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Hybrid Solar Dryer for Agricultural Products

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Abstract

Drying for crops and agricultural products plays crucial role during the rainy seasons, and also winter seasons. This review paper is all about the method of the drying the agricultural products. The demand for the fossil fuels is rapidly increases day by day. Hence the available sources of fossil fuels are reducing. Therefore we require an alternate energy source to satisfy our various demands. The method of removing wetness from product is known as drying. For drying of agricultural product energy is usually used. Then the alternative method is to be hybrid solar wind dryer. As solar dryer reduces the time required for drying and also improves quality and lifetime of the Agricultural products to be dried. There is need to develop cost effective solar dryer in which different agricultural products and crops can be dried. Almost all developing countries are using solar power devices like, solar cooker, solar water heater, dryer, air heater, and solar still etc. This paper is suitable for the rural surrounding areas and also small scale crops farmers with their suitable cost. Its depend on their crops and agricultural products.

Keywords: *Dryer, crops, solar, wind, Agricultural products.*

1. Introduction

The agricultural products like fruits, vegetables and other crops are spoilages due to lack of long standing storage without further degradation in terms of quality of products. To drying the agricultural products, peoples are using open air or sun drying. It is very dangerous to the products and also to the peoples. Because, in open sun drying products has wind dust, infections. Due to this, the quality of the product can be reduced and its economic market rate also fallen to low level. While compared to sun drying with solar drying, the utilization of solar drying period is to be 64%. Due to solar drying the quality of the products increases regarding safe moisture content, hygienic, cleanliness, taste and its color. The total agricultural products are also protected from the insects, dust, rain and its range of payback period around 2 to 3 years; it depends upon the speed of utilization.

The solution from the above mentioned problems is to be hybrid solar and wind dryer can be used. Hybrid solar dryer is a new technology used for the drying of variety of agricultural products. Hybrid solar dryer contains a separate drying chamber along with solar collector.

The working principle of dryer is, the sun rays falls on the solar collector it absorbs the solar radiation and it can converts into solar energy to thermal energy or heat energy it returns a heats the flowing air. Then latter it supplied to the drying chamber. Generally solar dryers have a low temperature level. But in order to get high temperature level, along with solar dryer another source can be added. Another source is to be a wind energy source. While in the absence of solar dryer along with it can be integrated with continuous wind energy drying system. The alternative energy heating system can be lead to high temperature level and the drying process can be continuity in cloudy days and also in night time.

2. Literature Review

Zoukit A et., al, proposed an Hybrid solar and electric dryer shows the an solar energy is incorporated with its electricity for their operation. Author was trying to drying all the craft products like pottery, leather, agricultural products and medical plants. The main parameter is the products can be dried it can maintain its level of the temperature could be high. During this paper the author considered a case study on clay drying. The main goal is the product can be dried it can be maintain temperature level is to be 80^{o}C. the method used in this paper is

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mamdani Fuzzy controller is designed in it can be called as MFC. It is used to maintain the temperature at 80ºC its inside the drying chamber. As this method is compared the PI controller. Then afterword's it can design into two methods. The software output can be shown in this paper in terms as simulation (Mat lab). To control the temperature levels MFC can be used. An error could be updated under 0.35ºC. The software fuzzy controller was maintaining in straight forwarded to design [1].

Rifatul Mursalin et., al, proposed an hybrid solar drying, especially for agricultural products and crops are plays crucial role in now a days. This paper is an alternative method drying for green chili was evaluated. The aim of this paper is to execute the construction, modification, design and performance result of the solar-biomass hybrid dryer. While during the trial period of the project, its results shows above the ambient temperature in a inside the solar dish, in most hours of the experimental trails. Its ambient temperature in inlet collector varies from 30º to 35ºC. Then the outlet air temperature in outlet collector was varies 54º to 64ºC. This is suitable to dry all the agricultural products like green chili. The average efficiency of collector was found as 46.54%. The Collector, producing the way of flowing air and it improves the isolation chamber walls and results are uncovered the drying of products is suffering from its modification of collector. This type of solar-biomass hybrid dryer is suitable for small scale crops farmers and also the products like green chili. It is useful for rural areas of developing countries with their suitable cost [2].

Metidji.N et., al., proposed that to design and construction of 150 kg capacity of a hybrid sola-thermal greenhouse dryer and also Equipment's developed units at Algeria, BouIsmail. The aim of this paper is to dry the apricot waste by using AC fan operates at convection mode. This experiment conducted during the period of june, 2016 to dry the apricot waste. While during this experiment reading taken hourly based on humidity, moisture evaporate, greenhouse air temperature, ambient air temperature etc. produced mass and heat can be transferred to the entire system[3].

Wang Xin et., al., proposed that, now a days design of drying takes a challenging research topics and it based on the interactive multivariable process and highly non-linear process. The principle of this paper is to be several experimental parameters are extremely complex with partial differential equations. Then data driven have a less transparency and to get a depth and quality of model training for commercial experimental data is very difficult. This paper explains about the solar based hybrid method applied to the rotary drying. This paper have two principles, one is any parameter of model is executed based on the solar model. Another one fuzzy rule is obtained to the SVR model it can increase the transparency of the model. Then finally a executed solar-based hybrid modeling drying method applied to the rotary system. The final results shows its have good prediction and adaptation when compared to the experimental results by using a rotary-solar hybrid modeling drying method. Its have good results when compared to author assumption [4].

