

Solar Dryer

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ABSTRACT

Solar drying is a sustainable method to preserve agricultural products, reduce post-harvest losses, and improve food in remote areas where transportation is limited. for electricity. This review examines various solar dryer projects, focusing on their design, performance, and problems. Provides an overview of different types of solar dryers and their performance models, including direct, indirect, and hybrid models. It also discusses performance indicators such as drying speed, drying time, and product quality used to evaluate solar dryers. The article also highlights the challenges of using solar dryers, including usage, efficiency, and social economy constraints. Finally, suggestions are made for future research and development studies to increase the performance and efficiency of solar dryers.

Keywords: solar dryer, solar energy, drying efficiency, agricultural protection, sustainability.

INTRODUCTION

Introduction Solar drying has become an important tool for agricultural conservation, providing effective solutions for post-harvest reduction and food security, especially in regions where conventional electricity is limited. Solar dryers offer a friendly alternative to other drying methods such as solar or oil-based dryers by using and recycling lots of sunlight. Solar dryers come in a variety of designs and configurations, each suitable for specific needs and environments. Direct solar

dryers use solar energy to directly heat the dryer, while solar dryers use electricity or air to transfer heat to dry air. Hybrid solar dryers combine solar energy with energy sources such as biomass or electric heat to provide drying and reliability.

Operating

Hardware Components:

Arduino Board: The Arduino board can be equipped with temperature and humidity sensors to monitor the conditions in the drying chamber. These sensors provide instant information about the

drying area, allowing the drying process to be controlled and adjusted.

Rechargeable Battery: In solar dryers with rechargeable batteries, the battery serves as a power reserve for continuous operation, allowing the dryer to be used even when sunlight is insufficient or absent.

Solar collector: A solar dryer has a material that allows sunlight to come in, usually made of transparent materials such as glass or plastic. Materials absorb solar radiation and convert it into heat.

Control System: Some solar dryers may use a control system to control airflow, temperature, and humidity to optimize the drying process for different products and environments.

Camera: Integrating a camera into the dryer can provide many benefits, mostly related to monitoring and controlling the drying process.

Temperature and Humidity Sensors: Temperature and humidity sensors play an important role in the operation of a solar dryer as they provide instant information about the environment inside the dryer.

Solar Panel: In solar dryers, the solar panel is the main power that operates equipment such as fans, blowers, or control systems.



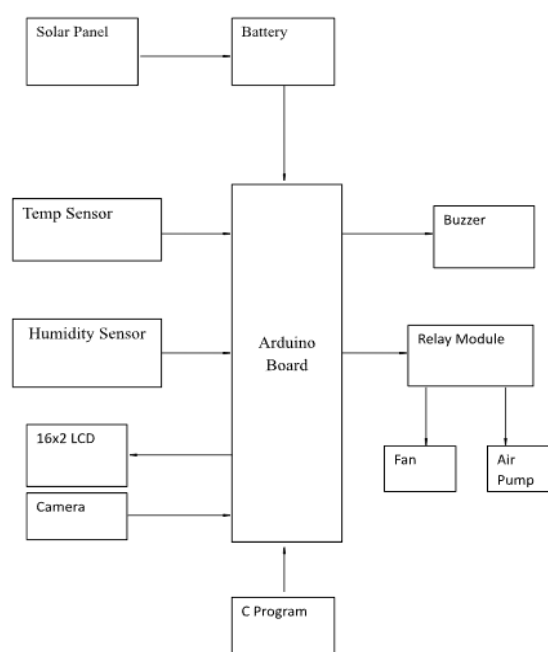
Software functions:

Monitoring and data collection: The software can collect data from various sensors mounted on the solar dryer, including temperature sensors, humidity sensors, and solar panels. It then collects this data in real time, allowing users to monitor and analyze the dryer's performance, identify conditions make informed decisions, and improve the drying process.

Remote monitoring: With remote monitoring, users can access information in real-time and control the operation of the solar dryer from anywhere with an internet connection. This allows users to monitor the drying process, adjust the drying process, and receive alerts or warnings if the system is not working properly or is different than expected.

Audio Alarm: Add an alarm to your solar dryer software to improve its performance by providing alerts for various events or situations.

Live streaming: Set up cameras to send live video streams to authorized users or cloud storage platforms for real-time monitoring.

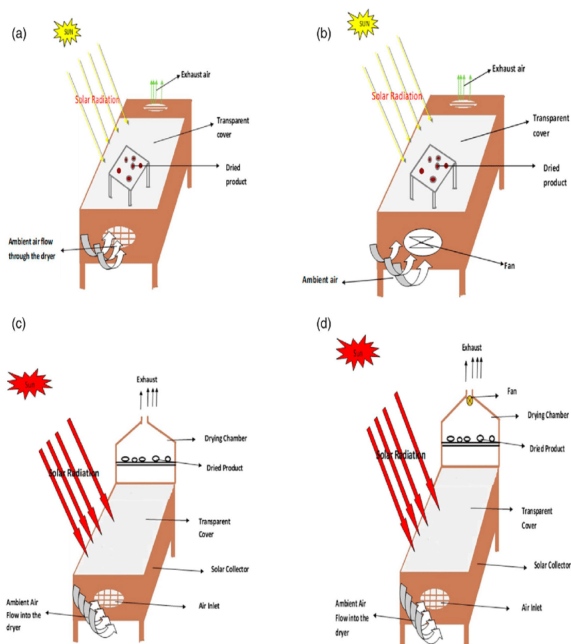


Solar Powered Drying System Types

a. Direct dryer: In a direct or natural dryer, the product is placed in a shallow place in the dryer. Direct drying machine: By machine Direct drying or natural convection, the product is placed in a shallow place in the black.

