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Eco- friendly Universal Smart Dryer System

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Abstract

Drying is one of the traditional methods for food preservation. Sun drying and shade drying methods need more space and there is possibility of contamination due to external environment conditions. Present days Microwave (MW) dehydration, Automatic Solar fruit dryers and Infrared radiation dryers have been utilized for the grape/cashew nut drying process. In this project modified technique of present grape/cashew nut drying method using IR radiation, sun rays, peltier heating is suggested. It is distinctly different from conventional or natural drying. The infrared radiations accelerate drying process with a better control to achieve uniform drying and reduced drying time. The proposed system makes the use of vacuum chamber which is weather independent and improves the quality by maintaining texture and colour of raisins/cashew nuts. The operation of the system makes use of nonconventional source of energy so it is cost effective. The Infrared Radiation drying method has better speed of analysis, so this technique is suited for qualitative in-process use. Efficient utilization of this system by the farmers will lead to profit optimization.

Keywords: IR LEDs, Lithium Ferro phosphate, MPPT, Peltier, Solar,

INTRODUCTION

In India, raisins are made from grapes Thompson seedless and its clones. The most common practice is the dipping of the berries in Australian dip emulsion, which contains 2.4% potassium carbonate and 1.5% ethyl oleate and subsequent drying in shade in open tier system. The main constituents of ripening grapes are water and sugar, as ripening advances, the sugar content increases and the water decreases. During drying, raisins lose most of the water and retain nearly all the sugar. There are several drying methods that are implemented for raisin making. Sun drying: In this technique the grapes are spread over a large area on the land. They are dried under sunlight and are raisins are formed. In this technique all the grapes don't get dried uniformly.

Fig1. Sun Drying

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The drying in this method is totally dependable on the sunlight. In adverse weather conditions the drying process cannot be continued. In this drying process manually monitoring is required to protect grapes from the birds. It's a traditional method of drying the grapes in raisin making process.

Shade Drying:

In the shade drying technique the bunches of grapes are spread on racks. Under a large shade area the racks are placed and the grapes are spread over the racks. They are dried by sunlight.

fig2. Shade drying

By this technique the grapes are protected from birds. It is also manually operated process. It takes around 15-20 days to get grapes completely dried in form of raisins. There are chances of grapes getting contaminated due to open drying method.In recent years due to technological developments in the agricultural sector the drying process has also got modified from these traditional techniques. Solar dryers, Microwave dryers, Vacuum and Infrared Dryers are being utilized on large scale.

Solar Drying:

In this technique solar energy used for the raisin/cashew kernel making. Here electricity is generated by the solar panel. It can be utilized in night also. The exhaust fans inner side of the dryer dry the grapes/cashew inside. In some solar dryers AC convective heaters with DC converters are also provided chamber which help in running fans.

Fig3 Solar drying

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Microwave Drying :

Here heat is not transferred to material but material is induced to heat. In this technique microwave radiations are used to dry the grapes/cashew nuts. The grapes/cashew nuts are heated directly. In this drying the temperature increase dramatically due to high moisture content in gapes/cashew nuts. Separate mechanism is required for the phase controlling .The colour of the raisins/cashew nuts gets darken due to the microwave drying.

Infrared Drying:

Infrared drying involves penetration of heat into the sample being dried, as compared with heat conductivity and convection with conventional ovens. Such heat penetration to evaporate moisture from the sample can significantly shorten the required drying time to 10–25 min. The infrared lamp used to supply heat to the sample results in a filament temperature of 2000–2500 K (degrees Kelvin). Factors that must be controlled include distance of the infrared source from the dried material and thickness of the sample.

The analyst must be careful that the sample does not burn or in case harden while drying. Infrared drying ovens may be equipped with forced ventilation to remove moisture air and an analytical balance to read moisture content directly.

In last few years there have appeared efforts agricultural products. Following is the literature on relevant topic referred for deciding various aspects in the proposed system.

