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Design of Prototyping Food Dehydration Model

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ABSTRACT

The project aims to design a Prototyping Food Dehydration Machine, utilizing innovative techniques for efficient and rapid dehydration of various food items. The machine integrates controlled temperature and airflow systems to optimize the dehydration process, ensuring preservation of nutritional value while extending shelf life. The prototype emphasizes user-friendly operation and cost-effectiveness, catering to small-scale food processing needs. Additionally, sustainability is considered in material selection and energy consumption. The outcome is expected to contribute to food preservation technologies, particularly in regions with limited access to traditional drying methods. The Prototyping Food Dehydration Machine project finds practical application in diverse scenarios such as home food preservation, small-scale food businesses, and community-based initiatives. Its user-friendly design caters to individuals with limited technical expertise, making it accessible for widespread use. The machine's efficiency and preservation of nutritional quality make it valuable in regions with limited access to conventional drying methods, contributing to food security and sustainability efforts. Additionally, its cost-effectiveness enhances its potential adoption in various settings, promoting local food processing and reducing dependency on external preservation methods. The Prototyping Food Dehydration Machine project abstract focuses on developing an advanced system for food dehydration. This innovative design incorporates precise temperature and airflow controls to enhance efficiency and preserve nutritional quality.

Keywords: Reducing moisture of food to low level, improved shelf life. To reduce wastage of foods and vegetables.

INTRODUCTION

India ranks first in the world in production of fruits and second in vegetables, accounting roughly 10 and 15 per cent, respectively, of total global production. India have a strong and dynamic food processing sector playing a vital role in diversifying the agricultural sector, improving value addition opportunities and creating surplus food for agro-food products. Presently, 2.2 per cent of fruits and vegetables are processed, even as the country ranks second in the world in terms of production. Sometimes moisture degradation in the quality of fruits and vegetables also starts immediately after the harvest leading to drying and shriveling. Fruits and vegetables absorb environment gasses such as oxygen and produce carbon dioxide and ethylene. They also get infested easily with microorganisms like fungi, bacteria & insects affecting food safety. In villages where fruits and vegetables are grown in plenty, facilities for processing are not in existence and lot of them are wasted. In the country the whole food processing industry is still in nascent stage and presently less than 4% of horticultural produce is being processed industrially. Though needs of preservation by drying and dehydration of fruits and vegetables are important to enhance the value of the crops.

Dehydrating foods until there isn't enough moisture to enable microbial growth is known as drying. Drying eliminates the water that bacteria, yeasts, and molds require to thrive. If properly dried and kept, it can last a long time (safe for storage at room temperature). The drying food preservation process is simple to use, safe, and suitable for a wide range of foods. Oven drying and dehydrating using an electric dehydrator are two of the simplest and most frequent methods that may be utilized in any environment. Air drying (in the shade during hot weather), sun drying (limited to desert conditions), solar drying (needs specially constructed dryer), and pit oven drying (helpful when other methods are unsuitable) are the other options.

2. RELATED WORK

The machine has a heating element, a fan, a temperature sensor. The heating element heats the air, which is then circulated by the fan. The temperature sensor measures the temperature of the aThe machine also has a control system that monitors the temperature and adjusts the heating element and fan as needed to maintain the desired conditions. The machine also has a loading tray for the material to be dehydrated.

The material to be dehydrated is placed on the loading tray and the machine is turned on. The heating element heats the air, which circulates around the material and removes moisture. The temperature of the air are monitored by the sensors and the control system adjusts the heating

element and fan as needed to maintain the desired conditions. The dehydration process continues until the material has reached the desired moisture content.

The machine can be used to dehydrate a variety of materials, including fruits, vegetables, herbs, and meats. The dehydration process can be used to preserve the food, extend its shelf life, and improve its flavor and texture.

2.1 TABLE

Fruits	Preparation & Pre-treatment	Time of Sulphuring (min)	Drying Temp. (°C) &Time	Drying Ratio
Apple	**Wash, peel, core trim and cut in to 5mm thick slices**	**30 min or immerse in 1-2% KMS solution for 30 min and drain**	**60-65 °C 6-10 hrs**	**8:1**
Apricot	**Wash, halve, destine**	**30 min**	**50-60 °C 10-12 hrs**	**6:1**
Banana	**Wash, peel, halve lengthwise or slice crosswise 12 mm thick**	**30 min**	**55-60 °C 18-20 hrs**	**6:1**

PROPOSED ALGORITHM

Preservation of fruits

Preservation means protection of foods against the spoilage, but scientifically it may be defined as a science which deals with the process for prevention of decay or spoilage of the food. In other words, controlling the physical, chemical or microbial changes in the foods is called preservation.

