryer over the ambient temperature, it depends on product. In comparison to open sun drying to obtain the same level of moisture contents resulting in a net saving in drying time of 40-50 per cent for solar tunnel dryer over open sun drying.

Keywords: Solar Tunnel Dryer (STD), chilly, Aonla Pulp

INTRODUCTION

India has been identified as one of the top twelve mega-biodiversity centres of the world with immensely rich medicinal, aromatic plants, fruits and vegetables occurring in diverse ecosystems. India which is the biggest repository of medicinal and aromatic plants in the world has to maintain an important position in the production. International markets for medicinal plants are increasing at the rate of 7% annually of which India share is only about 3-5 % while China is one of the leading countries in the world in export of herbal drugs besides meeting its large domestic demands¹⁻³. There is a seasonal wastage and off seasonal shortage of the agricultural products which is leading to wide fluctuation in market prices of these commodities. This situation is leading to poor profits in farming. Very few post harvest technologies exist and they are complex and unaffordable to the farmer⁴⁻⁶. Appropriate storage and processing methods⁷⁻⁹ can curtail post harvest losses, which are contributing to 30% of the total production.

Dehydration is a viable low cost alternative technology for a small farmer to prolong the shelf life of the products. Dehydration helps in ensuring continuous availability, by reducing the excessive supply during peak seasons and thus helps in maintaining reasonable price levels for the produce and thus benefiting the farmers. Drying is very important as this helps in better enzymatic action and also in grinding and also enables storability of products under ambient temperatures. Different drying methods¹⁰⁻¹² are available for drying of the agricultural crops. Sun drying is the traditional method of drying agricultural products in India. The disadvantage is contamination of the produce, laborious and weather dependent. Along with the moisture some volatile substances present in very small amounts are also lost. Moreover many rural areas in India suffer from unreliable and poor supply of electricity. Fortunately India is blessed with

abundant solar energy potential that can be used for different applications. Hence there is need for exploration of renewable energy sources for environmental protection and sustainable development. The average daily duration of bright sunshine is 8- 9 hours. Keeping the above facts in mind this innovation of local drier can prove to be of much help to farmer of most of developing nations where sunshine is abundant.

SOLAR TUNNEL DRYER

A unique low cost method of drying agriculture, horticulture and agro industrial products on commercial scale through Solar Tunnel Dryer of different capacity was developed at CTAE, Udaipur. The developed technology has significantly contributed in saving conventional fuel for drying products. It has been observed that on an average of Rs 1000-1500 per day for drying of one ton material could be saved in term of saving of conventional energy sources i.e. electricity and Diesel and thus the payback period of system comes around 60 working days. The CTAE has so far established 15 such units for drying various agricultural and agro industrial products in Udaipur region. Realizing importance of solar tunnel dryer for value addition and processing of products.

A semi-circular shaped walk in type solar tunnel dryer having a floor area of $10\text{m} \times 3.75\text{m}$ was designed for drying different processed products (**Figure 1**). The solar tunnel dryer is a poly house framed structure with UV-stabilized polythene sheet having height 2.25 meter, UV radiation in the sun rays may cause deterioration of active principle and also affect the texture, color and flavor of the sample so UV polythese used. The orientation of tunnel solar dryer is in east-west direction and ultra violet stabilized polythene sheet of 200-micron size is used as a cover material.

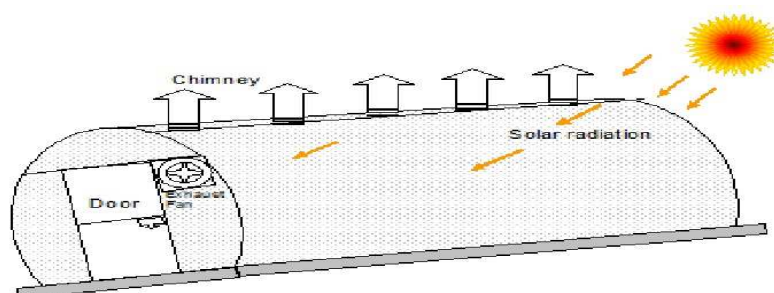


Fig.1: Solar Tunnel Dryer

Products on large scale could be dried under controlled environment and which is large enough to permit a person to enter into it and carry out operations such as to load and unload the material to be dried. The dryer consists of five inlets having radius of 15 cm each oriented in south west direction for entry of fresh air and three outlets at the top of the structure for the easy escape of hot air along with water vapour (**Figure 2**). The maximum temperature inside the domestic solar dryer reaches $20\text{-}30^{\circ}\text{C}$ higher to the ambient temperature at 14 h. Cost wise the unit reaches Rs. 75, 000/- per system.



Fig.2: Solar tunnel dryer of length 15 m.

Chilly drying in solar tunnel dryer to reduce the moisture content from 83.4 % (w.b.) to about 9 % (w.b.) and Aonla pulp from moisture content of 81 % (w.b.) to safe moisture content 9.5 % (w.b.) successfully dried (**Fig. 3**). The different products can be manufactured by the farmer include juice, squash, candy, powder, pickle, dry aonla, churn tablets and preserve. Drying dehydrating vegetables viz. mint, spinach, okra, tomato, ginger, red and green chillies, carrot, coriander leaves, fenugreek, peas, cabbage, onion, sweet potato, bitter gourd, radish, sugar beet, cauliflower, bathua and fruits, viz. ber, sapodilla, grapes, pomegranate, etc. were also very successfully in the drier. The leafy vegetables can be dehydrated within one day at the loading rate of 4 to 5 kg/m², whereas other vegetables can be dried within 2 days at loading rate of 8 to 10 kg/m². The green colour of solar dried products remained as such even after drying. Thus the local tunnel solar dryer is economically and environmentally profitable and need to be popularized in rural areas of India. Inside view of solar tunnel dryer in figure 3 during drying of Palak.



Fig. 3: Inside view of Solar Tunnel Dryer

ADVANTAGES OF SOLAR DRYERS

- Solar dryer can save fuel and electricity and drying time in solar dryer is reduced in comparison to open drying method.
- Fruits and vegetables dried in solar dryer are better in quality and hygienic than dried in open.
- Materials required for fabrication of solar dryer are locally available and the use of solar dryer involves no fire risks.
- The dryers can be connected in series and hence its capacity can be enhanced as per requirement and it can be dismantled easily so that its transportation is easy from one place to another.

Social and economic impacts of entrepreneurship: The positive results for social and economic aspects are also in close conformity with the study of Veerbhadrai et al., (2003) who reported that entrepreneurship development programmes bring prosperity and raise the income of farmers in rural areas.

CONCLUSION

The study concluded for a successful solar tunnel dryer, they can setup a small entrepreneurship, it is also very important for Indian farmers as they are having small land holdings and a combination of agriculture along with small scale agriculture based entrepreneurship is the key to sustainable livelihood. Solar tunnel dryer has the potential for application in drying of various other crops like chillies, ginger, figs, pineapple etc., as the products retain their quality, flavour and better shelf life.

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