International Journal of Agricultural Sciences ☞DOI:10.15740/HAS/IJAS/20.1/152-156
Volume 20 | Issue 1 | January, 2024 | 152-156 ■ ISSN : 0973-130X Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Fabrication of continuous solar dryer for fruits and vegetables slices

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Abstract : The world population is more than 8 billion and about 20-25 per cent people does not have enough food to eat. It has been estimated that world as a whole more than 30-50 per cent vegetables, fruits etc. are lost before it reaches to the consumers. To overcoming spoiling problems of vegetables and fruit; various preserving methods are used and renewable sources are best for this purpose by which we can save energy for preservation and keeping the product in their natural flavor by drying it.Drying is one of the oldest methods of preserving food. The solar drying system utilizes solar energy to heat air and to dry any food substance. It brings about a substantial reduction in weight, volume, minimizing packing, storage, and transportation costs, and enables storability of the product under ambient temperatures. This paper present the Construction of Continuous solar dryer which can be used for drying various fruits and vegetables products in rural areas under hygienic conditions. The Continues solar dryer was constructed consisting of a solar collector cum drying chamber. The overall dimension of the continues solar dryer is 1830×300×620mm and the drying chamber was painted black to absorb maximum solar radiations. The glass was covered it permits the solar radiation into the system but resists flow of heat energy out of system and product were moving continually from inlet to outlet through chain conveyors. This chain conveyors was connected to the rollers and the roller was connected to belt pully to reduction motor and VFD to control the chain conveyor from inlet to outlet to dry the product at required moisture content

Key Words : Fabrication of continuous, Solar dryer, Fruits, Vegetables slices

View Point Article : Vikas, L., Ravikumar Patil, H.S., Kandkur, Shivabasappa and Harhavardan Gowda, L. (2024). Fabrication of continuous solar dryer for fruits and vegetables slices. *Internat. J. agric. Sci.*, **20** (1) : 152-156, **DOI: 10.15740/HAS/IJAS/20.1/152-156.**

Article History : Received : 16.08.2023**; Revised :** 18.09.2023**; Accepted :** 21.10.2023

INTRODUCTION

The sun is the primal energy producer of our solar system. In addition, sun provides solar energy which is one of the most available type of alternative energy resource which can be used for overcome energy crises in coming years.Drying is an excellent way to preserve food, and solar food dryers are appropriate food preservation technology for sustainable development. Drying was probably the first ever food preservation method used by man, even before cooking. It involves the removal of moisture and agricultural produce to

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provide a product that can be safely stored for a longer period. In rural areas drying of fruits and vegetables is carried by spreading the products on the ground or roofs with exposure to the sun in the open air. Sun drying method may be an efficient and cheap process but has disadvantages such as contamination by dirt, insects, birds, rodents, and bacteria and due to adverse climatic conditions like rain, wind, moist, etc. The process also requires a large area of land takes time, and highly labour intensive. To protect the products from above mentioned disadvantages and also to accelerate the time of drying and control the final moisture of the product, with reducing wastages because of bacterial action, different types of solar dryers like direct or indirect solar dryers can be used. With cultural and industrial development, artificial mechanical drying came into practice, but this process is highly energy intensive and expensive, which ultimately increases product cost. Recently, efforts to improve sun drying have led to solar drying.

Solar dryers are specialized devices that control the drying process and protect agricultural produce from damage by birds, insects, rodents, dust, and harsh adverse climatic conditions. The most important advantage of the solar dryer is an economically feasible alternative to other available energy sources. This paper discusses the fabrication of Continues solar dryer for fruits and vegetables that can be constructed to dry the product to optimum moisture content.

Material and Methods

Fabrication of continues solar dryer :

Main frame and drying chamber :

Main frame was constructed from Mild steel forouter skeleton structure in the dryer for fixing drying chamber and hosing the reduction motor.The design of the drying chamber constructed from M.S and drying chamber was painted black to absorb maximum solar radiations and covered with toughened glass. The overall dimension of dryer was 1830×300×620 mm.

Rollers and bearing :

Two numbers of rollers and bearing are fixed at two ends on the main frame for connecting reduction motor through belt pully and S.S wire mesh conveyor.

Belt pulley :

Rubber belt is connected to pulley at the one side of the bearings for connecting reduction motor for the movement of S.S belt mesh conveyor.

