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Recent Trends in Food Processing and Preservation: A Review of Its Application

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Abstract

In the past, the food production process has played a significant role in realizing a healthy and sustainable diet. As development with the technologies, innovation in these processes has become a crucial focus on the food products to meet the changes needed by customers who are concerned about their health and environmental impact. One of the main aspects of innovation in food processing and production is the quantitative and qualitative values of the food products. Consumers require fresh, appetizing, good appearance, and sustainable food products that can be formed with fewer effects on the environment. Food packaging is one of the imperative steps in food processing. This is generally done to defend against the intrusion of undesirable external factors to protect the food. Different food processing and preservation techniques such as antimicrobial edible films for food preservation, nanotechnology in food processing, nanotechnology for food packaging, bacterial decontamination techniques, biodegradable antimicrobial food packaging, nanocellulose in food processing, and others are used for their effective output.The main purpose of the study is to emphasize the studies on food production and processing with the most recent and trending technologies applied in food processing and preservation.

Introduction

In the past, the food production process has played a significant role in realizing a healthy and sustainable diet. As development with the technologies, innovation in these processes has become a crucial focus on food products to meet the changes needed by customers who are concerned about their health and environmental impact (Herrero et al., 2021). In recent years, individuals have seen a growing interest in food that not only promotes health but is also concerned about the environment. This brings the different and effective techniques in the food processing and production. One of the main aspects of innovation in food processing and production is the quantitative and qualitative values of the food products (Shah et al., 2023).

Nowadays, consumers are looking for food that reflects the essential nutrients in better amounts and provides health benefits. In response to this demand, production technologies are being developed for nutrient conservation and minimizing loss of the nutrients during food processing (Singh et al., 2023). Additionally, food waste reduction has become a major concern. It's noted that a large quantity of food is generally wasted at the different stages of food production and its supply chain. To deal with this, more efficient production processes are needed to reduce waste and optimize the use of available resources. If we talk about the heart of innovation in the food production process then we can forget to talk about environmental sustainability. The methods are being developed to reduce the consumption of energy, water, and natural resources and emission of the greenhouse gases (Karwacka et al., 2020).

Different methods are adopted in sustainable food production and processing such as farming methods, implementing organic protection and renewable energy are some of the strategies. In addition, new technologies and production methods are being researched to improve food security. To improve food safety and quality, the early detection of contamination, the use of non-thermal processing methods, and real-time quality control are some methods used. For this reason, this article seeks to describe the main characteristics of the variable variables Food Processing, Innovation, and Healthy Eating, as well (Bustamante et al., 2023).

The current demand for the food processing technique is to adapt the non-edible raw material to the edible product by considering it safe and full of nutrition, for bioconversion and preservation techniques in the food have been established widely. Over the past three decades, we have seen tremendous changes in food processing and preservation techniques in increasing attention to health and wellbeing (Augustin et al., 2016).Consumers demand tasty, fresh, sustainable, and good appearance food products that can be formed with minimum effect on the environment. It has been noted that green non-thermal and cleaner processing technologies have

been the key areas in food processing. While the traditional processing techniques destroy the various heat-labile nutrients, so for novel thermal processing has been shown to improve nutrient retention. So, food processing is a well-established and more acceptable operation for food product production (Knorr & Augustin, 2021).

Fig. 1: Recent trends in food processing and preservation

The main objective of the study is to emphasize the studies on food production and processing with the most recent and trending technologies applied in food processing and preservation.

Antimicrobial edible films for food preservation

Antimicrobial edible films are well-thought-out the food packaging because it has good biodegradability, are eco-friendly, and are safe. These films are commonly made up of protein and polysaccharides and some lipids. The most important substrates used for making such films are protein and polysaccharides, whereas the lipids are used as plasticizers and transporters of the active components in composite films (Prakoso et al., 2023). Additionally, these films are the most recent advances and future trends in the food processing industry. The important role of these films is to the delivery system for the stable loading of bioactive compounds in the future promising direction such as microencapsulation, and nano emulsion (Chawla et al., 2021).