Mr. O. N. Thigale and Mr. A. M. Patil [1], have designed vacuum solar grape dryer to execute grape drying process. They found that vacuum dryer was efficient and required no power supply to carry out the entire drying process. Mr. G. D. Lohar, Mr. A. G. Nandekar, Mrs. W. S. Kandlikar [2], have presented modified natural grape drying method using Infrared Radiations. The Infrared Radiation unit mentioned has different sensors to monitor various parameters regarding drying process. They have concluded that Infrared Radiation unit shows significant drop in drying process duration compared to natural drying process A. H. Utgikar, A. K. Shete, A. A. Aknurwar [3], have proposed IR heating mechanism for grape drying process. By maintaining proper distance between IR source and target good quality raisins can be produced. V. R. Thool, K. K. Narwade, A. B. Kokate, S.D. Khurjuleand , M.B. Pawar [4], have developed PLC based grape drying system which can be used to produce all types of raisins. Results realize Infrared Radiation (IR) technique is more effective and has no losses during drying process. Mr. Onkar B. Kadam, Mr. Digvijay D. Shirke, Mr. Shantanu P. Kadam, Mr. Nilesh N. Desai, Mr. Suraj S. Pawar, Mr.Sujit S. Malgave [5], have described different grape drying techniques. They have discussed various drying techniques and found that Infrared Radiation drying technique dries the grapes in lesser period of time compared to other drying techniques. Mr. Patil Kiran, Ms. Swami Sonam, Ms. Thorat Ashwini, Ms. Mane Pratidnya [6], have described Automatic fruit drying system which is powered by solar energy. One day experimental analysis was done on grapes. Microcontroller is used for monitoring purpose and Infrared radiations for grape drying are used. The system proposed uses minimal space consuming and economical. Namani Rakesh, T. Santosh, Udugula Malavya, D. Rishikesh [7], have described development of Maximum Power Point Tracking (MPPT) algorithm using incremental conductance method to extract maximum power from solar panel. They have implemented battery charge controller using PIC microcontroller to protect batteries from overcharging and deep discharging. They have found that system gives good dynamic response in

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all conditions. Nitesh Bhatnagar, Neetu Jangi, Megha Nagar, Rajkumar Saini, Manoj Krishnia [8], have presented a design of Maximum Power Point Tracking (MPPT) for Photovoltaic system implementing Perturb and Observe algorithm. Here PWM generated signal is controlled by utilizing the AVR controller, the maximum power can be made available.From the above review of literature we find that there is great scope for improvement in techniques of Raisin making.

METHODOLOGY

All the agriculture products grow in different seasons and in a particular area only. Preserving food product by drying is an important operation continued from prehistoric period. Drying the fruits at the constant temperature is an important task. The proposed system modifies the traditional natural drying method by adding infrared radiation technology The block diagram of system is shown in Fig.4. The Intelligent fruit drying system is an automatic drying system. The vacuum chamber is heart of the system. Different sensors are mounted in chamber to monitor parameters like weight, humidity and temperature.

