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A review on drying process using Solar Dryer

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ABSTRACT

The use of solar energy in the recent trend has a remarkable edge. The continuous research for an alternative power source due to perceived scarcity of fuel fossils is its driving force. This paper presents a possibility of drying by using solar energy and technical equipment that may designed and manufactured. The quality restrictions imposed to the dehydration process refers to maintaining the nutritional components appreciated by the content of vitamin C and keeping the color as close as possible with the color of fresh products. The methodology of research is complex and it takes into account the possibilities of the technical equipment that was used. Drying is one of the methods used to preserve food products for longer periods .The objective of this work is to develop a solar dryer in which the grains are dried by forced convection, the air passing in the collecting tank heated due to high temperature of plate due to trapped heat by glass .The other problem arise is orientation of sun which is eliminated by solar dryer containing drying chamber so that orientation of sun does not become the issue

Keywords: Solar dryer, forced convection, Green Herbs,

I.INTRODUCTION

In most of developing countries facing the problem of food for the entire population because of the rapidly increasing population in their respective territories. This rapid population increase has a direct impact on food balance. The quality and quantity of food grains are deteriorating because of poor processing techniques and shortage in storage facilities. To maintain the right balance between food supply and population growth, reducing food losses during production time is mandatory. However, maximizing the food production capabilities of small farmers in rural areas is difficult. To solve the problem, drying has become one of the main processing techniques used to preserve food products in sunny areas. Drying of fruits and vegetables is one of the oldest procedures for food preservation known to human being. It is a process that involves removal of biologically active water to a safe level that reduces deteriorative chemical reactions, provides microbiological Stability and extends the shelf life of dried products. Drying processes play an important role in the preservation of agricultural products. They are defined as a process of moisture removal due to simultaneous heat and mass transfer. Two types of water are present in food items: the chemically bound water and the physically held water [4] .In drying, it is only the physically held water that is removed. The application of dryers in developing countries can reduce post-harvest losses and significantly contribute to the availability of food in these countries. The use of solar dryer leads to considerable reduction of drying time in comparison to sun drying and

the quality of the product dried in the solar dryer found to be better [3].

1.1Advantages of Solar Drying System

1) Better Quality of Products are obtained

2) It Reduces Losses and Better market price to the products.

3) Products are protected against flies, rain and dust; product can be left in the dryer overnight during rain, since dryers are waterproof.

4) Prevent fuel dependence and Reduces the environmental impact

5) It is more efficient and cheap.

1.2Disadvantages of Solar Drying System

1) Quality of products is not obtained in some cases.

2) Adequate solar radiation is required.

3) It is more expensive require more time for drying.

1.3 Type of solar dryer

Direct Solar Dryer

It is a type of dryer in which solar radiation is directly absorbed by the product to be dried.it is also called as natural convection cabinet dryer since the solar radiation is directly fall on the product, the quality of product is reduced

Indirect Solar Dryer

The solar radiation gained by the system is utilized to heat the air which flows through the product to be dried in this dryer. In this of dryer quality of product improved though drying rate increased. Heated air is blown through the drying chamber. At the top of drying chamber vents are provide through which moisture is removed. In indirect type of solar drying systems a better control over drying is achieved. Fig. describes another principle of indirect solar drying which is generally known as conventional dryer

Forced Convection and Natural Convection Solar Dryer

Forced convection- In this type of dryer air is forced through a solar collector and the product bed by a fan or a blower, normally referred to as active dryer.

Natural convection – In this dryer natural movement of air takes place thus called as passive dryers. The heated air flow is induced by thermal gradient

II. RELATED WORK

1. Gh. BRĂTUCU, A.L. MARIN, C.C. FLOREA [1]-in their paper entitled RESEARCH ON CARROT DRYING BY MEANS OF SOLAR ENERGY, The research objects of the drying process by using solar energy were carrots with 15 and 20 mm in diameter, cut in quarters and in 5 and 10 mm slices, and also the stand that was designed and manufactured for this operation and they found that the drying time, the vitamin C content of fresh and dried carrots and the colour of the finished products were considered. The carrots to be dried were prepared by successive sectioning in quarters and slices with a 5 and 10 mm thickness. As a chemical component representative for fresh and dried products was the vitamin C content, and as a physical aspect - the

way that the colour of finished products was maintained. Referring to the vitamin C content, this was 0.6864 g/100 g at fresh carrots, and 0.9504 g/100 g finished product at dried carrots. A vitamin C concentration 2.2…2.4 times higher than in similar masses of fresh and dried products is obtained, even if, by drying, there is a global loss of vitamin C. By the inclination of surfaces for the products' exposure, drying time reductions by 10…15% as compared to the horizontal position of the surfaces were obtained

2. A.S.M.Mohsin ,Md. Nasimul Islam Maruf [2]- In all the cases the use of solar dryer leads to considerable reduction of drying time in comparison to sun drying and the quality of the product dried in the solar drier was of quality dried products as compared to sun dried products and they are appropriate for production of quality dried fruits, vegetables, spices, herbs and medicinal plants, and fish. Solar dryers are simple in construction and can be constructed using locally available materials by the local craftsman. They may vary in construction depending upon their loading capacity. The solar drier can be operated by a photovoltaic module independent of electrical grid