Nanotechnologies in food science

Nanotechnology is the technology that is applied to manipulate nanomaterials for various purpose, which plays a vital role in the food and agriculture sector, improvement of crop, enhancing food safety and quality, and also promoting good human wellbeing through various novel and inventive approaches (Duncan, 2011). Nanotechnologies have gain more attention in the agro-food sector, medicine, sewage water treatment, and other industries (Parisi et al., 2015; El-Temsah et al., 2012). The nanoparticles such as silver (Ag), zinc oxide (ZnO), Gold (Au), carbon, and titanium dioxide (TiO2) nanoparticles possess a significant antimicrobial property, being generally used in a storage of food container, air filter, and other food materials (El-Temsah et al., 2012).

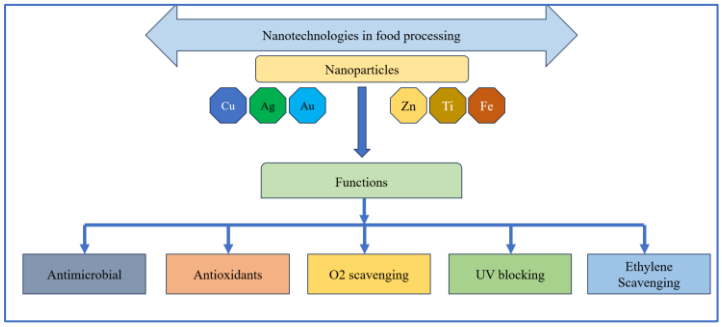

Fig. 2: Nanotechnologies in food processing

Nanotechnology in Food Processing

Nanofood increases the feasibility of food bioavailability, and properties of the foods (such as texture, color, appearance, and consistency) (Powers et al., 2006). Edible nanocoating of 5 nm thin can be used in fruit, vegetable, meat, milk product, bakeries, and confectionery edible products. Additionally, it provides flavor, color, antioxidants, anti-browsing, and enzymatic property and prolongs the shelf-life of manufactured food products. Nanofilters are also used to eliminate the color from beetroot juice while retain the flavor of the red wine. The nanomaterials are generally used for the development of nano sieves in filtrating milk and beer (Naoto & Hiroshi 2009). It is used in the manufacture of healthy food contain low sugar, salt, and fat to avoid the risk of foodborne diseases. It has been noted that silicon dioxide (SiO2) and TiO2 are used as food additives, to amplify the shelf-life of the tomato a bio-nano-encapsulated quercetin is generally used, and for the fruits and vegetables too. Nano green tea, canola active oil, Neosino capsules, aquanova, and Nutralease are the ordinary commercialize nanotechnology-based goods used in the marketplace (Gilligan, 2008).

Nanotechnology for food packaging

The main principles of the packaging is to overcome spoilage, infection, improve the soreness by introducing enzymatic activity, and preserve the color and flavor of the food. The dawn of nano sensors

delivers food contamination or spoilage in edible products, based on flavor manufacture and colordevelopment. Most of the nanoparticles used in the packaging have antimicrobial activity, that protects against microbial spoilage (Sorrentino et al., 2007). Some metal oxide nanoparticles namely titanium, silicon, magnesium, carbon, zinc, silver, and iron, are widely used as food ingredients and antimicrobials. The TiO2 is detrimental to pathogenic microbes inhibits the production of reactive oxygen species, and makes it a strong antimicrobial agent. It also enhances heat resistance and increases the obstacle against moisture, CO2, and O2 with the use of nanocomposites. The nanocomposites are generally used for coating or packaging purpose (Pinto et al 2013).

Bacterial decontamination technique by Hurdle technology

Hurdle technology is technology that refers to the consecutive tender of two or more food preservation methods for the enhancement of food safety and quality by means of individual treatment intensities. This concept promises the techniques that advocate the brainy use of a combination of different preservative factors to attain the multitarget, mild but consistent preservation effect (Khan et al., 2017). Lots of research is being done to discover new technology for microbial be in charge of to safeguard food safety from farm to fork worldwide. Moreover, few decontamination methods carry unwanted variations in the food products by affecting the nutritional as well as the organoleptic properties of the food. To minimize or control the growth of the microbes (Aaliya et al., 2021).

