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"A REVIEW ON STUDY OF DRYING KINETICS OF VEGETABLES AND FRUITS"

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Abstract

Drying process removes water at optimum level, due to which deterioration reaction are greatly reduced. Drying kinetics is the study of dehydration mechanism. In this paper the study of drying kinetics of different fruits and vegetables which is carried out by various researchers on fruits and vegetables. Products are dried at different temperature in different types of dryer. The Main aim of drying kinetics is to find optimum condition of temperature and time which reduce weight and volume of food products for the ease of transportation and storage.

Index Terms: *Drying kinetics, Dehydration, Moisture ratio, Drying rate, etc.*

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1. INTRODUCTION

For study of drying kinetics, it is necessary to understand the change in water droplet (moisture) mass with proceeding drying process to obtain necessary information about evaporation rate. Dehydration is a significant food preservation process which decreases water activity through the reduction of water content, avoiding potential debasements (spoiling) and contamination during prolonged storage period. Other important objectives of food dehydration are volume and weight reduction, which is necessary to reduce transportation, collection and storage. Drying also provides increased shelf life.

2. LITERATURE SURVEY

Ibrahim Doymaz, The air-drying characteristics of spinach leaves have been investigated in a cabinet-type dryer, at constant air velocity of 1.2 m/s and between 50^0 and 80^0 C air temperature. Increase of air temperature were observed to increase the drying rate and thus decrease the drying time. Drying time was as short as 165 min at 80^0 C, and as long as 495 min at 50^0 C. The drying of spinach leaves occurred in the falling rate period. The effective moisture, diffusivity varied from 6.590×10^{-10} to 1.927×10^{-9} m^2 /s over the temperature range, and it increases with the increase of the air temperature. The activation energy of the spinach leaves was found as 34.35 kJ/mol. **[1]**

S. Karaaslan, The effects of three different drying methods on the drying of broccoli samples were evaluated based on the drying parameters such as moisture content, the drying rate. Combined microwave-air drying of broccoli samples was faster than the other drying methods. Results obtained for combined microwave-air drying kinetics of broccoli samples shows that the increase in microwave power and temperatures from 180W-100°C to 540W-200°C decreased the drying time from 35-14 min. The drying process occurred in the falling rate period. Two stage drying process was observed, composed of an increasing rate period initially followed by a falling rate period until the end of the drying**. [2]**

V. D. Mudgal, Moisture diffusivity and drying time of Fenugreek leaves were dependent on air temperature used for drying. The minimum drying time of 65 min was observed for 70^0 C air temperature with maximum moisture diffusivity of 3.55×10^{-11} m² /s. The dehydration ratio and water activity of fenugreek leaves was found to increase and decrease, respectively with increase in air temperature. Maximum dehydration ratio (3.39) and minimum water activity (0.392) was found for fenugreek leaves dried at 70^0 C air temperature but the quality of product dried at 60^0 C air temperature was found to be a superior in terms of colour, taste. **[3]**

P. Rajkumar, Study of the drying kinetics of tomato slices (4, 6, and 8 mm thicknesses) were performed in a vacuum-assisted solar dryer and compared with open sun drying under the weather conditions. The drying study showed that the time taken for drying of tomato slices from the initial moisture content of 94.0% to the final moisture content of around 11.5± 0.5% (w. b.) was 360, 480, and 600 min in vacuum assisted solar dryer and 450, 600, and 750 min in open sun drying, respectively. During drying, it was observed that the temperature inside the vacuum chamber was increased to 48^0 C when the maximum ambient temperature was only 30^0 C. The quality of tomato slices dried under vacuum-assisted solar dryer was found superior in quality in terms of colour retention and rehydration ratio. **[4]**

V. R. Sagar, Osmosed slices and segments were dehydrated in a cabinet drier, low temperature drier and vacuum drier with the tray loads of 0.30, 0.35, 0.40 and 0.45 g/cm^2. On the basis of, correlation and regression analyses performed by using dehydration time (h), drier and tray load as independent variables and moisture content as dependent variable, vacuum drier was found to be better in faster drying followed by cabinet drier. Tray load of 0.40 g/cm^2 was optimum quantity in drying of better quality osmo-dehydrated products by both vacuum and cabinet drier. R2 value revealed that the model based on different tray loads and drier found to be appropriate to predict the drying under various drying conditions.

