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Research Article

Critical Analysis of Recent Innovations in Food Packaging

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Abstract-Our methods for preserving, storing, and consuming food are evolving due to new and improved packaging technology. Certain food packaging is designed to keep food fresher for longer; some even have sensors e.g. Nanotechnology and indications that indicate if the food is still safe to consume. Furthermore, food packaging uses several technologies to stop chemicals from migrating from the food and packaging and guarantees that the food is free of bacteria. We may learn vital information about the contents of the food and whether it contains any chemicals that could trigger allergies from the labels and numbers on the package. Use of nanotechnology in packaging for food, medicines, sustainable products, etc. Numerous advancements have occurred. These advancements improve the safety, sustainability, and nutritional value of our food.

Keywords: Nanotechnology, Food Safety, Shelf-Life Extension, Sustainable Packaging.

I. INTRODUCTION

In recent years, consumers have become more aware of food quality and aware of the problem of food additives deliberately added to reduce spoilage. There is no doubt that food spoilage due to microbial contamination is a serious problem that causes huge economic losses and accounts for more than 25% of food before consumption (Huanget et al.,2012). Moreover, modern trends in retail prices and changes in life encourage the development of new packaging technologies without affecting food quality, safe and good product (Dainelli et al., 2008).

Food packaging machine is a series of research solutions for special food packaging. It aims to improve customer safety, quality and convenience, including tamper-proof packaging, transfer packaging, aseptic packaging and microwave packaging. Packaging technology is also important for improving the performance of the packaging industry, retail products and waste management.

New technologies such as anti-bacterial packaging, controlled release packaging, nanotechnology, sustainable packaging, biosensors and radio frequency identification (RFID) have recently attracted the attention of those who package products. Since the development of new technology is often costly, the use of technology to improve specific types of packaging to meet specific health needs must be carefully monitored (DONG et al., 2008).

II. ACTIVE PACKAGING

Active packaging is packaging that changes the conditions of the packaging and maintains these conditions throughout storage to extend shelf life or increase safety or sensitivity when dealing with food quality (Özdemir andFlorosr, 2002; Dainelli et al., 2008).Antimicrobial compounds have been the subject of research to prevent the growth of spoilage bacteria in packing materials. Films with fragrant fragrances or silvernanoparticles are two examples ("Active and Intelligent Food Packaging", 2023). Many companies preferthis technology to do business because it is more economical than other technologies. According to the European Community understanding, regulations define ingredients that are intended to be placed or absorbed into food packaging and the environment surrounding the food. Oxygen scrubbers and moisture absorbers are by far the most important industrial packaging products and the market has grown steadily over the years and is expected to continue growing. All other encapsulation technologies, especially ethylene scavengers, carbon dioxide traps and emitters, moisture absorbers and temperature control vessels, need to be used more in the future.

Intelligent/ Smart Packaging?

Intelligent packaging, sometimes called smart packaging, can recognize certain characteristics of the food it contains or the environment in which it is stored and inform companies, retailers and people about the conditions and conditions of behavior during transportation and storage (Ravishankar, 2016). Wang, Zhang, and Li examine the most recent developments in intelligent packaging systems with the goal of improving food safety and quality control in their review paper from 2024. They offer a thorough rundown of all the cutting-edge technology used in smart packaging, such as sensor-based technologies, real-time monitoring systems, and indicators that track the safety and freshness of food items. According to their analysis, food quality management can be greatly enhanced by these intelligent packaging solutions at every stage of the supply chain, from manufacturing to consumer. The authors highlight how these technologies, which provide accurate and useful data on food conditions, have the potential to address important issues related to food safety and waste reduction (Wang, Zhang, and Li, 2024).Another indicator is an indicator of the freshness and health of food based on microbial growth or chemical changes.Hydrogen sulfide is used to measure the quality of meat. Hydrogen sulfide released from the muscle matrix during aging is compared to the color of myoglobin to represent the quality of meat nutrition (Ghanni et al., 2016).

Nano Technology:

Nano technology involves the use of matter on a small scale, usually between 1 and 100 nanometers. Many major food companies around the world are exploring the potential of nanotechnology in food products. Recent research has demonstrated the potential of nanotechnology in various food applications, including novel food packaging (Cushen et al., 2012). The use of non-scientific technologies in food packaging is expected to increase over the next two decades (Peelman et al., 2013). Potential benefits have been reported, particularly in the interaction between food packaging and the preservation of quality and freshness (Amal, 2015).

Nano sensors are small devices that can be attached to any object you want to detect and send signals back. Micro sensors can detect and respond to physicochemical (sensors) and biological signals (biosensors)and convert the response into a signal or product that humans can use. Nano sensors can be used to detect bacteria, viruses, fungi and ultimately fresh foods (Joyner and Kumar, 2015). Application of nano sensors in food packaging will help consumers purchase fresh and delicious products and increase food safety (Omanović et al., 2016). Consumers rely on the expiration date of food packaging provided by manufacturers based on their storage and operating needs.

Sustainable Packaging:

The Sustainability and Green Deal recommends the use of biodegradable and environmentally friendly materials in food packaging, as many packaging materials create waste. There is a new interest in creating sustainable packaging, and some examples of these materials include polylactic acid (PLA) plastic, sugar paste, fiber, starch, etc.

It is located. (Nitaigour, 2014). Biopolymers last thousandsof years longer than synthetic materials such as plastic. They are produced from renewable energy sources, are mostly biodegradable and their products are non-toxic. They can be produced by biological organisms (e.g. bacteria, plants and animals) or chemically from organic materials (e.g. sugars, starches, natural fats or oils, etc.) (Pawar and Aachal, 2013). Sustainable packaging is a complex concept that must be used with strategy and thought. The Sustainable Packaging Alliance, an international organization of more than 200 industry members, offers the best definition of sustainable packaging. It is beneficial, safe and healthy for people and societies throughout life. Meets industry standards for performance and cost.It makes use of renewable or recycled materials.4. It is produced using the most hygienic methods and best practices. It is designed to optimize data and power.It is efficient and used in biological and/or commercial cradle-to-cradle cycles (SPC 2011).

III. CONCLUSION

Food packaging plays an important role in today's food industry because it helps maintain the quality of food and ensure food safety throughout its shelf life. These developments are necessary due to changes in people's lifestyles and provide convenience and quality to consumers. Various technologies have been developed in food packaging, such as artificial and smart packaging materials, use of nanotechnology in food packaging, anti-bacterial packaging, food packaging using films and processes, and solid packaging, which is expected to increase in the future. is more innovation. It is important to assess and evaluate the risks of new technologies to avoid harm to food, consumers and the environment.

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