Biodegradable antimicrobial food packaging

From natural agents such as essential oils, natural extracts, and bacteriocins various components are used as the main polymer for the packaging as it induces antibacterial, antioxidant, and antifungal activities.

This packaging will improve the shelf-life of the food roducts and also diminishes the wasting of agricultural resources and reduces the plastic population generated by new polymers. Polysaccharides such as cellulose, starch, chitosan, lipids, proteins, polyvinyl alcohol have been used as single components to obtain antimicrobial packaging materials. The package's antimicrobial and antioxidant activities require a large spectrum of certain active substances that are grafted, coated, encapsulated, and embedded into the polymeric film (Motelica et al., 2020).

Nanocellulose in food processing

Nanocellulose is defined as the nanostructured material that can be attained from various sources such as natural fiber, food processing waste, wood, cotton, agricultural residues, and other lignocellulosic materials.

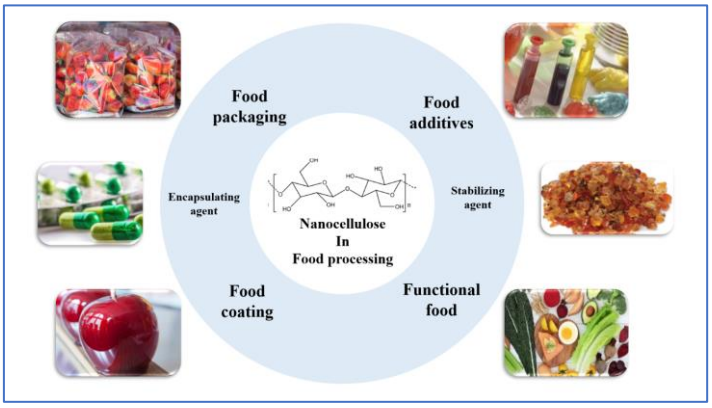

Figure 3: Nanocellulose in food processing

The nanocellulose can be integrated in coating and films formation, and extensively used in food preservation. It play an important role in food during transportation of food and during food distribution. It also includes some functional properties such as antioxidants and antimicrobial activity, and due that property they can significantly inhibits the microbial growth and spoilage and thus increases the shelf-life of the product. These films can be prepared by solvent casting method and then used for the food packaging. The coating is directly applied to the food products through sparying, panning, brushing, and dipping and then dried. Biopolymers such as cellulose reports the good gas permeability and due to the compact packed structure of hydrogen-bonded network makes it intresting food application. The nanocellulose can be used reinforce filler in packaging films for the preservation of food, extension of shelf life and reduce the water vapour and oxygen permeability of the films and inhibits the invasion of pathogen. It also improves their mechanical and thermal properties thus, making NC a potential applicant to utilize in food packaging application (Perumal et al., 2022).

The nanocellulose materials like cellulose nanocrystal, bacterial nanocellulose, and cellulose nanofiber, have distinctive characteristics that can boost various commercial marketing such as food packaging. It is also used as a food stabilizer, flavor carrier, thickener, dietary fiber, and suspension stabilizer, and also used to minimize the caloric value of foods.It is also widely used for filling, biscuit cream, ice cream, crushes, chips, wafers, soup, puddings, etc. The gel formed from it is also used as it has good rheological properties and can be used in food

applications. It also improves the tensile and barrier properties as a nanofiller in packaging film resulting and prospective applications of cellulose nanomaterials in food applications (Perumal et al., 2022).

Conclusion

As development with the technologies, innovation in these processes has become a crucial focus on the food products to meet the changes needed by customers who are concerned about their health and environmental impact. The different and effective techniques in food processing and production. One of the main aspects of innovation in food processing and production is the quantitative and qualitative values of the food products. A few metals and metal oxide nanoparticles namely iron, silver, zinc, carbon, magnesium, titanium, and silicon are widely used as antimicrobials and as food ingredients. Foodborne diseases are an inevitable problem in both developed and developing countries and that causes great public health issues. In this article, we have learned elaborately the different food processing and preservation techniques such as antimicrobial edible films for food preservation, nanotechnology in food processing, nanotechnology for food packaging, bacterial decontamination techniques, biodegradable antimicrobial food packaging, nano cellulose in food processing, and others are used for their effective output.

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