

Chapter 9

Novel Packaging Technologies in Dairy Products: Principles and Recent Advances

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ABSTRACT

The packaging process is an important step in maintaining the quality characteristics of foods. Packaging foods protects products from external effects and provides product information to consumers. Due to the various changes occurring during the distribution and storage of the products, some significant quality characteristics can be lost. In recent years, novel packaging technologies have been developed to supply long shelf life, safety, and 'fresh-like' characteristics to the products. These novel technologies include nanotechnology, modified atmosphere packaging, active packaging, and intelligent/smart packaging. Since dairy products are generally vulnerable to biological, physical, and chemical changes, they lose their quality characteristics within a short term. Therefore, the use of these novel techniques in dairy products is greatly important. This chapter informs about general principles of the novel packaging techniques and their current applications in dairy technology.

INTRODUCTION

Containers or cases made of special materials such as metal, glass, and plastic which protect the products against external factors and facilitate the marketing and consumption of foods are called food packaging. To ensure the food safety, the stages of packaging, transportation, and storage until the product reaches consumers are as important as the production of foods (Çelik & Tümer, 2016). The main purpose of food packaging is to ensure food safety by preserving the overall quality throughout the time interval of production and consumption (Cutter, 2006).

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Novel Packaging Technologies in Dairy Products

The UK Packaging Institute defines packaging in three different ways (Gawith & Robertson, 2000):

1. Preparation of products for transportation, distribution, storage, retailing, and final use in a coordinated manner.
2. Safe and cost-efficient delivery way of products to the final consumers.
3. Technological and economic function of the goal of minimizing delivery costs while maximizing sales and profits.

Food packaging is being developed day by day upon the demands of the consumers and the novel trends applied in food industry. There are four important functions to be considered when developing a food package: storage, protection, convenience, and communication. In other words, package should be able to protect the product against external factors such as water, gas, odor, microorganisms, dust, and pressure. In addition, food packages need to contain information about the product and should be constantly improved to adapt to varying living conditions (Gawith & Robertson, 2000). Particularly in milk and dairy products which are prone to physical, chemical, and biological changes in a short time, the packaging technologies have been constantly developed to extend the shelf life of products.

The novel methods used in packaging technology can be listed as follows (Patel, Prajapati, & Balakrishnan, 2015):

1. Nanotechnology
2. Modified Atmosphere Packaging
3. Active Packaging
4. Intelligent/Smart Packaging

NANOTECHNOLOGY

Nanotechnology is an applied science that controls occurrences at atomic or molecular level below 100 nm (Anonymous, 2019). Nanotechnology is implemented in many food fields such as increasing food safety, reducing agricultural inputs, and preventing the nutritional factors (Schnettler et al., 2013). In food science, food packaging is known as the most common field where nanotechnology is applied (Sürengil & Kılınç, 2011).

Nanotechnology can be used in food packaging in three ways (Duncan, 2011):

1. To produce synthetic polymer and biopolymer-based packaging materials for the purpose of developing packages with better barrier and mechanical properties.
2. To develop active packaging materials by using nanoparticles having antimicrobial properties or oxygen absorption such as Ag, ZnO, and TiO₂.
3. To detect the storage conditions in which food products are exposed by use of different nanoparticles such as Fe₂O₃ and TiO₂ in intelligent packaging technology and to produce markers that inform the manufacturer, seller, and consumer.

Nanotechnological applications, which are used in many fields in food technology, have advantages and disadvantages.

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