DESIGN AND DEVELOPMENT OF LOW-COST SOLAR APPLIANCES USING AN ADVANCED CONTROLLER FOR AGRICULTURE APPLICATIONS

Project Reference No.: *45S_BE_4327*

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Keywords:

Solar dryer, solar water heater, Agriculture, PV system, Acrylic.

Introduction:

1. Drying is the traditional method for preserving food.
2. Drying is an important unit operation in food processing which aids in preservation through the lowering of water activity of the product by evaporation of water.
3. Case studies has been made for analysis purpose.
4. Hardware design of dryer is implemented along with two trays.
5. The new technology and ideologies benefit us by implementing modern ways of saving energy which will be used in numerous ways.
6. The efficient technique used in nowadays is solar dryer. The traditional way of drying had many drawbacks. The direct type will remove the proteins present in the crop along with moisture.
7. Hence new way of drying i.e., indirect, or mixed type is used. Drying is the traditional method for preserving food.
8. Because of moisture loss, reduction in weight and size helps easy storage and transport.
9. Drying prevents germination and growth of fungi and bacteria.
10. There are recommended drying temperature and moisture content for different crops for storing them for a specific duration over a year or more. The unique design helps the user to get the maximum benefit from solar dryer. Additionally, a solar heater is set up along with the dryer.

Objectives:

1. To implement of low-cost solar dryer cum solar water heater.
    a. To use a minimum amount of energy for maximum moisture removal of the product.
    b. To design unique type of Dryer module.
    c. Implementation of Solar drying chamber.
    d. Testing the coconut to turn into copra.
2. Implementing water heater and charge controller for battery.
    a. The solar water heater is fixed uniquely so that we can get the maximum benefit from solar energy.
    b. Case study on mixed-mode solar dryer for drying coconut shells.

Methodology:

The traditional way of drying coconut requires a minimum of 4-5 sunny days with a temperature of 40 degrees Celsius in minimum. But in this type of dryer, it is theoretically 1-2 days. The moist coconut is placed on the tray and kept inside the drying chamber. The temperature sensor senses the humidity level and controls the airflow accordingly. The solar collector collects or traps the heat, and it is forced to go through the drying chamber. The air will be exerted from the exhaust fan. The solar panel collects the maximum amount of solar energy, and the energy is stored in the battery. It can be used for minimal loads like glowing IR lamps and can be used as a charger. During the non-sunny days when the temperature falls below 18 degrees Celsius, the energy saved in the battery runs the exhaust fan and hot air is made to flow through the drying chamber. The heating element will be placed along with the airflow which makes the air hot. The charge controller maintains the charges and converts them into DC to make them compatible with the loads. The solar water heater collects the heat from the sunlight and can be used to heat the water. This can be used for domestic purposes. It is made portable and user-friendly. During the off-season, the electrically generated hot air is made to flow through the pipes after the drying chamber. Hence this setup is made to use for multipurpose.

The charge controller is set up such that the battery does not get overcharged and maintains a constant flow of charges. The product is dried both by direct radiation and by heated moving air. This type is called a mixed or combined dryer. Forced convection is used when the temperature falls. Air circulation is done using an electrically drying fan. Ambient air is drawn in from one end of the solar inlet, heated by solar energy as it passes along the length of the absorber, and then hot air is discharged into the drying chamber. The material to be dried could be placed on trays.

Conclusion:

By using a mixed mode of drying method coconut is turned into copra within 40 hours (theoretically). The dryer is fixed along with the solar water heater. Both conventional methods of drying and exerting hot air are used electrical methods is aimed. The solar PV panels store the energy in a battery and are used for the future. The battery is charged to the maximum during sunlight and used for other purpose. The main aim of this project is to build a farmer-friendly dryer at a low cost. Hence Dryer, water heater, and charger are built in a very peculiar manner.

Scope for future work:

1. Implementation of Solar drying chamber.
2. The maximum power point tracking mechanism is fixed for solar PV panel.
3. This review explains why solar drying a viable option is for overcoming traditional solar drying limitations, particularly in low-income nations.
4. Solar dryers can be built in a variety of styles, depending on budget, location, and the necessity for drying goods.
5. Finally, increased technology use in Asian and SSA nations still necessitates efficient coordination and communication among key stakeholders in agricultural research, expansion, and output.
6. The same type of solar dryer is used for automatic based temperature control.
7. The water heater can be extended to the use for more litres and different temperature of heating.
8. The water heater and solar dryer can be used to work in different climate conditions by feedback process of storing the heat.