



USE OF NANOTECHNOLOGY IN FOOD PROCESSING, PACKAGING AND SAFETY

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Abstract: This review focuses on the use of nanotechnologies in food processing and packaging with special attention to their reflection on food quality and safety. The topic of this review includes application of nanotechnology in food processing, application of nanotechnology in food packaging and food contact materials, nanotechnology and food safety as well as regulation of nanotechnologies to ensure food safety. Nanotechnology has potential applications in all aspects of food sectors including food processing, food packaging, food monitoring, production of functional foods, development of foods capable of modifying their color, flavor or nutritional properties according to a person's dietary needs as well as production of stronger flavorings, colorings and nutritional food additives. Moreover, lowering the costs of food additive ingredients and increasing the shelf life of food products could be achieved using this technology. The food market demands technologies, which are essential to keep market leadership in the food processing industry to produce fresh authentic, convenient and flavorful food products. Prolonging the product shelf life and freshness as well as improving the quality of food are the target. Nanotechnology is a technology that has the potential to revolutionize the food industry. Developing smart packaging to optimize product shelf life using nanotechnologies has been the goal of many companies. Such packaging systems would be able to repair small holes/tears, respond to environmental conditions such as temperature and moisture changes and alert the customer if the food is contaminated. Nanotechnology can provide solutions for these, for example modifying the permeation behavior of foils, increasing barrier properties (mechanical, thermal, chemical and microbial), improving mechanical and heat-resistance properties, developing active antimicrobial and antifungal surfaces, and sensing as well as signaling microbiological and biochemical changes and creates the nano-biodegradable packaging.

• Introduction

The food market demands technologies, which are essential to keep market leadership in the food processing industry to produce fresh authentic, convenient and flavorful food products. Prolonging the product shelf life and freshness as well as improving the quality of food are the target. Nanotechnology is a technology that has the potential to revolutionize the food industry. Detection of very small amounts of chemical contaminants, virus or bacteria in food systems is another potential use of nanotechnology.

• Material and method

Nanotechnology has potential applications in all aspect's food processing, food packaging and food monitoring. Production of functional foods such as soft drinks, ice cream, chocolate and chips are marketed as healthy foods by reducing fat, carbohydrate or calorie content or by increasing protein, fiber or vitamin contents. Development of foods capable of modifying their color, flavor or nutritional properties according to a person's dietary needs, allergies, or taste preferences, production of stronger flavorings, colorings and nutritional additives and lowering costs of ingredients. Increasing the shelf life of the products by using packaging materials, which can release antimicrobials or control air and moisture exchange with the environment can be done also by nanotechnology techniques .

Nanoparticles are added to many foods to improve flow properties, color and stability during processing, or to increase shelf life. For example, aluminosilicate materials are commonly used as anticaking agents in granular or powdered processed foods, while anatase titanium dioxide is a common food whitener and brightener additive, used in confectionery, some cheeses and sauces.

• Results and discussions

Waxy coating is used widely for some foods such as apples and cheeses. Recently, nanotechnology has enabled the development of nanoscale edible coatings as thin as 5 nm wide, which are invisible to the human eye. These edible nano-coatings could be used on meats, cheese, fruits, vegetables, confectionery, bakery goods and fast foods. They could provide a barrier to moisture and gas exchange, act as a vehicle to deliver colors, flavors, antioxidants, enzymes and anti-browning agents and could also increase the shelf life of manufactured foods, even after the packaging is opened.

Another trend in this respect is the chemical release nano-packaging. This technique enables food packaging to interact with the food. The exchange can be processed in both directions. Packaging can release nanoscale antimicrobials, antioxidants, flavors, fragrances or nutraceuticals into the food or beverages to extend its shelf life or to improve its taste or smell.



Figure 1: Nanotechnology improves fast food industry

Conclusions

In conclusion, we could recommend that there is an urgent need for regulation of nanomaterials before their incorporation into food processing, packaging, and food contact. Nanomaterials must not cause any health risks for consumers or to the environment. More research studies are required to investigate the hazards of nanomaterials, taking the size as a main factor even though some of chemical materials in the form of large particles are safer than when they are in the nano state.