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DRYING EFFECTIVENESS ON AGRICULTURAL PRODUCTS CHARACTERISTICS

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ABSTRACT:

Various drying methods are employed to dry different agricultural products. Each method has its own advantages and limitations. Choosing the right drying system is thus important in the process of drying agricultural products. Care must be taken in choosing the drying system. Study comparing traditional drying and other drying methods for the reduction of the drying time and to a significant improvement of the product quality in terms of color texture and taste. Reduces the possibilities, the contamination by insects and microorganisms so that product is prevented.

An experimental study was performed to determine the drying characteristics of vegetables (okra, Potato) using hot air dryer, solar dryer and open sun drying method. For drying the test samples were dried in a laboratory scale hot air dryer, solar dryer at a constant air velocity of 1 m/s and air temperature in the range of 40–90°C and open air drying. Drying characteristics of okra and potato slices were investigated in a hot air dryer for a temperature range 60 to 90°C at constant air velocity 1.0 m/s. Results indicated that drying took place in the falling rate period. The sample dried analyses on the basis of color, texture and taste as comparatively at different temperatures.

Keywords: - Drying, product quality, moisture content, mathematical model, hot air dryer, solar dryer.

INTRODUCTION:

Drying of fruit and vegetables is one of the oldest forms of food preservation method known to man and is the most important process to preserve food since it has great effect on the quality of the dried products. The major objective in drying agricultural products is the reduction of the moisture content to a level, which allows safe storage over an extended period. The removal of moisture prevents the growth and reproduction of microorganisms which cause decay, and minimizes

many of the moisture-mediated deteriorative reactions. It brings about substantial reduction in weight and volume, minimizing packing, storage and transportation costs and enables storability of the product under ambient temperatures (Mujumdar, 1995). During drying many changes take place; structural and physic-chemical modifications affect the final product quality, and the quality aspects involved in dry conversation in relation to the quality of fresh products and applied drying techniques. Currently hot air drying is the most widely used method in post-harvest technology of agricultural products. Using this method, a more uniform, hygienic and attractively colored dried product can be produced rapidly.

Okra is a flowering plant, tropical perennial crop growing 3 to 6 feet tall. It is grown throughout the tropical and sub tropical countries. According to FAO data for 2007, okra production all over the world was about 5,941 million tones. The major producer countries include India, Nigeria, Sudan, Pakistan, Iraq and Ghana. Okra can be consumed as a fresh vegetable, cooked vegetable or an additive for soups, salads and stews.

To study and compare the drying characteristics of okra and potato slices using the open sun, solar dryer and hot air drying methods and to fit the experimental data obtained to describe drying behavior of agricultural products.

MATERIALS AND METHODS:

The slices were then weighed exactly 100 gms for each treatment. These were kept for drying in three replications. The hot air drying was carried by drying the samples at 40°C, 60°C and 90°C air temperatures and a constant air velocity of 1 m/s. For sun drying the weighed okra and potato slices were taken in paper plates and kept on the open floor on the top of terrace. For solar drying the weighed okra and potato slices were taken in paper plates and kept inside the solar dryer platform. The hot air drying was carried out by keeping the weighed slices in steel plates. Observations on physiological loss in weight and colour change in

each sample were recorded at the particular interval of in sun drying 1 hrs, 1 hour in solar drying and 10-20 minutes for hot air drying. The change in color of slices was observed for further analysis. The texture of end produce was also tested by breaking the dried slices and the produce was categorized into different grades. Temperature and relative humidity in the open sun drying and solar drying was recorded throughout the drying period using hygrothermometer.

