

Electric cloths dryer and dehydrator

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Abstract – The paper is a combine design of coupling a cloth dryer and dehydrator as a single unit. The machine is used for the cloths drying as well as food dehydrates. The cloths and food dehydrator are designed at the top and bottom of a box. Temperature controllers are used to maintain the desired temperature and fans are used to distribute the heat uniformly. The unit is designed, fabricated and tested for its efficiency.

Key Words: Cloth Drying, Food Drying, Machine Efficiency

1. INTRODUCTION

Drying means preservation of food, fruits and vegetables for long time with good quality. It is a process of moisture removal due to simultaneous heat and mass transfer. Agricultural products, especially fruits and vegetables requires hot air in the temperature range of 45–60°C and for cloths drying they require temperature range is 35-45°C safe drying and when any agricultural product is drying under controlled condition at a specific humidity as well as temperature it gives rapid superior quality of dry product. [1] Drying involves the application of heat to vaporize moisture and some means of removing water vapour after its separation from the food products. It is thus a combined and simultaneous heat and mass transfer operation for which energy must be supplied. The removal of moisture prevents the growth and reproduction of microorganisms like bacteria, yeasts causing decay and minimizes many of the moisture-mediated deteriorative reactions. [2]

It observed that reduction in weight and volume, storage and travel costs and enables storage of the product under the ambient temperature. Drying process takes place in two stages first is at the surface of the drying material at constant drying rate and is similar to the vaporization of water into the ambient and second stage is according to properties of drying product with decreasing drying rate. In past open sun drying is used for drying product; the foods and vegetables is placed on the ground or floor, which can reach higher temperatures in open sun, and left there for a number of days to dry. This method no investment in equipment is required but the process has some limitations. The most obvious ones are that the crops suffer the undesirable effects of dust, dirt, and insect attacks. Because of All these disadvantages can be eliminated by using that dryer. The purpose of a dryer is to supply more heat to the product than that available traditional process.

The dryer is device which is powered by electricity as source of heat, design for house product like cloths or farming product and used air used for drying the product like food and cloths.

2. LITERATURE REVIEW

The first electric dryer was invented in the early 20th century. Inventor J. Ross Moore was tired of hanging his clothing outside, especially during the winter. To help keep his wardrobe out of the freezing weather, he built a shed to house his clothes while they dried. In addition, he added a stove. The clothing would hang on the line in front of the fire and dry. This was the beginning of the development of electric dryers. For the next three decades, Moore worked to eventually build a gas and Electric unit, but couldn't find anyone to help him get his idea manufactured. The drum-type model was built and eventually picked up by Hamilton Manufacturing in Wisconsin.[3] The new dryers were sold under the name June Day beginning in 1938. In England and France during the end of the 18th century, clothes dryers were being made. Called ventilators, these large contraptions were made of metal. George T. Sampson of Ohio decided that the ventilator invention needed to be tweaked. Instead of using heat from an open fire, he chose to place a rack over a stove. This heat source was much better, as it didn't dirty the clothing or catch it on fire! On June 7, 1892, Sampson was granted a patent for his idea. These "dryers" were used well into the 19th century.

Sun drying is oldest method of preservation method for fruits and vegetables. The ancient Hindus and Chinese used to dry fruits & vegetables by the sun and wind

Around 5000 years ago In Pakistan Early Bronze Age (3,300 to 2,100 B.C.E.) raisins and dried figs are identified in an archaeobotany study (Milczarek, (2013).

At the end of 1800s and beginning of 1990s sun drying is replaces by artificial drying (Van Arsdel and Copley, 1963). WWI & WWII introduced improved dehydration for commercial operation. First record of drying vegetables mechanically appeared in 18th century (Van Arsdel and Copley, 1963) is considered as improved form of sun drying. It is a controlled efficient system which utilizes solar energy Bala, 1997a & 1998, Zaman and Bala, 1989 and Muhlbauer, 1986). Solar driers can generate higher air temperatures and lower relative humidity (Brett et al., 1996).

