Review Article

Intelligent Packaging Systems: Sensors and Nanosensors to Monitor Food Quality and Safety

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The application of nanotechnology in different areas of food packaging is an emerging field that will grow rapidly in the coming years. Advances in food safety have yielded promising results leading to the development of intelligent packaging (IP). By these containers, it is possible to monitor and provide information of the condition of food, packaging, or the environment. This article describes the role of the different concepts of intelligent packaging. It is possible that this new technology could reach enhancing food safety, improving pathogen detection time, and controlling the quality of food and packaging throughout the supply chain.

1. Introduction

Globalization and dynamism in the exchange of products, along with reduced time for selection/cooking with fresh ingredients, and the growing interest in health safety and environment are the main challenges and enhance the development of new improved packaging concepts [1]. According to [2], among packaging optimization strategies to reduce food waste, there are size diversification to help consumers buy the right amount and new packaging designs to prevent the loss of scent and the appropriate moisture content [3].

The safety of food products is one of the main objectives of food law. Quality control in food manufacturing is closely related to technology, physical and sensory attributes of the product, the microbiological safety, the chemical composition, and nutritional value [4].

The functions of the packages include protection, containment, communication with the user, ergonomics and marketing (Figure 1). Containment means ensuring the right quantities of products to avoid spills. The communication function is regulated by law and the proper display will influence the consumer acceptance of the product. The information must contain features such as weight, origin, ingredients, nutritional value, precautions for use, mode of transport, and recycling or disposal. Trademarks used packaging and labels for promotion, marketing, and product sales [5]. Ergonomics in the consumption of a food product is related to minimizing physical effort and discomfort to transport, store, use, and dispose of the container [6]. It has been shown that the physical characteristics and improved containment aspect of food packaging are expectations that affect sales of products and consumer attitudes [7].

According to [8], the global market for active and intelligent packaging will double between 2011 and 2021, growing at an annual rate of 8% until 2016, reaching US $17,230 million, and later at an annual rate of 7, 7%, reaching US $24,650