The hot air drying experiments were conducted at 40, 60 and 90 °C air temperatures and a constant air velocity of 1 m/s. In each experiment, about 100 g of okra and potato samples were used. Moisture losses of samples were recorded at 10 min intervals for first one hour and 20 min subsequently thereafter for determination of drying curves. The open sun and solar drying experiments were carried out during the periods of February-March under the clean climatic conditions of vidarbha. Each experiment started at 8:00 am and continued till 6:00 pm. To determine the moisture loss of drying samples during experiments, okra and potato samples were taken out of the solar dryer and weighed at various time intervals, ranging from 30 min at the beginning of the drying to 1hr during the last stage of the process. The moisture loss of samples was determined with the help of a digital electronic balance having an accuracy of 0.01 g. These were again spread in the dryer in the next morning and the drying process was continued until no further changes in their mass were observed. Also, to compare the performance of the solar dryer with that of open sun drying, both samples were dried simultaneously under the same weather conditions.

Drying analysis:

Moisture Content:

The percentage moisture content was determined by using following formula,

$$Mc = \frac{Mi - Md}{Mi} x\ 100\%$$

Where, Mi is the mass of sample before drying and Md is the mass of sample after drying.

Drying Rate:

The drying rate of sample during drying period was determined as follows,

$$Rd = \frac{Mi - Md}{t}$$

Where, t is time interval of drying readings

Moisture Ratio:

The Moisture ratio of prawns was computed by using the initial moisture content (IMC) and equilibrium moisture content (EMC)

$$MR = \frac{M - Me}{Mo - Me}$$

where, MR is the dimensionless moisture ratio, M, Me and Mo are the moisture content at any time, the equilibrium moisture content and the initial moisture content in kg respectively.

RESULT AND DISCUSSION:

The effect of different drying methods on drying time, color and texture of the okra and potato slices were determined. The result shown that there was a general decline in moisture content of the sample from 100 g to 15 g in all methods of drying. Time required for open sun drying of okra was 23 hours and solar drying took 15 hours, where as hot air drying was found to be quicker drying method. It took lesser time of about 470 minutes at 40°C air temperature.

Hot air drying of okra and potato the moisture content versus drying time curves as affected by various air temperatures are shown in Fig. 1. The samples of average initial moisture content of around 67 gm were dried to the final moisture content of about 15.6 gm until no further changes in their mass were observed. It is evident from these curves that the moisture content decreases continuously with the drying time. As expected, the air temperature had a significant effect on the moisture content of samples. Solar drying of okra and potato Fig. 1 shows the variations of the ambient air temperature, relative

humidity and solar radiation during the solar dryer and open sun drying of okra and potato in the day.

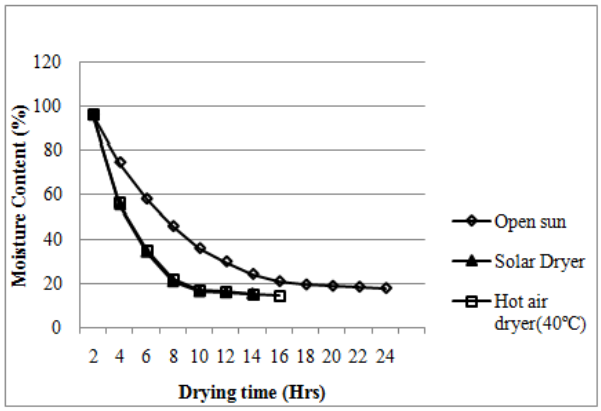

Fig. 1: Drying curve of different drying techniques of dried okra and potato slices.

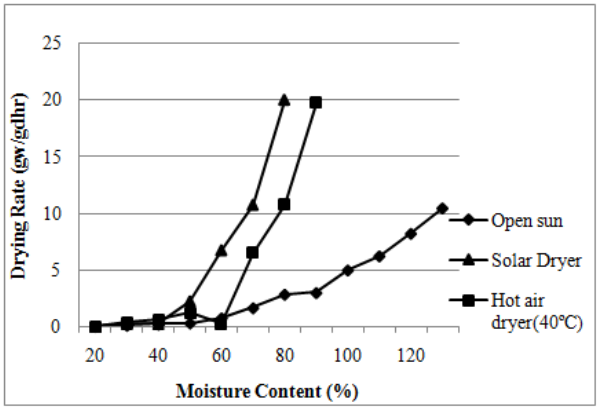

Fig. 2: Drying rate of different drying techniques on respective moisture content of dried okra and potato slices.