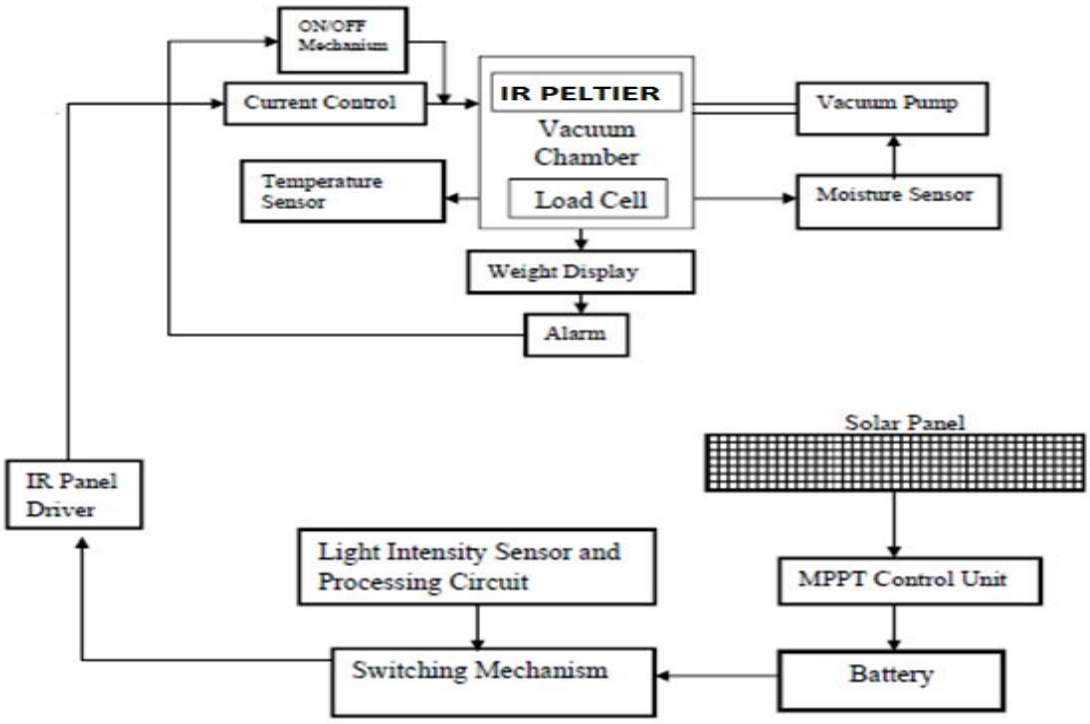

Fig4 System Blocks

The vacuum pump is connected to chamber to maintain the vacuum inside the chamber. During the day time sunlight is used for the grape/cashew drying process. On the top of the vacuum chamber an aperture plate is present which filters the sunlight coming in the chamber. The solar panels charge the batteries and the light Intensity sensor detects the lumens of the light. Depending on the light intensity the switching mechanism operates the IR radiators in the vacuum chamber. As the day proceed resistance of light intensity sensor increases. During the night system works on the solar charged batteries and IR led. Peltier plate along with IR

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provides heat to grapes/cashew nuts. Temperature of 70 degree is maintained up to 7 hours in a day for drying. In this way the drying process is carried out in day as well as in the night also. When the moisture of the grapes/cashew nuts reaches a desired value an alarm is generated indicating raisin are ready for use. The system provides a dust free drying due to which the hygiene and quality is maintained. The manual interference in entire raisin/cashew nut making process is reduced on large scale.

The entire hardware system alone cannot serve the purpose, unless the real-time program instructions are flashed into the hardware. The software part plays an important role to coordinate and control all the peripherals connected with the controller, the system becomes functional by configuring and initializing the peripherals as per the software instructions. In the beginning all the sensors, controllers and entire components are initialized. At first the grapes/cashew nuts are placed in tray which is mounted on weighing sensor. The sensor reads the weight and displays the same on LCD. The weight is continuously monitored, when the weight goes 30% of its initial weight alarm is generated and weight is displayed on LCD.

