

# Nano-Enabled Packaging for the Food and Beverage Industry: a Technology, Industry and Market Analysis

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## Abstracts

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Nanotechnology, the science of very small materials, is poised to have a big impact in food and beverage packaging. Due to very large aspect ratios, a relatively low level of nanoparticle is sufficient to change the properties of packaging materials without significant changes in density, transparency and processing characteristics. The addition of certain nanoparticles into shaped objects and films has been shown to render them light, fire-resistant and stronger in terms of mechanical and thermal performance, as well as less permeable to gases. New packaging solutions will focus more on food safety by controlling microbial growth, delaying oxidation, improving tamper visibility, and convenience. Three basic categories of nanotechnology applications and functionalities appear to be in development for food packaging: enhancement of plastic materials' barriers; incorporation of active components that can deliver functional attributes beyond those of conventional active packaging; and sensing and signaling of relevant information.

The applications of nanotechnology in the food and beverage sector are only now emerging, but these are predicted to grow rapidly in the coming years. Applications in this area already support development of improved tastes, color, flavor, texture and consistency of foodstuffs, increased absorption and bioavailability of nutrients and health supplements, new food packaging materials with improved mechanical, barrier and antimicrobial properties, and nano-sensors for traceability and monitoring the condition of food during transport and storage.

The rapid use of nano-based packaging in a wide range of consumer products has also raised a number of safety, environmental, ethical, policy and regulatory issues. The main concerns stem from the lack of knowledge with regard to the interactions of nano-sized materials at the molecular or physiological levels and their potential effects and impacts on consumers' health and the environment. Research and development in the field of active and intelligent packaging materials is very dynamic and develops in step with the search for environmentally friendly packaging solutions. In this context, the design of tailor-made packaging is a real challenge, and it implies the use of reverse engineering approaches based on food requirements and not just on the availability of packaging materials any longer. Nanotechnologies are expected to play a major role, taking into account all additional safety considerations and filling present packaging needs.

## **STUDY GOAL AND OBJECTIVES**

The study is intended to benefit the existing manufacturers of food and beverage packaging who seek to expand revenues and market opportunities. It also can serve as a reference for small food and beverage packaging industry players who would like to expand to nano-enabled technologies for food and beverage packaging. This study also provides the most complete accounting of nano-enabled packaging for food and beverage products in various markets around the globe.

The main objective of this report is to understand the current state of nano-enabled packaging in the food and beverage industry, the companies involved, technologies being pursued and intellectual property being generated.

This study focuses on various types of nano-enabled packaging, providing market data about the size and growth of application segments, industry trends, new developments including a detailed patent analysis, and company profiles. Another goal of this report is to provide a detailed and comprehensive multi-client study of the market in North America, Europe, Asia/Pacific and the rest of the world for nano-enabled packaging, as well as potential business opportunities emerging in the future.

The study objectives include a thorough coverage of the underlying economic issues driving the nano-enabled packaging business, as well as assessments of new advanced nano-enabled packaging that are being developed. Particular attention was paid to providing realistic market data and forecasts for the nano-enabled packaging industry segments. To our knowledge, this study provides the most thorough and up-to-date assessment that can be found anywhere on the subject. The study also provides

extensive quantification of the many important facets of market developments in nano-enabled packaging all over the world. Ultimately, the study contributes to the determination of what kinds of strategic responses can be adopted by companies hoping to compete in this dynamic market.

## **REASONS FOR DOING THE STUDY**

With an increasing global customer base, food retailing is transforming. However, food packaging requires longer shelf life, along with monitoring food safety and quality based upon international standards. Nanotechnology is enabling new food and beverage packaging technologies to respond to these requirements.

Also, most commercialized foodstuffs, including fresh fruits and vegetables, are being marketed inside packages. By means of the correct selection of materials and packaging technologies, it is possible to maintain product quality and freshness during the period required for commercialization and consumption. Nanotechnology derived food packaging materials are the largest category of current nanotechnology applications for the food and beverage sector. Therefore, iRAP felt a need to do a detailed market update and industry analysis for this industry.