3. OBJECTIVE

The project aims to fabricate a low cost, durable, user-friendly, time efficient and low power consuming product for drying clothes in humid weather and rainy areas for both home use and industrial sectors.

To understand different forms and properties of water. To understand water content and water activity of food materials and cloths materials. After estimation problem of the food dehydration and cloths drying methods we want to build the machine which is fulfill over the serious problems.

4. DESIGN

The designing of Cloths dryer with Food dehydrator is divided into two sections.

- A) Box design
- B) Electronics Circuit design

4.1 Box Design

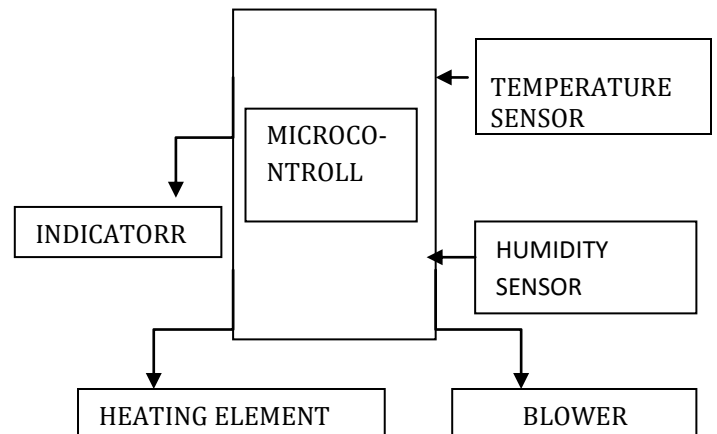


Fig.1 Main assembly Design

Parts of Main Assembly

1. Exhaust Blower, 2. Drying cabinet for cloths
3. Hanger hooks, 4 .Dehydrate cabinet for the foods
5. Tray for holding food, 6. Heating coil, 7. Fan
8. Air Duct, 9. Control panel, 10. Door.

4.2 Electronics Circuit Design



4.3 Design Methodology

- 1. Problem detection in drying and dehydrates process -**
The existing machines are observed and studied properly to detect the problems faced by the operator.
- 2. New drying technology -** The research work in the traditional drying cloths as well as food dehydration process studied and new methods were developed to achieve desired goal.
- 3. Combine operation -** In this machine the clothes dryer and food dehydrates process is working combine that why useful for the user.
- 4. Safety -** Highest priority is given to safety of the user.

5. CONSTRUCTION &WORKING

5.1 Components

The basic components involved in the fabrication of dehydrator with cloths dryer are:

- Cover plate
- Insulation
- Temperature sensor(range 45-60C) for cloths section
- Temperature sensor (range 35-45C) for food section
- Heating coil (500W – 230V space heater)
- Fan (AIRFLO- 230V – 120mm x 120mm x 130mm)
- Blower(velocity range-1.2m/s)
- Switches and wires (push button type)

5.2 Working

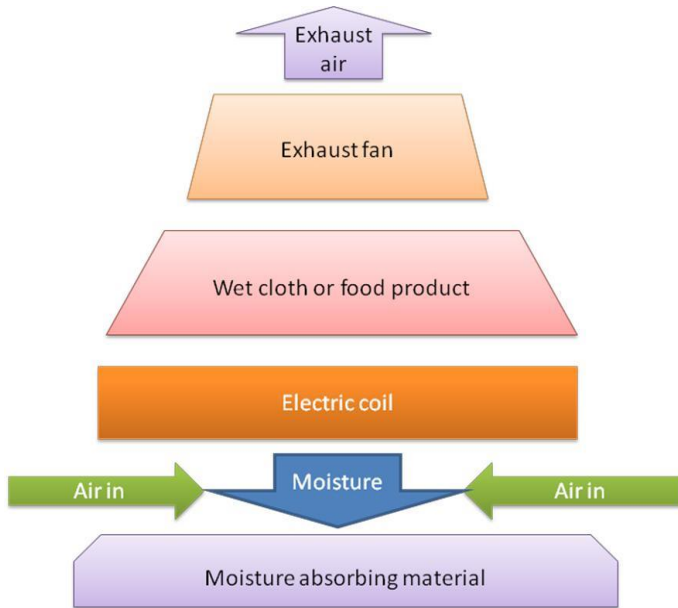


Fig.4 working diagram [5]