Reduction gear motor and VFD (Variable frequency device) :

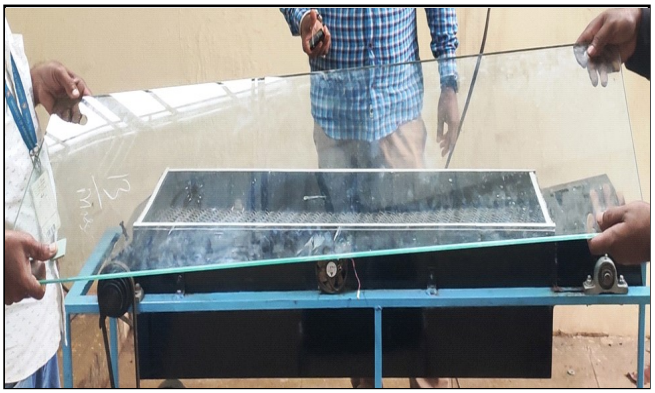
0.5 HP Reduction gear motors is connected to belt pulley for the movement of mesh conveyor for carrying product at controlled speed through VFD.

S.S. belt wire mesh conveyor :

S.S belt wire mesh conveyor was connected to the two ends of the rollers for carrying product from inlet to outlet and S.S belt wire mesh is used for the anti-contamination for drying the food products.

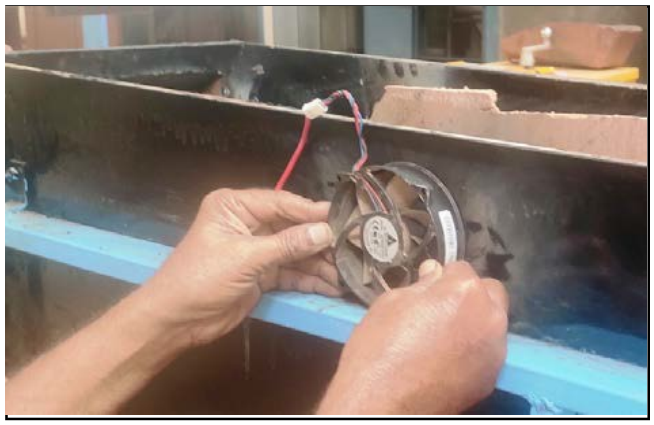
Toughened glass :

Toughened glass (8mm) is used to cover the drying chamber, it permits the solar radiation into the system but resists flow of heat energy out of system and product were moving continually from inlet to outlet through chain conveyors. Hence, to aid the drying process and to keep the temperature within the drying chamber fairly constant due to the greenhouse effect of glass



Exhaust fans :

Exhaust fans are used in the drying chamber to circulate the heated air in the drying chamber and also remove the dried air from the product.

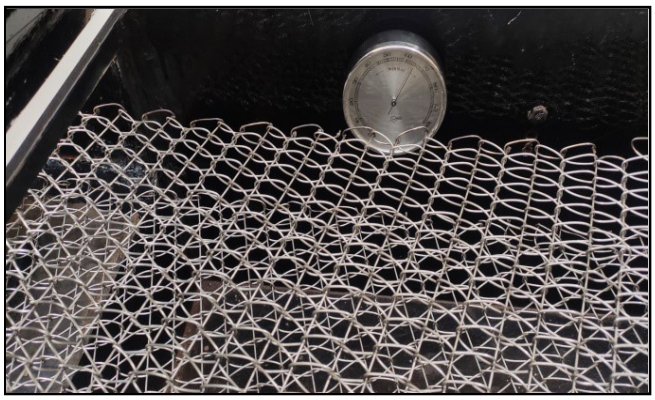


Thermocouple:

The holes are made on the drying chamber to keep the thermocouple for detection of temperature in the drying chamber at inlet and outlet of the chamber.

Hygrometer :

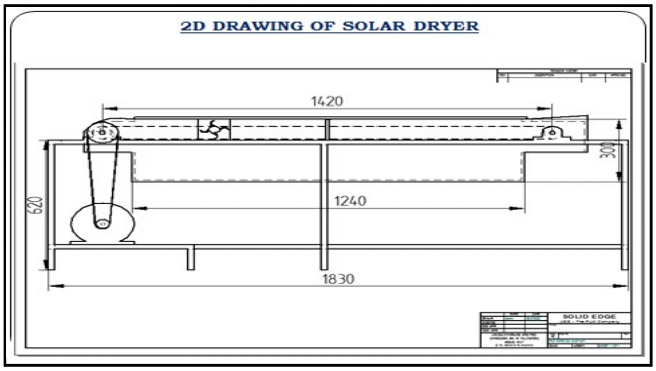
Hygrometer was used fixed inside the chamber to analysis the relative humidity inside the drying chamber.