It would be economical to dry the osmosed slices with the tray load of 0.40 g/cm^2 in cabinet and vacuum drier, though with less tray load faster drying was achieved. A tray load less than optimum might not be economically viable and more than this increases the drying time. However, under low temperature drier, since the osmosed slices tend to shrink due to more time for drying with high tray load, it was advisable to select optimum tray load of 0.35 g/cm^2. Tray load and drier has the profound influence on the dehydration characteristics of fruit slices. Therefore, during setting up the drying industry on large scale, tray load, drying time and drier types are the process variables, which are to be monitored carefully so as to get good quality osmo-dehydrated products. **[5]**

Mohammad H. Khoshtaghaza, The effect of microwave-convective heating on drying characteristics and colour change of lemon slices was investigated. The drying experiments were carried out at 180, 360, 540 and 720 W and at 22°C, with air velocity of 1 m s-1. The values of effective moisture diffusivity were found to be in the range between 1.87 10-8 and 3.95 10-8 m2 s -1, and the activation energy was estimated to be 10.91 W g-1. The drying data were fitted with six mathematical models available in the literature. The model describing drying kinetics of lemon slices in the best way was found. The colour change of the dried lemon slices was analysed and considered as a quality index affecting the drying quality of the product. The values of lightness/darkness, yellowness/blueness and hue angle increased, while the value of redness/greenness decreased with increasing microwave power. **[6]**

Prashant Rewatkar, Drying kinetics of Nagpur orange fruit was studied and analyse as a function of drying time and 02 velocities for temperatures 55° C, 65 ° C, and 75 ° C. The effect of air temperature on drying characteristics was more significant as compare to air velocity. Drying rate is higher at higher temperature and consequently moisture ratio decreases faster. It is due to increase of air heat supply to the sample and faster migration of moisture was found in the sample. The whole drying process occurs during falling rate period, it is proved that effect of drying temperature and drying time is more significant then air velocity. It was found that drying time is more for more temperature at 55° C and small at 75° C from the statistical analysis it is concluded that Wang and Sing model (R2=0.9888) is the most suitable model for drying behaviour of Nagpur orange fruit (Citrus Synesis- L). **[7]**

Ozge Sufer, This research revealed the hot-air drying kinetics, mass transfer characteristics, rehydration and the changes in the bioactivity of pomegranate arils which included no preservatives at different temperatures. For the first time, 22 thin-layer drying equations and 5 rehydration models were analysed together in a study and it was inferred that sigmoid model for drying and two-term exponential decay equation for rehydration were the suitable mathematical expressions. Also, effective moisture diffusivity, averaged convective mass transfer coefficient and moisture extraction rate showed their maximum levels at 75^0C. Except rehydration ratio, all physical analysis gave their best results at 55^0 C. However, the contents of bioactive substances (apart from total anthocyanins) enhanced at 75^0C when compared to other processing temperatures. On the other hand, anthocyanins were observed as the most heat sensitive substances by thermal operation. As a result, the dehydration temperature of 65^0 C may be advised as the most appropriate condition in order for drying of pomegranate arils (cv. Hicaznar) among tested aspects. **[8]**

3. CONCLUSION

The effect of a drying temperature on drying characteristics are more significant. At higher temperature the drying rate is higher as the moisture ratio decreasing consequently. The drying time varies with moisture content for fruits. it is more than the time required for vegetables. Also, the temperature required for dehydration depends on moisture content but to prevent vegetable and foods from becoming crap, the optimum temperature range has to decided. Many researchers have done experiment on drying kinetics of fruits and vegetables. And they found some optimum drying temperature, drying time at which fruits and vegetables dose not crap, ultimately it is the prevention of these commodities from spoilage for storage period.

4. REFFERNCES

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