Solar Dryer with Intermittent Toppler

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Abstract— The unpredictable rise and frequent scarcity of fossil fuel accelerated the continuous search for an alternative power source. Solar is one of the renewable and sustainable sources of power that attracted a large community of researchers from all over the world. This is largely due to its abundant in both direct and indirect form. As such the development of efficient and inexpensive equipment for the drying of agricultural and marine products using solar power evolved thereby improving the quality of the products as well as improving the quality of life. The use of solar dryers in the drying of agricultural products can significantly reduce or eliminate product wastage, food poisoning and at the sometime enhance productivity of the farmers towards better revenue derived. A solar crop drying system does not solely depend on solar energy to function; it combines fuel burning with the energy of the sun, thus reducing fossil fuel consumption. In this paper a review of the solar dryer is presented. The various design of the solar dryer is reported in the literature thus far is presented.

Keywords: Solar Dryer, Gear Box Shaft

I. INTRODUCTION

Solar drying is in practice since the time im-memorable for preservation of food and agriculture crops. This was done particularly by open sun drying under open the sky. This process has several disadvantages like spoilage of product due to adverse climatic condition like rain, wind, moist, and dust, loss of material due to birds and animals, deterioration of the material by decomposition, insects and fungus growth. Also the process is highly labor intensive, time consuming and requires large area. With cultural and industrial development artificial mechanical drying came in to practice. This process is highly energy intensive and expensive which ultimately increases product cost. Thus solar drying is the best alternative as a solution of all the drawbacks of natural drying and artificial mechanical drying.

Solar dryers used in agriculture for food and crop drying ,for industrial drying process, dryers can be proved to be most useful device from energy conservation point of view. It not only save energy but also save lot of time, occupying less area, improves quality of the product, make the process more efficient and protects environment also. Solar dryers circumvent some of the major disadvantages of classical drying. Solar drying can be used for the entire drying process or for supplementing artificial drying systems, thus reducing the total amount of fuel energy required.

A. Problem Statement:

Conventional dyer system in direct dying only has a box that contains the seeds or material to be dried, where in the material is dried in a span of eight hours, intermittent checking will be need to observe the quality or prevent the seeds from burning. Hence man power required is more, productivity is low hence a new type of system for solar drying is needed.

B. Objectives:

1) Better Quality of Products can be maintained.
2) It Reduces Losses and Better market price to the products.
3) Products are protected against flies, rain and dust; product can be left in the dryer overcome in rain, hence solar dryer are waterproof.
4) Prevent fuel dependence and Reduces the environmental impact
5) It is more efficient and cheap.

C. Methodology:

- Study of various configuration micro wind turbine using various Handbooks, United State Patent documents, Technical papers, etc.
- Literature gap
- Problem statement
- Solution
- Working
- Design and Calculation
- Result
- Conclusion

D. Scope:

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

II. LITERATURE REVIEW

In this chapter, a detail review of literature on the developments in the area of harnessing solar energy for application like solar food dryer is presented. The present study has been carried out for design and developed of the Evacuated Tube Solar Grape Dryer system, work done in the area of solar food drying mainly focused on grape drying by researchers have been thoroughly reviewed with regards to approaches used and tools and techniques employed. The thrust of the ongoing research and limitations of existing approaches are highlighted. The review of literature has been categorized as follows:

1) Design and developments of flat plate solar dryer with natural and forced convection heat transfer.
2) Design and developments of Evacuated Tube Solar Collector for food drying and water/ air heating applications.
3) Pre-treatment used to improve the water permeability, to increase Drying Rate.

4) Drying kinetics study of the high moisture content food product like grape to predict mathematically the drying phenomenon.
5) Mathematical modelling of Evacuated Tube Solar Collector.

III. CONSTRUCTION

The mechanism of the auto side stand comprises of the following parts:

A. Motor:

Motor is a 12 volt DC motor, with following specification:
Voltage: 12 Volt DC
Speed = 800 rpm
Mounting: Foot mounted

IV. CALCULATIONS

A. Design of Worm and Worm Wheel (Worm Gear Box)

The pair of worm and worm wheel used in the machine is designated as 1/55/10/1
The worm is made of case hardened steel 14C6 whereas the worm wheel is made of Cast iron.
Z1 = 1
Z2 = 55
q= 10
M=1
I = z2/z1 =55
N = 800 rpm
N2 = 800/55 =14.5 rpm
D2 = m x z2 =1 x55 =55
tanU =z1/q = 5.71 ^{0}
F = 2m sq.rt (q+ 1) = 9.94
Da1 = m(q+2) =12
C= 0.2mcosU = 0.3
Lr ={ da1+2c} sin-1[F/(da1+2c)]
Lr = 632
For case hardened steel Sb =28.2
For BRASS, Sb =6.2
Xb1 = 0.25
Xb2 =0.48
Mt_1 = 17.65 Xb_1 Sb_1m lr d_2 cosU
= 4.694 x 10^6N-mm
Mt_2 = 17.65 Xb_2 Sb_2m lr d_2 cosU
= 1.98 x 10^6 N-mm
The lower value of torque is on the wheel = 1.98 x 10^6 N-mm
Kw = 2Π n2 Mt/60 x 10^6
Kw =7.46 Kw
As the drive is capable of transmitting 7.46 Kw and we intend to transmit 0.08Kw the drive is safe.

B. Design of Gear Box Shaft

MATERIAL SELECTION: -Ref: - PSG (1.10 & 1.12) + (1.17)

DESIGNATION	ULTIMATE TENSILE STRENGTH N/mm^2	YEILD STRENGTH N/mm^2
EN 24	800	680

C. Working

1) Contents to be dryed are placed in the box
2) Protective glass lid is closed
3) Gear box is started using motor
4) Stirrer shaft is moved by the gear box.
5) Mixing will churn the content and expose the new layer to drying.

D. Advantages and Disadvantages

1) Advantages

1) Solar energy is used that reduces cost of energy.
2) No fossil fuel is used.
3) Less cost
4) Low infrastructure cost

2) Disadvantages

1) Depends on solar power…not useful in rainy season
2) Limited capacity of drying

V. CONCLUSION

In this report, solar drying of various product (such as food, vegetables, agricultural atoms, herbs etc) is one of the most potential application of solar energy.

In developing countries, such drying exercises are being carried out using conventional drying method like open sun drying, classical drying and others. But this method are trapped with some severe drawbacks in terms of quality, accuracy, capacity, economy and handling these cause loss of products during the drying which is estimated 30 to 40 percent of the total production in developing countries. The best alternative to overcome the bottleneck of traditional drying method is the development of solar dryer.

In this report, the state of art technologies of solar dryer has been presented has follows:

– Comprehensive review on the design development and pre-performance evaluation of various types of solar dryer has been presented.
– Various types of solar dryer such as direct and indirect

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