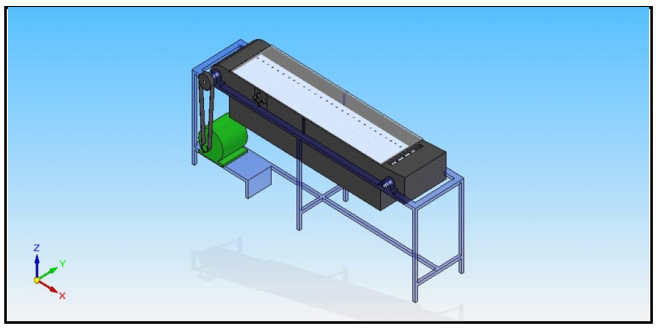


Contraction of continuous solar dryer :

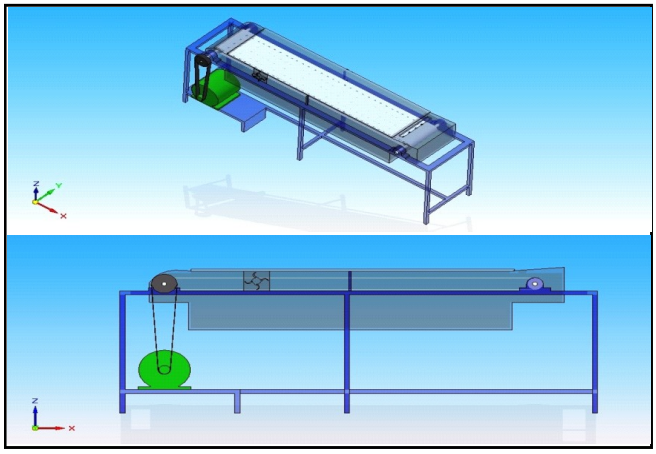
The continuous solar dryer was constructed making use of locally available materials. Main frame was constructed from the Mild steel for outer skeleton structure in the dryer for fixing drying chamber and stand for hosing the reduction motor. The design of the drying chamber constructed from M.S and drying chamber was painted black to absorb maximum solar radiations and covered with toughened glass, the overall dimension of dryer was 1830×300×620mm.Two numbers of rollers and bearing are fixed at two ends on the main frame for connecting reduction motor and S.S wire mesh conveyor through pully. Rubber belt is connected to pully at the one side of the bearings for connecting reduction motor for the movement of S.S belt mesh conveyor from inlet to out. The hopper was made at one side of the rollers to feed the product and outlet at the other end of the roller. S.S Wire mesh conveyor was connected to the two ends of the rollers for carrying product from inlet to outlet.0.5HP Reduction gear motors is connected to belt pully for the movement of mesh conveyor for carrying product at controlled speed through VFD.Toughened glass (8mm) is used to cover the drying chamber, it permits the solar radiation into the system but resists flow of heat energy out of system and product were moving continually from inlet to outlet through chain conveyors. Hence, to aid the drying process and to keep the temperature within the drying chamber fairly constant due to the greenhouse effect of glass Exhaust fans are used in the drying chamber to circulate the heated air in the drying chamber and also remove the dried air from the product.The holes are made on the drying chamber to keep the thermocouple for detection of temperature

Views of continues solar dryer





3D Isometric view of solar dryer



3D Isometric transperent view of solar dryer

Experimental setup for drying kiwi fruit and guava fruit

in the drying chamber at inlet and outlet of the chamber and also Hygrometer was fixed inside the chamber to analysis the relative humidity inside the drying chamber.

Conclusion:

Solar radiations can be effectively and efficiently utilized for drying of agricultural produce in the environment if the proper design is carried out. The solar dryer designed and constructed exhibited sufficient ability to dry agricultural products to an appreciably reduced moisture level. Locally available cheap materials were used in construction, making it available and affordable to all rural people. This will go a long way in reducing food wastages and at the same time, food shortage since it can be used extensively for the majority of agricultural food crops. Apart from this, solar energy is required for its operation, which is readily available in the tropics, and it is also a clean form of energy. It protects the environment and saves cost and time spent on open sun drying of agricultural produce since it dries food items faster. The food items are also well protected in the solar dryer than in the open sun, thus minimizing the case of pest and insect attack and also contamination.

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