3. WaheedDeshmukh,MaheshN.Varma [5]- In the their study, solar cabinet dryer exhibited sufficient ability to dry ginger reasonably rapidly to a safe moisture level without any energy investment and positive environmental impact. Simultaneously it ensures a superior quality of the dried product over the conventional open sun drying method. The maximum drying time required to dry ginger from 621.50 to 12.19% (d.b.) was found to be 450 to 480 minutes. The drying time was found to be drying rate and moisture content dependent. Thin layer drying studies show that constant rate period is absent and the entire drying process occurred in falling rate period.The experimental drying data was fitted to five different mathematical models andcompared using statistical criteria. Page model was found to be best suitable to describe the drying kinetics of ginger among the tested models. The moisture ratio obtained experimentally and predicted by Page model shows good agreement and fitted smoothly to straight line.

4. AnnaHubackova, IvaKucerova [6] -Five most typical Cambodian fish species were selected for solar drying experiments in this study. Drying temperature and drying air relative humidity in the solar dryer were in average about 55.6◦C and 19.9%, respectively. The overall solar dryer efficiency corresponding to 15% of final productmoisturecontentwas12.37%.This is well in the typical range for natural convection solar dryers. An average evaporative capacityofsolardryeris0.049kg·h−1.Comparingthedrying process in the solar dryer and control drying in electric oven, we may conclude that, in general, the drying rates were higher during solar drying.

5. E Azad [7]-The solar dryer described in this paper can be used for drying various products in rural area under hygienic conditions. This solar drying system was constructed, consisting of two parts (solar collector and solar drying cabinet). Solar collector with area of 1.2m2 (1.2mx1mx0.2m) has black painted rocks to absorb solar radiation and a cabinet that is divided into five divisions separated by four removable shelves. Each shelf is 0.3m width and 0.5m length and made of nylon wire net framed in wooden border. Three sides of the drying chamber walls are covered by fiberglass sheet and a door in the back. Grapes were dried during the present work. The moisture content of grapes was reduced from 81.7% to 36.7% within five days of drying. The drying air flows through the product by natural circulation. In this work two modes of operation are discussed. The results were applied to the design of modified large scale solar agricultural dryer. This paper deals with a

suitable design of a solar agricultural dryer that can be built in rural area with locally available construction materials and skills

6. S.Smohapatra, D.V.N Lakshmiand P Mahanta [8] -has given Conservation of agricultural crops and minimization of grain losses is challenging issue in the present scenario. Effective use of thermal energy for drying of paddy and other cereals for maintaining proper quality is the quality drying process. Natural convection grain dryer is quite suitable for under developed and developing countries like India where rural electrification and advanced drying technology are not reachable. Natural convection dryer using biomass as a fuel can save the problems .In thispresent paper natural convection dryer along with phase change materials and its performance in effective drying of paddy has been studied. A detailed investigation has been carried out for drying of paddy at an average drying temperature of 5058^{0}C.Effective drying, quality of paddy and content of nutritional values have been explained. The drying efficiency was estimated 50.4% for drying of 100kg of paddy.

7. L. Kagande, S. Musoni J. Madzore[9]- High quality and aesthetically appealing dried tomatoes can be produced from solar tunnel drying. Solar dryers have the advantage of creating higher temperatures and movement of air that increases the rate of drying, therefore reducing the risk of spoilage by micro-organisms. Food is enclosed in the drier keeping contamination (by dust, insects and animals for example) at a minimum. The higher drying rate enables a greater quantity of produce to be dried in a relatively short space of time. Drying by natural means avoids the discoloration that occurs with artificial drying methods caused by high temperatures. However, there are also some drawbacks to solar drying. This process takes longer than oven controlled drying. This drying method is also dependant on weather conditions which include: humidity, insolation intensity and wind speed unlike artificial drying methods where drying conditions can be controlled. Solar dryers also demand a greater labour input than traditional methods, e.g. loading and unloading of trays of produce, but above all, the structure can be cheaply constructed using simple and affordable technologies and capable of being made and repaired in the areas where they are to be adopted, and are constructed using simple tools and limited locally-available resources. No special skills are required. Dried tomatoes need to be rehydrated to improve on texture so that their quality matches that of fresh foods. There is need to taste the nutrional differences between fresh, oven dried , sun dried and solar dried tomatoes to assess any nutritional losses due to this processing technique

III.CONCLUSION

Solar dryer is the best alternative option to avoid disadvantages of conventional drying methods. Solar dryer is designed particularly for drying agricultural products. One of the most important potential applications of solar energy is the solar drying of agricultural products. Losses of fruits and vegetables during their drying in developing countries are estimated to be 30–40% of production. The postharvest losses of agricultural products in the rural areas of the developing countries can be reduced drastically by using well-designed solar drying systems. Among the different types of solar dryers, the indirect mode forced convection solar dryer has been demonstrate to be superior in the speed and quality of drying

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