This clearly indicates that the drying rate in the solar drying would be higher than open sun drying. Fig. 1 suggests drying curves for okra dried by solar dryer and open sun drying methods. Whereas the drying is smooth and controlled by temperature variation using hot air dryer. Drying rate goes on decreasing with decrease in moisture content as shown in Fig. 2. And it appears to be smooth and controlled in hot air dryer than in open sun and solar dryer.

CONCLUSION:

The three drying methods used greatly affected the drying characteristics okra and potato. The solar dryer was found to be more efficient than the open sun drying. In addition, the samples of solar dryer were completely protected from insects, birds, rain and dusts. The commonly consumed okra was dried under conventional drying, sun drying and open sun drying. The drying characteristic and time required for drying of okra and potato was studied and final dry weight of the okra slices were estimated. It was found that okra and potato samples, dried by hot air drying were reported to take minimum time for drying with maximum removal of moisture. The initial first hour of hot air drying and sun drying and initial 6 hours under open sun drying resulted in maximum removal of moisture from okra and potato. The okra and potato slices dried in hot air dryer at 40°C gives better results in maintaining better appearance, colour and texture.

REFERENCES:

Adom, K.K., Dzogbefia, V.P. and Ellis, W.D. (1997), Effect of drying time and slice thickness on the solar drying of okra, Journal of Science of Food and Agriculture, 73(3), 315-320.

Bala, B. K., Mondol, M. R. A., Biswas, B. K., Das Chowdury, B. L.,and Janjai, S. (2003). Solar drying of pineapple using solar tunnel drier. Renewable Energy, 28(2), 183–190.

Bhosale, B.S. and Arya, A.B. (2004), Effect of different modes of drying on moisture content and drying time of the selected vegetables, The Indian Journal of Nutrition and Dietetics, 41, 293.

Ertekin, C., and Yaldiz, O. (2004). Drying of eggplant and selection of a suitable thin layer drying model. Journal of Food Engineering, 63(3), 349–359

I.Domyaz, (2011). Drying of green bean and okra under solar energy CI&CEQ 17(2) 199-205.

Jayaraman, D.K., Das Gupta and N. Babu Rao (1991). Quality characteristic of some vegetables dried by direct and indirect sun drying, Indian food packer**,** 45**,** 18-23.

Kalra, S. K. and K. C. Bhardwaj (1981), Use of simple solar dehydration for drying fruits and vegetable products. Journal of Food Science Technology, 45, 18-23.

K.R. Ajao ,and A.A. Adedeji, (2008). Assessing the Drying rates of some Crops in Solar Dryer. Journal of Research information in Civil Engineering, Vol.5, No.1.

Maskan, A., Kaya, S., and Maskan, M. (2002). Hot air and sun drying of grape leather (pestil). Journal of Food Engineering, 54(1), 81–88.

Mujumdar, A. S. (1995). Handbook of industrial drying (second ed.). New York: Marcel Dekker.

Pangavhane, D. R., Sawhney, R. L., and Sarsavadia, P. N. (2002). Design, development and performance testing of a new natural convection solar dryer. Energy, 27(6), 579–590.

Sacilik, K., and Elicin, A. K. (2006). The thin layer drying characteristics of organic apple slices. Journal of Food Engineering, 73(3), 281–289.

Schirmer, P., Janjai, S., Esper, A., Smitabhindu, R., and Mu¨hlbauer, W. (1996). Experimental investigation of the performance of the solar tunnel dryer for drying bananas. Renewable Energy, 7(2), 119–129.

Tiris, C., Tiris, M., & Dincer, I. (1996). Energy efficiency of a solar drying system. International Journal of Energy Research, 20(9), 767–770.

Togrul, I. T., and Pehlivan, D. (2003). Modelling of drying kinetics of single apricot. Journal of Food Engineering, 58(1), 23–32.

Westerman, P. W., White, G. M., and Ross, I. J. (1973). Relative humidity effect on the high temperature drying of shelled corn. Transactions of the ASAE, 16, 1136–1139.