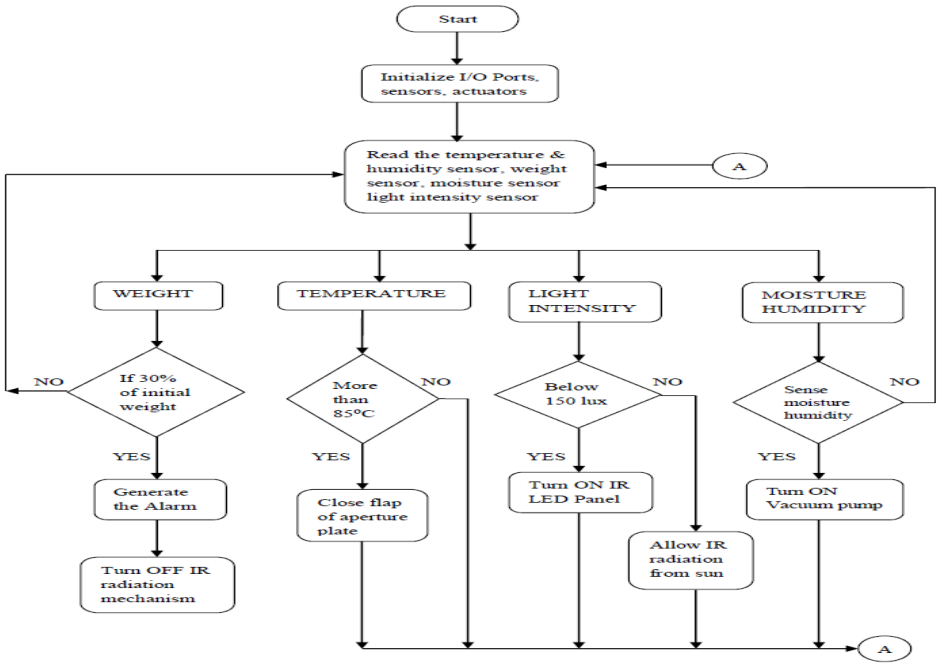

Fig5. Flowchart

The temperature in the chamber is monitored by temperature sensor. When the temperature crosses the set point the aperture plate is closed and the incoming radiations from sun are reduced. The light intensity sensor monitors the lux in the sun light. As the light intensity of sun reduces the IR panel from the vacuum chamber is turned ON. The moisture humidity sensors sense the moisture inside the vacuum chamber. The vacuum pump extracts the moisture and maintains vacuum in chamber. The natural nutrients contents of the grapes/cashew nuts are preserved .The quality and colour of the raisin/ cashew kernel is maintained. More quantity of food products can be dried. The proposed system has ability to operate without sun. The drying process can be executed during night time also using IR radiators and peltier. During the day time the batteries are charged from sun and during night charged batteries supply voltage to IR radiators. A uniform drying is provided by

help of the proposed system. It provides a good stability. The operation of the system makes use of nonconventional source of energy so it is cost effective. Efficient utilization of this system by the farmers will lead to profit optimization. Also in absence of sunlight lithium batteries are providing supply to system so as to operate in night also. Solar panel will store the charge in batteries in day time so as to utilise power in absence of sunlight or solar.

CONCLUSION

In this project existing natural grape/cashew nut drying process is modified with suitable enclosure containing IR radiators with peltier plate and allied system. Appropriate sensors are used to measure parameters like humidity, temperature and weight of sample. Experimental analysis done with the help of dryer proves the uniform drying of the grapes/cashew with the help of infrared radiation. The original colour of grapes/cashew nuts is better conserved as the drying takes place at low temperature. The drying time is reduced to a significant level as compared to natural drying process. The use of vacuum solar dryer is efficient and time saving; it should be preferred where good quality of raisins/cashew nuts and minimum time is required. Proposed system operates automatically. It increases accuracy and is user comfort. Entire raisin/cashew nut making process is carried out without any human interference.

REFERENCES

1. Mr. O. N. Thigale and Mr. A. M. Patil, “Development of Vacuum Solar Grape Dryer (IJLRET)” ISSN: 2454-5031 Volume 02-Issue 05 May 2016
2. Mr. G. D. Lohar, Mr. A. G. Nandekar, Mrs. W. S. Kandlikar**, “**IR Based Electronic Grape Drying System (IJETR) “, ISSN: 2321-0869 (O) 2454-4698 (P), Vol.-4, Issue-3, March 2016
3. A.H. Utgikar, A. K. Shete, A. A. Aknurwar, “Drying of Grape with an Infrared Radiation heating Mechanism” (IJIET) ISSN: Pages 2319-1058Vol.2, Issue 4, August 2013
4. V.R.Thool, K.K. Narwade, A.B. Kokate, S.D. Khurjuleand M.B. Pawar “Development of PLC-based automatic Grape dryer” a review by Engineering and Technology in India Volume 5,Issue 1&2, Pages 60-66, Apr. & Oct., 2014
5. Onkar B. Kadam, Digvijay D. Shirke, Shantanu P. Kadam, Nilesh N. Desai , Suraj S. Pawar, Sujit S. Malgave**, “**Solar Grapes Dryer: A Review by (ICRTES) “ ISBN: 978-93-86171-06-1, September 2016.
6. Mr. Patil Kiran , Ms. Swami Sonam, Ms.ThoratAshwini, Ms. Mane Pratidnya, “Solar Powered Automatic Fruit Drying System (IJARECE)” ISSN: 2278 – 909X Vol.5, Issue 3, March 2016
7. Namani Rakesh, T.Santosh, Udugula Malavya, D. Rishikesh**, “**Battery Management for Solar PV Panel (ICIMIA)”, 2017
8. Nitesh Bhatnagar, Neetu Jangid, Megha Nagar, Rajkumar Saini, Manoj Krishnia” Maximum Power Point Tracking for PV System (IJRASET)” ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 6 Issue IV, April 2018.