b. Indirect Dryer: In this dryer, the food is put into the dryer. The air is heated by solar heating and then blown through the drying chamber. In some designs, the dryer receives direct electrical energy as well as solar heating. In these dryers, temperature, humidity, and drying can be controlled to some extent.

c. Forced circulation dryer: In these dryers, hot air is constantly blown on the food. The food itself is loaded or unloaded regularly or on time. This type of dryer has high thermodynamic performance and high speed and can be used to dry large agricultural products. These dryers can be flooded, co-flow, or counter-flow.



Future Scope:

Development: Continuous research and development should focus on improving solar dryers, both in terms of energy consumption and electricity and drying. This includes improving product quality, improving energy conversion processes, and implementing management strategies to maximize drying costs while minimizing energy consumption.

Integration of Renewable Energy Sources: Integration of solar dryers with other renewable energy sources such as wind power or biomass can increase their reliability and range. Hybrid systems that combine multiple energy sources can provide greater flexibility and power, especially in regions with different weather conditions or insufficient sunlight.

Smart and IoT technology: The combination of smart sensors, Internet of Things (IoT) devices, and data can help in real-time monitoring, control, and optimization of the solar dryer. Predictive analytical algorithms can predict drying needs, adjust drying conditions, and detect potential problems before they escalate, improving overall efficiency and reliability.

Modular and Scalable Design: The modular and scalable design of the solar dryer allows for customization and adaptation to different needs, sizes, and contents. Modular components can be easily assembled, replaced, or expanded to facilitate deployment to different locations and to accommodate changes in volume or product type.

Production of more valuable products: The solar dryer can be used not only for the simple preservation of food but also for the production of valuable products such as dried fruits, herbs, or herbs. Research on drying efficiency and the technology behind it can open up new business opportunities and improve the business of solar dryers.

Social economic impact assessment: Future research should focus on the economic impact assessment of solar dryers, including income generation, employment, and rural development programs. Understanding the broader impact of solar drying technology can inform policy decisions, critical investments, and community engagement strategies.

Capacity Building and Transformation: Initial capacity building, training, and operational transformation information are required to promote dry technologies and build regional expertise in their design, operation, and maintenance. Collaboration between researchers, policymakers, business stakeholders, and community organizations can facilitate knowledge sharing and technology transfer, enabling customers to gain stability using solar drying capability.

Advantages:

- Energy efficiency
- Cost-effectiveness
- Low post-harvest
- Loss High product quality
- Environmental sustainability
- Small farmers
- Empowerment response
- Technology change and capacity building.

Public Awareness and Prevention Practices:

Agriculture: Solar dryers are widely used in agriculture to dry fruits, vegetables, grains, medicines, spices, and other agricultural products. They help farmers reduce post-harvest losses, improve product quality, and extend the shelf life of crops.

Food processing: In the food processing industry, solar dryers are used to dry fruits, vegetables, meat, fish, herbs, and spices, and valuable products such as dried fruits, dehydrated fruits, dried fruits, and spice mixtures are added. Solar drying preserves

the nutritional value and flavor of food while extending its shelf life.

Medicinal plants and herbs: A solar dryer is often used to dry medicinal herbs and herbs that are sensitive to heat and need to be dried slightly to preserve their properties. Solar drying stabilizes bioactive compounds and improves the quality and productivity of plant products.

Biomass Drying: Solar dryers can be used to dry biomass materials such as wood chips, sawdust, agricultural residues, and biofuels. Dry biomass fuel is used in cooking, heating, and electricity generation, contributing to the development of renewable energy and reducing dependence on fossil fuels.

Textile Industry: Solar dryer is used in the textile industry to dry fabrics, yarns, and clothes. They offer a good alternative to drying clothes, reducing energy consumption and operating costs while improving the drying process that ensures the integrity of the fabric.

Household Materials: Solar dryers can dry household materials such as clay, ceramic tiles, and wood. Solar drying speeds up the drying process and improves the quality of household products, reducing production time and costs while reducing environmental impact.

Industrial Process: Solar dryers can be used in many industries, including drying medicine, medicine, tissue paper, and food. Water mud. Solar drying provides energy savings and environmental safety in industrial dehumidification.

Community and People Projects: Solar dryers are being integrated into community and people projects to improve food security, income generation, and livelihoods in rural and underserved areas. It allows communities to

operate and protect local crops, create additional assets, and access new markets.

Conclusion:

Solar dryers provide safety, efficiency, and environmental protection for agricultural storage and drying applications, contributing to food security, poverty alleviation, and environmental management. Continued investment, research, and collaboration are essential to realize the full potential of solar drying technology and its positive impact on global food supply and development goals.

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