



Mini Solar Tunnel Dryer (Fruit Drying)

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Abstract

A solar tunnel dryer is commissioned at the Department of Agril. Engineering of College of Agriculture, Risod. Dryer performance is evaluated with a chimney, GI sheet and wooden frame covered with polythene for Gooseberry drying. Indian Gooseberry drying in solar tunnel dryer to reduce the moisture content from 82.05% to about 5.72% which is successfully dried. In comparison of open sun drying to obtain the same level of moisture contents resulting in saving drying time with the help of mini solar tunnel dryer.

Keywords: Solar tunnel Dryer, Goose berry, Moisture Content, Drying time, Temperature.

Introduction

One of the most commonly used methods for preserving foods & agricultural product is drying. Sun drying is the most widely practiced agricultural drying operation in India. The solar energy option has been identified as one of the promising alternative energy sources for the future. Agriculture is the main source of livelihood in India. The solar dryer has considerable advantages over the traditional sun drying method in terms of less risk of spoilage because of the speed of drying. The process of drying is faster because temperature inside the dryer is higher than that of outside temperature. So the quality of the products dried inside the dryer is better in terms of nutrients, hygiene and color. Due to direct solar radiation colour of the dried product becomes lighter and thus the market value of the product decreases. If we dry these in the mini solar tunnel dryer the colour of the dried product retains and we get the product darker in the colour and thus the market value increases. Also mini solar tunnel dryer eliminates the losses due to birds and winds, can withstand against unfavorable weather such as rain.

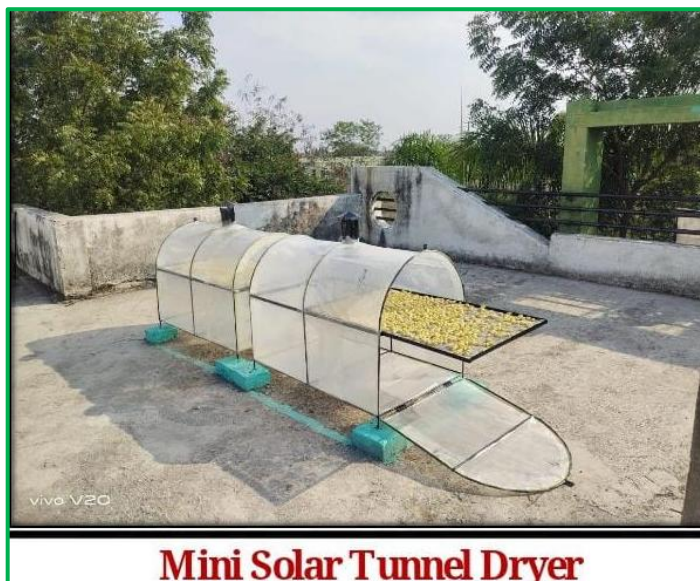
The sun is the source of all energy sources whether it is conventional energy sources or nonconventional energy sources. The sun provides us heat and light energy free of cost, which ultimately provides us energy and sensation of sight. The solar dryer is a device which uses solar energy for drying. Large sizes of the solar dryers are fixed type and could not change its position. Also its capacity is more; therefore we cannot change orientation of these dryers. So the small house hold size mini solar tunnel dryer can be used at domestic level for drying of fruits and vegetables. Price of the mini solar tunnel dryer will also be low as this can be owned by small farmers.

Materials and Methods for Solar Tunnel Dryer

The solar tunnel dryer is designed and constructed. The solar tunnel dryer consists of different parts such as drying chamber, collector area and chimney. The drying chamber is covered with UV-stabilized polythene sheet, which is available at the local market. The solar tunnel dryer having semi cylindrical shape for increasing absorption of solar radiation. The dryer are made to open and close easily for the functions of spreading the drying product at the beginning of

the day and cleaning the absorber surface and trays. Base of the tunnel dryer is covered with thermal insulation of one inch, in order to reduce the heat loss.

