

# Mixed Mode Solar Dryer

SHUBHAM MHATRE, ATULKUMAR VAGHELA, JITESH MAHESHWARI, PRATHAMESH SURYAWANSHI  
guided by Prof. PRAMOD SURYAVANSHI

(Department of Mechanical, Bharati Vidyapeeth College of Engineering, Navi Mumbai)

**Abstract:- Mixed mode solar dryer composed of solar collector and a drying chamber. The flat plate collector is the most extensively used solar collector for domestical and business motive because it is easy and portable format and required lots much less maintenance. The drying device uses most effective solar energy. The air allowed in through air inlet is heated up inside the solar collector channeled through the drying chamber wherein it is implemented in drying and removing the moisture content from the agriculture product. This paper gives a format of mixed mode dryer for drying products records were obtained from the results.**

## I. INTRODUCTION

Solar dryers are devices used to remove moisture in agricultural products or foods by means of heat produced from solar energy. Solar dryers are classified as direct, indirect and mixed mode solar dryers. Direct solar dryer uses direct sunlight for drying the food. It consists of a drying chamber with transparent roof cover, food tray and air inlet and outlet vents. In an indirect solar dryer, a solar collector is air heated and then passes through the food tray for drying the food.

Mixed mode solar is basically a combination of direct and indirect solar dryers. In mixed mode solar dryer, the food is dried by the heat generated from direct sunlight and the heated air from the solar collector. In comparison with direct and indirect dryers, it is best and significantly gives better results.

## II. LITERATURE REVIEW

- **Vigneshwaran.T:** They proposed the design of the mixed-mode solar dryer, which consists of a solar collector and a drying chamber. From its construction, it is concluded that solar radiation can be used effectively and efficiently to dry various agricultural products. Also, with the little region of the dryer, the entire arrangement can be conveyed anyplace without any problem.
- **Bukola O. Bolaji:** This paper gives the design, construction and overall performance assessment of a solar dryer which is used to preserve food. When they were testing the dryer, they noticed that during most hours of sunlight, the temperature inside the solar collector and chamber were much higher than ambient temperature.
- **Emmanuel Ayua:** In this study, from a Horticultural Innovation Laboratory design they have made a mixed mode solar dryer. And compared it to a direct solar dryer, where mixed mode solar dryer had high drying rate. They made it at low cost and suitable for drying small scale agricultural products.
- **Syed Mohammed Shamiq:** In this study, they have developed a solar dryer with a solar collector, a drying

chamber and a blower. For dryer to more drying rate, they carried out tests in different conditions.

## III. CONSTRUCTION

- **Solar Air Collector:** The Solar Air Collector consists of components aluminum absorber plate, black glass and for insulation black paint is applied which helps in decreasing the heat loss. For absorbing solar energy 1mm thick aluminum plate is used. The important material that is used in the dryer is 5mm thick black tinted glass. The casing is made up of sheet metal, which surrounds the forging components and keeps them free from dust and moisture.
- **Drying Chamber:** The drying chamber is constructed of sheet metal with aluminum frame body. It consists of flat tray with holes for drying the product. To increase heat absorption, black coating is applied on the drying chamber. The roof of drying chamber is covered with black tinted glass with 5 mm thickness. To control the convection flow of air an outlet vent is provided to the upper end of drying chamber. A door is also provided at the back of the drying chamber to access tray.
- **Blower:** A blower of 600V with motor speed of 15000rpm and blowing speed of 80mph is used to pass the hot air from the solar collector to the drying chamber.



Fig.1: Working Model of Mixed Mode Solar Dryer

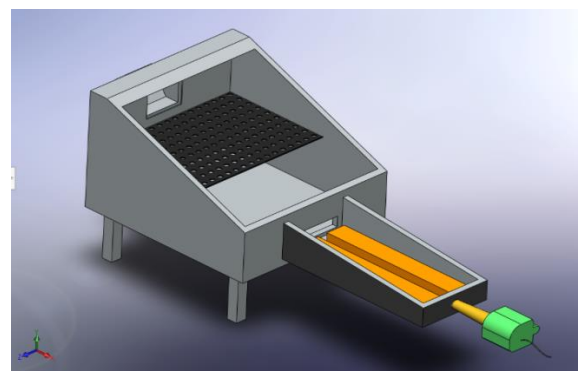


Fig. 2: Solidworks model of mixed mode solar dryer

#### IV. METHODOLOGY

The procedure of dehydration includes elimination of moisture from the product by heat generated from direct sunlight and heated air from collector. First the product to be dried is washed, peeled and prepared (if necessary), and placed on flat-bottomed trays of drying chamber. The direct sun rays on the solar air collector and drying chamber elevate the drying chamber temperature and the heat produced is used to dry the product. The heated product offers out water vapor and dries up. Gradually the moist air goes up and leaves the drying chamber through the air outlet on the back of drying chamber.

#### V. RESULT (GRAPH)

Time (pm)	Temperature in dryer( <sup>0</sup> C)	Normal temperature( <sup>0</sup> C)
2.15	34.7	34.7
2.45	45.9	34.8
3.15	44.3	35
3.45	43.7	35.3
4.15	44.8	35.2
4.45	45.9	35.3
5.15	44.2	34.6
5.45	41.6	33.3

Table1: Reading without blower

Time (pm)	Temperature in dryer( <sup>0</sup> C)	Normal temperature( <sup>0</sup> C)
2.15	37	34.2
2.45	41.8	34.4
3.15	43.7	34.7
3.45	46.7	35
4.15	46.9	35.2
4.45	49.3	35.1
5.15	48.6	34.9
5.45	46.9	34.1

Table 2: Reading with blower

From the table 1 and 2 readings, it concludes that by using blower, we get more temperature in the drying chamber.

By using blower, it gives more efficiency in sunny days as well as cloudy weather.

#### VI. CONCLUSION

The portable Mixed Mode Solar Dryer is used to dry the produce by using the blower and direct sunlight.

By using the blower there is increase in the temperature inside the drying chamber and product is dried faster than any regular drying process.

Without blower the temperature doesn't increase that much as compared to using blower.

#### REFERENCES

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