The process of our system is a very simple one. Air is initially heated by the heating element, and is flows towards cloths section and food section through a humidifier. Here the hot dry air absorbs moisture so that the supply air to the home is dry. This also reduces cost of electricity in the home. The air is drawn though the house by an exhaust fan blower. Whenever heating coil is in working condition only that time fan in working. Next, a small fraction of the supply air (SA) is drawn from the main supply duct. This air will be our supply for drying clothes. The air enters our drying chamber through buffers and a hood which helps distribute the air such that the velocity of the air in the chamber relatively the same. [4].

The hot supply air flow through our drying chamber where it absorbs moisture from the wet clothing or foods and heats the cloths and food to stimulate evaporation. Moisture is removed of the chamber by the hot air. The air is drawn through the bottom section as well as dryer. The air then enters in the ducts and the drying chamber by an exhaust fan, in line with the duct.

In food section there are two trays provided on which vegetable and fruits slices are kept. The vent is provided to remove water vapour from the both section on right side of machine.

Cloths are requiring 45 to 55°C temperature for effective drying within 20 minutes and for the food dehydrator require 35 to 50°C temperature for 2 to 4 hour which are depend on the types of foods and vegetables. When the estimated time is reached turn off the machine switch and

check whether the cloths are dried or not also check the food are completely dehydrator or not. If yes then turn off the machine. We have to required the time for the testing the cloths section and food section is different.

Our aim to dry the cloths within 15-20 minute and food dehydrates within 2-4 hrs (depend upon the type of the food use) and less energy consumption for this process. That's why we use good velocity fan blower which throws the 1.2m/s air so cloths dry's rapidly and less time required because of such arrangement. And for food section we use exhaust fan which maintain air velocity with long time process.

6. RESULT

The testing of the clothes dryer and food dehydration gives the following result:

- **DEHYDRATOR**

The sample from the table is selected and the results [3] are tabulated as follows.

FOOD ITEMS	SLICE DIMENSIONS	TIME IN HOURS	TEMPERATURE RANGE
Carrots	5 mm slices	4	140°F
Onions	2 mm slices	2	140°F
Potato	3mm slices	4-6	140°F
Tomato	2mm slices	8-10	140°F

- **CLOTHS SECTION**

For the cloths after testing we find time require for the drying cloths properly require maximum 20-25 minutes. For this we taken dry cloths weight and weighted cloths weight and after this comprise both reading and find out the how much moisture content removed from the cloths.

7. CONCLUSIONS

Drying is an important unit operation. Drying of food products has been a very important agricultural as well as household sector for many years. This is also useful in the continuing improvement in drying technique. Continuous improvement in drying technology is carried by handling various foods, improving product quality, reducing costs and demand for energy-efficient, faster, environmentally friendly and cost-effective drying technique will continue to increase over the world. As the fuel prices rise, it is necessary to develop sustainable drying technologies using renewable sources using innovative ideas. Thus we can say that, drying is an ancient process which is still continuing providing food security and increasing commercialization of foods.

ACKNOWLEDGEMENT

We are thankful to Prof. A.N. Kalyankar, Department of Mechanical Engineering, D.Y.Patil College of engineering Kolhapur and Prof. A.J. Gujar HOD of Mechanical Engineering for their advice and help both theoretically and practically. We would like to take the opportunity to thank the Principal, D.Y.Patil College of engineering and entire faculty members of Department of Mechanical Engineering, D.Y.Patil College of engineering Kolhapur Maharashtra, for their valuable help and support.

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