The solar tunnel dryer is a small poly house framed structure with UV-stabilized polythene sheet having height 1 ft, UV radiation in the sun rays may cause deterioration of active principal and also affect the texture, color and flavor of the sample so UV polythene is used. The orientation of solar tunnel dryer is in North-South direction and UV stabilized sheet of 150 micron is used as a cover material. The collector serves as a solar air heater. The absorber plate is painted black, a good absorber as well as a good emitter for radiation. In the drying chamber, a wire mesh is used as the tray material of size 2 ft X 2 ft on which drying product is spread and it is fixed at higher level above absorber plate to allow a smooth flow for the heated air. The number of trays used for drying is two. The remaining area is used as a heating area. In this area, a flow controlling unit is provided by means of a fan & wooden flap. This flap can operate outside in order to control the airflow through drying chamber.



Mini Solar Tunnel Dryer

- Design and fabrication of mini solar tunnel dryer.
- Instrumentation involved for performance evaluation of mini solar tunnel dryer.
- Performance evaluation of mini solar tunnel dryer.
- Study of drying characteristics.
- ✓ Mini solar tunnel dryer (MSTD) consisted of following components:-
 - A hemispherical cylinder-shaped Tunnel (drying chamber)
 - UV Protected Plastic Sheet (Solar heat collector)
 - Collector area of solar tunnel dryer required for drying:-
 - 65% area of hemispherical shaped solar tunnel dryer towards south is able to receive sunlight.
 - 35% area toward north is away from the sun.
 - The overall thermal efficiency of solar tunnel dryer is 27 percent.

Open sun drying is economical and simple, it has the drawbacks like; no control over the rate of drying, non-uniform drying, chances of deterioration due to exposure of products against rain, dust, storm, birds, rodents, insects and pests which results in poor quality of dried products. Solar drying relies, as does sun drying, on the sun as its source of energy. Solar tunnel drying can be considered as an elaboration of sun drying, and is an efficient system of utilizing solar energy.

Drying Parameters Of Various Agro-products:-

Sr. No.	Material	Initial Moisture Content %	Desired Moisture Content %	Drying Time (Days)		Final Prduct
				Sun Drying	Solar Drying	
1	Grapes	80%	18%	4-5	3	Raisins
2	Amla	87%	17%	3-4	2	Amla candy
3	Mango	91%	30%	4-5	2	Amchur Powder
4	Curry leaves	60%	06%	2-3	1	Curry leaves (powder)

COST OF MATERIALS

Sr. No	Materials	Specifications	Unit cost	Total cost
1	M. S. Rod	Dia10mm×34m	65Rs/kg	Rs1349
2	M. S. Mesh	1.52×1m(2 pcs)	310 Rs/pcs	Rs620
3	M. S. angle	0.75 inch×12m	68 Rs /kg	Rs660
4	UV protected plastic sheet	200 μ (15×3.25 ft.) 4pcs	947 Rs/pcs	Rs3788
5	Chimney	2pcs	275 Rs/pcs	Rs550
6	Cyanoacrylate solution (superglue)	6 bottles	94 Rs/pcs	Rs564
7	Miscellaneous	-	-	Rs570
8	Fabrication	-	-	Rs2350
			Total	Rs 10,451

DIMENSION

Sr. No	Dimension	Value
1	Length	120 cm
2	Width	76cm
3	Tray size	
	Length	112cm
	Width	72cm
4	Height of the dryer	83cm
5	Height of the chimney	26cm
6	Area of the collector	9120cm ²



Fig. Mini Solar Tunnel Dryer

Conclusion

The study of project concluded for a successful solar tunnel dryer, this solar dryer is of project 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. The semi cylindrical shape solar tunnel dryer must be optimized for an efficient operation. Solar drying achieves higher drying rates compared with sun drying. Mini Solar tunnel dryer has the potential for application in drying of various other crops like ginger, figs, pineapple, etc. as the products retain their quality, flavor and better shelf life. Solar tunnel dryer can be easily constructed using locally available materials. The fan system has an advantage of control air flow because there is a possibility of increasing relative humidity inside the drying chamber.

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