

Introduction to Food Packaging (Institute of Food Technologists Series)



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Active and Intelligent Packaging Food – Research and Development – A Review

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Innovation in food and beverage packaging is mostly driven by consumer needs and demands influenced by changing global trends, such as increased life expectancy, and fewer organizations investing in food production and distribution. Food industry has seen great advances in the packaging sector since its inception in the 19th century with most active and intelligent innovations occurring during the past century. These advances have led to improved food quality and safety. Active and intelligent packaging is a new and exciting area of technology which received efficient contemporary consumer response. The aim of this review article was to present active and intelligent packaging currently existing on the market.

INTRODUCTION

New food packaging technologies are developing as a response to consumer demands or industrial production trends towards mildly preserved, fresh, tasty and convenient food products with prolonged shelf-life and controlled quality. In addition, changes in retailing practices, or consumers lifestyle, present major challenges to the food packaging industry and act as driving forces for the development of new and improved packaging concepts that extend shelf-life while maintaining and monitoring food safety and quality (Dainelli *et al.*, 2008). Innovations in packaging were up to now limited mainly to a small number of commodity materials such as barrier materials (new polymers, complex and multilayer materials) with new designs, for marketing purposes. However, food packaging has no longer just a passive role in protecting and marketing a food product. New concepts of active and intelligent packaging are due to play an increasingly important role by offering numerous and innovative solutions for extending the shelf-life or maintain, improve or monitor food quality and safety (Contard, 2000). Food quality and shelf-life extension (e.g. for delicatessen, cooked meats *etc.*) Next to these, numerous other concepts such as ethanol emitters (e.g. for bakery products), ethylene absorbers (e.g. for climacteric fruits), carbon dioxide emitters/ absorbers, time/temperature and oxygen indicators *etc.* have been developed. In a general way, the field has been extended largely as a series of niche markets owing to the current approach of packaging industries looking at it in terms of new market opportunities

(Roomey, 2005). Table 1 contains basic definitions of active and intelligent packaging.

Introduction of active and intelligent packaging can extend the shelf life of food or improve its organoleptic properties and thus prevent food losses. According to the FDA report of 2011, about 1.3 billion tons of food is thrown away every year. Every year only Europe produces 89 million tons of wasted food, and the average rubbish thrown by European household constitutes 20–30% of food purchased. New packaging solutions allow to improve the economic aspect. The interest in active and intelligent packaging is successively increasing. This is evidenced by the fact that the global market of active and intelligent packaging for food and beverages coupled with controlled/modified atmosphere packaging (CAP/MAP) increased from \$15.5 billion in 2005 to \$16.9 billion by the end of 2008 and it should reach \$23.6 billion by 2013 with a compound annual growth rate of 6.9%. The global market is broken down into different technology applications of active, controlled and intelligent packaging; of these, CAP/MAP has the largest share of the market estimated to comprise 45.4% in 2008, probably decreasing slightly to approximately 40.5% in 2013.

TABLE 1. Definitions of active and intelligent packaging.

Packaging type	Definition
Active packaging	packaging in which subsidiary constituents have been deliberately included in or on either the packaging material or the package headspace to enhance the performance of the package system
Intelligent packaging	packaging that contains an external or internal indicator to provide information about aspects of the history of the package and/or the quality of the food

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