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Food Preservation Techniques

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Abstract

The realm of food preservation has undergone a significant evolution, necessitating a comprehensive and multifaceted approach that encompasses the various stages of food production and processing. This integrated approach is essential for the effective preservation of food items and the assurance of their quality and safety. Shelf life refers to the duration within which food can be consumed safely without adverse health effects under suitable environmental conditions. Distinctions based on shelf life are made between perishable items such as vegetables and fruits, nonperishable items like nuts, sugar, pulses, and grains, as well as semi-perishable food groups. Effective preservation methods and appropriate storage techniques play a vital role in upholding food quality and preventing the proliferation of pathogens and pests. Over time, the need for food preservation techniques has advanced, with modern methods replacing outdated practices such as sun drying. Additionally, a variety of additives, chemicals, and processing methods are employed to regulate the pH of food and prevent spoilage.

Introduction

The realm of food preservation has undergone a significant evolution, necessitating a comprehensive and multifaceted approach that encompasses the various stages of food production and processing. This integrated approach is essential for the effective preservation of food items and the assurance of their quality and safety (Amit et al., 2017). According to Sadiku, food preservation involves a diverse array of techniques aimed at inhibiting the process of food spoilage, thereby extending its shelf life (Sadiku et al., 2019). Shelf life refers to the duration within which food can be consumed safely without adverse health effects under suitable environmental conditions (Haouet et al., 2018). Distinctions based on shelf life are made between perishable items such as vegetables and fruits, nonperishable items like nuts, sugar, pulses, and grains, as well as semi-perishable food groups (Sagar and Pareek, 2020). Adherence to the nutritional information on food labels is crucial for maintaining the physical, chemical, sensory, and microbiological attributes of food over a specified period (Dominic, 2002). Microbial contamination significantly contributes to food deterioration and subsequent spoilage (Prokopov and Tanchey, 2007). Effective preservation methods and appropriate storage techniques play a vital role in upholding food quality and preventing the proliferation of pathogens and pests (Sagar and Pareek, 2020). Over time, food preservation techniques have advanced, with modern methods replacing outdated practices such as sun drying. Additionally, a variety of additives, chemicals, and processing methods are employed to regulate the pH of food and prevent spoilage (Rahman, 2020). Preservation of food products through packaging has various health benefits as there are recent advancements in the field of packaging, biotechnology as well as material science to fulfill consumer demand and it helps to increase the shelf life and maintains the nutritional quality of food products by providing food safety (Bhat et al, 2012).

Traditional and Modern methods of food Preservation and processing

Hurdle technology – According to Leistner hurdle technology is based on an application in which more than one approach is combined that ensures the preservation of food products by the control of the pathogens (Leistner 2007). Hurdle technology is a very effective method of preservation that is widely used by developing countries (Leistner 2000) and during processing at high temperatures, storage during low temperatures and acidity increase are the hurdles in a system. The quality, stability along with safety of food preservation depend on the application of empirically combined methods used for the process of preservation that brings healthy and nutritious food worldwide through gentle as well as effective technique of food preservation (Leistner 2007) as their principles for preservative factors and interaction becomes known, such as PH, competitive flora, temperature, and Eh (Singh and Shalini 2016). According to Leistner the ultimate goal of multitarget preservation will soon be achieved for the highest safety preservation of food products (Leistner 2007).

Canning – Canning or canned foods can be described as food preserved in a hermetically sealed such as in water and can be in an airtight container stored in non-refrigerated condition. Sterilization of wholesome foods that are ready to eat is preserved by using a canning technique that ensures safety at room temperature. The stability of food storage is the main concern that is considered mainly by the canning industry and their main goal is to produce microbiology better and highly nutritious food by using saturated steam for the process of sterilization to pack food products (Naczk and Artyukhova 2020).

