Effect of the Factor Affecting Dryer and Humidity Impact in a Food Product

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Abstract

Drying is one of the oldest ways of food preservation methods that removes the water from the fruits. The most frequent uses of drying technology embrace diffusion dehydration, vacuum drying, freezing and completely different combinations of alternative drying technologies. The drying practices have considerable have effect on the potency of dryers, increase the value of production, and cut back the standard of the dried product. Based on the mechanism of warmth transfer that is used, drying is classified into direct (convection), indirect or contact (conduction), beaming (radiation) and dielectric or microwave (radio frequency) drying. Sometimes-complicated warmth- and mass-transfer processes are used in drying. Several technologies used to accomplish the drying task are discussed in this paper. Selecting the right drying equipment and understanding the science behind the drying process including thermal properties are important factors in dryer selection.
Keyword :- impact of climate, Heat and mass transfer,. Mass transfer kinetics

Background

Moisture-related microbial growth is a key factor contributing to food spoilage in developing countries. Dehydration or drying of food reduces the moisture content supporting this microbial growth, thereby addressing this problem. Hence the moisture content of food materials is a key factor influencing the quality of storage thereby reducing post-harvest loss and is thus very important for the farmers.

Review study

The intrinsic factors areas; pH, water activity, oxidation-reduction potential, nutrient content, antimicrobial constituents, biological structures affect drying operation. Extrinsic factors are, areas, the temperature of storage, relative humidity, gases in the environment. In this operation, the moisture present in a material evaporates because of heat and matter exchange between the product and the working medium.

Effects of parameter on drying. The dry airflow transfers heat energy to the material, causing the moisture in the granules to evaporate and dissipate. The airflow volume will also have an impact on drying speed, but once again it cannot be simply adjusted as required. Although a higher volume of air will translate into faster dehumidification. Also drying temperature, air humidity affects drying operation.

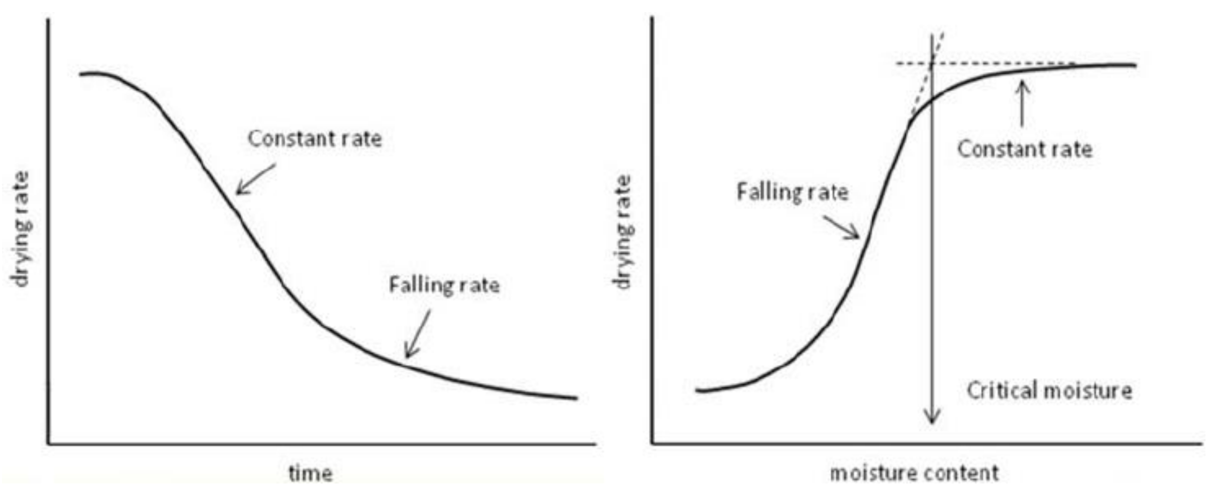
Pre-drying treatment Procedure for drying**.** Fruit and vegetables and other paper mills are selected and sorted according to size, maturity, and soundness. They are then washed in running water to remove dust, dirt, insects, mould spores, plant parts, soils, debris, and other materials that might contaminate the final product's colour, aroma, flavour, or taste. Depending upon the type and quantity of products to be dried, any method of peeling can be selected like hand peeling, steam, hot water, lye peeling, or abrasive peeling.

Humidity effects in dryers**.** Solids left in contact with moist air for long periods will reach their equilibrium moisture content, which increases as relative humidity increases or temperature falls.

Effect of drying temperature on drying time. Moisture content during the drying process was measured every 10 min for 120 min and converted into a moisture ratio, the effect of drying temperatures on moisture ratio. At the same observation time, the higher drying temperature resulted in a lower moisture ratio. With an increase in drying temperature from 40^0C to 50^0C, the misture ratio was 0.5 times lesser.
effective moisture diffusivity as calculated using Fick's model, $mRt = \frac{8}{\pi^2}\exp\left(\frac{-\pi 2Det}{4L^2}\right)$

Kinetic model of drying. Drying kinetics models does not take into account the effects of interactions by parameters other than the time of drying. Models that incorporate a large number of variables still do not exist but due to the complex non-linear relationship between the kinetics of drying and variables related, the development of such models is not feasible.
Moisture ratio $(MR) = \frac{x-x_e}{x_0-x_e} = \exp(-kt)$
Where,
MR is moisture ratio,
k is drying constant (m−1m−1),
t is drying time,

Characteristic of Drying Curve.
The theoretical foundation for the concept of the characteristic drying curve is examined by considering the drying out of a porous, non-hygroscopic slab of infinite extent. Under intensive drying conditions when a drying front appears, the characteristic drying curve is a function of the relative intensity of drying, whereas under less intensive drying conditions it is not. In the limit of the slow drying of thick, fairly impervious materials, a single linear characteristic drying curve appears.



Examples of freeze-dried fruits with various operational parameters[17]

Dried material	Shape	Freezing temperature	Pressure	Drying time	properties
Rasberry	Whole	-20	1Pa	48hr	shrinkage, color change
Stawbarries	35cm pieces	-20 and -80	15-200Pa	60-65hr	rehydration ratio, appearance, shape, color
Kivi	Whole fruit	-40	12,20,42,85, 103Pa	24hr	Color, texture, rehydration, total phenolic content,
Banana	Dia 2mm Height 8mm	-35	3-300Pa	24hr	Volume, bulk density, glass transition temperature, porosity
blueberries	Whole fruit	-31	13Pa	24hr	Mass transfer, drying time, berry-busting, skin perforation

Importance. In this review, four prominent features of the dryer are discussed – quality as well as economic, environmental, and social aspects.

1. Quality aspects: During food drying, various physical, chemical, and biological process characteristics endure modification thanks to mass and warmth transfers report that star drying with air use reduced color changes and volume shrinkage of dried pistachio bonkers compared to sun drying. show that a brighter color was ascertained in dried lemon samples beneath complementary star drying compared to samples dried by hot air at 60^0C.
2. Economic aspects: Assessing the economic viability of investments in solar dryer technologies require detailed financial and economic appraisals as such investments are was made based on perceived economic and technical viability. with the other similar commercial dryers.
3. Environmental aspects. Fossil fuels and electricity are widely used as energy sources in most of the drying systems. It results in high operational costs and environmental problems due to greenhouse gas (GHG) emissions. Food producers have shifted towards clean energy-based technologies such as solar and thermal energy. Direct and indirect use of nonconventional energy is being explored

by various investigators. The literature study suggests that the energy usage of the solar dryer could be computed using indicators such as embodied energy, time to energy payback, CO_2 emission, and carbon mitigation.

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