Ferouli EL et., al., proposed that, generally solar power is renewable energy sources and it is free to the environment without creating any pollution. This power can be used to dry the agricultural products and other crops. A solar cell stores a temperature in form of a heat inside the drying chamber. To vary the temperature level by using a proportional valve. The temperature can be maintained inside the cell in order to take care of temperature level. The solar power can be maintain 935W/m2 to 1045W/m2 from the solar radiation to dry the agricultural products. Finally at the inlet temperatures vary at drying chamber have 61oC to81o respectively [5].

Ashish D et., al., proposed a solar power is a crucial source of renewable energy and is that the most readily available non-polluting source of energy. the target of this paper is to develop an extremely smart solar tunnel dryer incorporated with sensors and controllers for giant scale agricultural drying purpose. Temperature and humidity sensors are used for

detecting the present atmosphere inside the dryer. A blower fan is additionally used for delivering the recent air to the surface of the crops and products to be dried. Solar dryer gives faster drying rates, reduces humidity and spoilage or wastage can be reduced and it can improve the standard of the products [6].

Khattab, N.M et., al., proposed that a Drying could also be either by a solar energy from sunlight or heat from the fossil fuels. From the solar energy as the source taken, The author has developed a new drying technology for products i.e. solar drying that maintains a desirable taste of the product. This system uses the glass to transfer the heat from the solar panel. It can dry products on the glass through warmth and hot air. The author has developed the hybrid solar dryer or solar dish which will produce a heat, hot air at an equivalent time so as to develop a hybrid solar dryer for the agro products and also marine products. The entire heat collection efficiency was 74% and may be a large value when the water and air flows are balanced during a corresponding manner. Furthermore, the consequences of rays wont to dry marine products on the changes in umami components found in such products were investigated [7].

Boughali.S et., al., proposed that in renewable sources, Solar energy is comes under a renewable energy source which is trending energy source on the earth. Which is used for the drying of agricultural products and other crops. For this paper have an infrastructure of a drying technology, and its circuit design, hardware setups are available. As this paper shows the experimental results of a dryer for agricultural products. The drying method is Fuzzy hybrid PID control is to applied for drying of products. For this system have a non-linear characteristic of temperature control of a dry box in that systems. It's have a good drying effect and also it avoided the loss of nutrition's while on drying of any products [8].

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Sandeep Bukkel et., al proposed A sun oriented passage dryer nearby sunlight based air warmer has been worked with reasonable warmth stockpiling material in Vellore institute of technology in Vellore. It is basically to dry agricultural products and also little scope for farmers. The stones covered with dark shading are utilized as reasonable warmth stockpiling material; it is inside its dryer. Weight is used its inside dryer is to be around 36 Kg is to be used. This paper is all about to drying the orange strips. To drying of an orange strip, it took around 14hrs. Whereas it dry normally 8hrs depend on its characteristics convection close by reasonable warmth stockpiling material. Sun powered passage dryer coordinated with sun oriented air warmer and reasonable warmth stockpiling material speaks to a large amount of drying effectiveness than its physical dryers with no extra expense is utilized to running of any machine and keeping up of its dryer and regular convection with its reasonable warmth stockpiling might be a decent technique improving execution of the dryer [9].

Qijun Xiao et., al., proposed that a solar energy is comes under a renewable energy, which can be used for the agricultural products drying. Demand for the dryer of agricultural products has been increasing day by day. To dry any products, solar power is to be demonstrated. The principle of drying device and its structure as shown in this paper, and also the circuit designs and its hardware devices is to be designed. The experimental output of drying products by using solar power also can be shown in it. Fuzzy hybrid PID control is the method to be applied within the experiment. In this device a temperature control of dry box is available. It is a non-linear characteristic temperature control. In this method of drying, there is no loss in the form of nutrition and color [10].

3. Proposed System of Drying Agricultural Products

The proposed system have a two sources are wind and solar. Both are attached parallel to each other. Solar can be working during sunlight and wind energy working in all time in a day. A solar-wind dryer consists of a solar panel, drying chamber blower fan, heating coil, temperature and humidity sensor. Solar panel provides the power supply for the entire system. Drying process can be executed in the drying chamber. The heated travels through the drying chamber via inlet connector where walls are coated with aluminum foil which help in retaining the heat inside the chamber. When the recent air is blown through the agricultural products to be dried, it'll take up the moisture until absolute humidity is reached. The speed of drying is directly proportional to the temperature and its circulation speed. Solar food drying are often using mostly in all area but the question is how quickly products can be dried in most areas but how quickly the food will dry especially from the solar heat and its humidity. Generally the agricultural products can be dried in 1 to 3 days. It's totally depending upon the temperature level, heat flows and its humidity. Solar drying food is healthy to all humans and it can avoid the dust from the surroundings areas.

4. Conclusion

The hybrid solar-wind energy dryer for agricultural products plays crucial role in now a day. From the above literature review all authors says their proposed system to dry agro products. Generally solar is a renewable energy source and it is free to the environment without creating pollution to the environment. All papers have solar dryer and some of papers have hybrid dryer. This hybrid dryer one source has renewable and another source have a fossil fuel sources like biomass, thermal, etc. But in my paper both two sources are renewable energy sources. They are solar and wind energy sources. It is pollution free to the environment. By using these dryers, quality of products are better compared to the open air-sun drying. This can available to small scale crop farmers with their reasonable cost. But the time to dry the products it will take when compared to the other dryers. We need the quality of the products. So its have good quality compared to other dryers.

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