Freezing – Freezing simply implies storing food products at low temperatures. Physical reactions or biochemical reactions are not stopped due to freezing however it slows down the food deterioration process. The shelf life of various food products is increased by using freezing techniques that help to preserve food at low temperatures effectively. At low temperatures, it changes the physical form of liquid into solid form as ice. However, with the help of a phase diagram or cooling curve process of freezing can be seen and at the storage level temperature is decreased to 18 degrees Celsius (Rahman and Velez, 2007).

Drying – Drying is the oldest method of food preservation in which liquid is dehydrated or excluded from substances such as foods, coal, or biomass. There are 2 types that show the presence of water in various food products that are held with each other by a physical and chemical water bond and during the process of drying only physical water held is excluded. Water is excluded so that food storage and preservation can be achieved by the process of drying and safely stored to use food in the future. Many techniques such as microwave drying or flash and hot air drying along with traditional techniques of drying that include vacuum drying have been used and still emerging methods such as sonic drying, and infrared drying are used to enhance the quality by providing low economic conditions as compared to high-cost techniques (Michailidis and Krokida 2014).

Pickling – According to Nummer & Brian pickling is a process in which preservation is done by adding vinegar, common salt, and different acids that are produced by the fermentation of sugar and starches to alcohol which is then oxidized and converted into acetic acids with the help of specific bacteria (Nummer and Brian 2002). Pickling is an old method for preserving vegetables and fruits by adding vinegar and salt in it along with other spices and pickle is a common example of pickling that has low calories and is consumed by people as an appetizer (Sharif et al, 2017).

Pasteurization – Pasteurisation is a method of food preservation in which heat is applied to kill the microorganisms (Panchal et al, 2018). Nutritional quality of food is not affected much during the process of pasteurization by heat. This process is used to increase the shelf life by inactivating bacteria (Teixeira 2014), the term pasteurization is coined by Louis Pasteur suggests that heating at low temperatures enhances keeping the quality of liquid while storage. However, preservation by pasteurization technique can improve shelf life for a few days and other non-thermal techniques that include ultraviolet exposure and membrane filtration are also better methods for liquid preservation of foods. Commonly used to preserve milk and fruit juices (Chen and Rupasinghe 2013).

Pulsed Electric Field - Pulsed electric field is a technique that is used to inactivate the microorganisms by nonthermal methods of processing. (Jeyamkondan et al, 1999) while causing only minimal harmful effects on the quality of food. It is based on an application of novel food preserving technique in which treatment is done by exposing food to the pulsed electric field where permeability in biological cells is induced resulting in destroying microorganisms (Gerlach et al, 2008). Higher temperatures such as at 40 degrees Celsius have been shown to improve and increase lethality in the process of the pulsed electric field with an increase in the shelf life of food (Toepfl et al, 2007).

Food additives – Food additives can be understood as the substances that are incorporated in foods so that their taste, flavor, and appearance along with other qualities will be enhanced or preserved and to ensure the safety of food while enhancing shelf life. In terms of safety or toxicity essential nutritional additives, preservatives, flavoring, and coloring agents are identified in which natural food additives become popular and provide better health benefits and according to the INS system, there are 3 types of preservatives include antioxidants, antimicrobial & antibrowning agents are included. The term GRAS was introduced during the hour of need that is "Generally recognized as safe" that brings or assures the safety of food ingredients for the consumers. Food additives that are plant-based as compared to synthetic additives are becoming popular and catching attention as they are providing better health, along with green safety, and providing a new

direction for the future of the food industry (Dhama and Sharma 2024).

Conclusion

It is concluded that food spoilage harms health due to various reasons, including contamination by microorganisms and other factors. Food preservative techniques have effectively controlled food spoilage and health benefits. Recent trends attracted the food industry to increase the shelf life of perishable foods in a more advanced way so that they can increase the shelf life of the product and increase their income by reducing the cost of wastage through the process of refrigeration and by adding additives preservatives and more different methods has been elaborately explained so that the readers can understand all the concepts behind the food storage and preservation.

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