- Physical Changes : Colour, flavor, texture and taste etc.
- Chemical Changes : Carbohydrate, fats, proteins, vitamins and minerals etc.
- Microbial Changes : Mould, yeasts and bacteria etc.

Need of preservation

- To increase the shelf life of the food for increasing the supply.
- To make the seasonal fruits available throughout the year.
- To add the variety to the diet.
- To save time by reducing preparation, time and energy.
- To stabilize the prices of the food in the market.
- To improve the health of the population.

Principles of preservation

There are three main principles:

- Prevention / delay the microbial decomposition of the food.
- Prevention / delay the shelf decomposition of the food.
- Prevention of damage by insects, animals, mechanical causes etc

Drying and Dehydration

The practice of drying of foodstuffs, specially fruits and vegetables, for preserving them is very old. Both the terms 'drying' and 'dehydration' mean the removal of water. The former term is generally used for drying under the influence of non-conventional energy sources like sun and wind.

Dehydration means the process of removal of moisture by the application of artificial heat under controlled conditions of temperature, humidity and air flow. The drying operation for fruits and vegetables is complex mechanism as this involves simultaneous exchange of moisture and heat. The relationship between the moisture content and temperature of air during drying process is referred to as 'psychometric' relation.

Aim of Drying

The basic aim of drying is to reduce the biological water which is required for the growth and 4multiplication of microorganisms such as bacteria, fungi, mold, that causes food spoilage and decay. Since water acts as a potential vehicle for pathogens in the food chain and it has to be removed to increase the shelf life of the fruit products.

Drying and dehydration is an ideal process applicable to all food materials such as fruits, vegetable, cereals, pulses, milk, meat, fish etc to remove moisture content. Moisture is an important factor in agricultural and food materials affecting their shelf life mainly due to microbial spoilage, oxidation and breakdown of the physical structure of the foods.

3. EXPERIMENTAL RESULT

We performed some tests on various aspects of our project, and the following are some of the results:

1. The initial machine operation procedure has been confirmed, and the procedure has been compared to the needed procedure
2. In the second stage, bananas pieces were added, and the drying process was completed, however the final product was slightly moist due to mechanical defects that enabled hot air to seep from the machine to the outside, affecting the final product.
3. Due to the variable nature of the materials to be dried from some of them, the basket that was built does not fit all types of materials, such as materials that are soft before the drying process.
4. Due to heat loss to the outside, the heater worked for longer than expected.

Fig.1 Banana before and after dehydration

Fig.2 Cucumber before and after dehydration

4.NEED FOR DEHYDRATION OF FOODS

Dehydration is meant to preserve the food for longer time and in addition to reduce bulk and weight. This reduction in weight and bulk can result in economics in transport and cost of containers. It retains the size and shape of the original food. Dehydration produces convenience items like fruit juice concentrates, fruit juice powders, soup mixes etc. The consumer can simply dehydrate the material and uses for different purpose. Many fruits and vegetables are available only during specific season, hence with the help of dehydration process it can be preserved and made available for all seasons. The biological forces acting upon foods are minimized, and spoilage of foods are easily controlled in dehydration process

5.CONCLUSION

On the basis of above presentation it may be concluded that drying is an industrial preservation method in which water content and water activity of the fruits and vegetables are decreased by heated air to minimized biological, chemical and microbial deterioration.
Drying is a process of simultaneous heat and mass transfer. To obtain the dehydrated product of high quality. The drying process should be such that it allows effective retention of color appearance, flavor, taste and nutritive value, comparable to fresh vegetables.
The technique of drying is probably the oldest method of food preservation practiced by mankind for the extension of food shelf life. The use of artificial drying to preserve agricultural commodities is expanding, creating a need for more rapid drying techniques and methods that reduce the large amount of energy required in drying processes.

6.FUTURE WORK

The future scope of prototyping a dehydration machine lies in enhancing efficiency, reducing energy consumption, and expanding its applicability across various industries. Innovations could focus on improving dehydration speed, preserving nutritional content, and developing smart, automated controls for optimal resource utilization. Additionally, exploring sustainable technologies and addressing environmental concerns could play a significant role in the evolution of dehydration machines.

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