## **CONTRIBUTIONS OF THE STUDY**

This study provides the most complete accounting of the growth of the nano-enabled food and beverage packaging market in North America, Europe, Asia/Pacific and the rest of the world currently available in a multi-client format. It provides the most thorough and up-to-date assessment that can be found anywhere on the subject and provides extensive quantification of the many important facets of developments in various markets for nano-enabled food and beverage packaging. This quantification, in turn, contributes to the determination of what kind of strategic response suppliers may adopt in order to compete in these dynamic markets. Audiences for this study include marketing executives, business unit managers and other decision makers in the nano-enabled food and beverage packaging companies, as well as in companies peripheral to this business.

## **SCOPE AND FORMAT**

The market data contained in this report quantifies opportunities for nano-enabled food and beverage packaging technologies, nanomaterials used for packaging, and the technology applications. In addition to product types, it also covers the many issues

concerning the merits and future prospects of the nano-enabled food packaging business. It also covers in detail the economic and regulatory issues regarded by many as critical to the industry's current state of change. The report provides a review of the nanotechnologies involved in the food and beverage packaging industry, along with the industry structure and the companies involved in providing these packaged products.

## **TO WHOM THE STUDY CATERS**

The report provides the most thorough and up-to-date assessment that can be found anywhere on the subject. The study is intended to benefit current food and beverage packaging producers and users, as well as developers of new technologies in this area. Specifically, the report would be of great use to:

producers and suppliers of food and beverage packaging materials,

resin suppliers,

producers and suppliers of nanoparticle materials.

users of food and beverage packaging,

universities and research institutions involved in research in the food and beverage packaging area,

investors and venture capitalists interested in new technology areas.

## **REPORT SUMMARY**

With the increasing global customer base, food retailing is transforming. However, with the move toward globalization, food packaging requires longer shelf life, along with monitoring food safety and quality based upon international standards. To address these needs, nanotechnology is enabling new food and beverage packaging technologies.

Applications in nano-enabled packaging span development of improved tastes, color, flavor, texture and consistency of foodstuffs, increased absorption and bio-availability of nutrients and health supplements, new food packaging materials with improved

mechanical, barrier and antimicrobial properties, and nano-sensors for traceability and monitoring the condition of food during transport and storage.

The total nano-enabled food and beverage packaging market in the year 2008 was \$4.13 billion, which is expected to grow in 2009 to \$4.21 billion and forecasted to grow to \$7.30 billion by 2014, at a CAGR of 11.65%. Active technology represents the largest share of the market, with \$2.7 billion in 2008, followed by intelligent packaging with \$1.03 billion, and finally, controlled release packaging of \$360 million. In 2014, the active segment will remain the largest, with \$4.35 billion in sales, and the intelligent segment will grow to \$2.47 billion sales.

Other major findings of this report are:

Among active technologies, oxygen scavenger, moisture absorbers and barrier packaging represent more than 80% of the current market.

Time/temperature indicators are a major share of intelligent packaging, with radio frequency identification data tags (RFIDs) forecasted to show the strongest growth in this category in the future.

In controlled release packaging, antioxidants have a 60% share, compared to a 40% share for antimicrobials.

In food products, the bakery and meat products categories have attracted the most nano-packaging applications, and in beverages, carbonated drinks and bottled water dominate.

Among the regions, Asia/Pacific, in particular Japan, is the market leader in active nano-enabled packaging.

In the United States, Japan, and Australia, active packaging is already being successfully applied to extend shelf-life while maintaining nutritional quality and ensuring microbiological safety. Examples of commercial applications include the use of oxygen scavengers for sliced processed meat, ready-to-eat meals and beer, the use of moisture absorbers for fresh meat, poultry, and fresh fish, and ethylene-scavenging bags for packaging of fruit and vegetables. In Europe, however, only a few of these systems have been developed and are being applied now. The main reasons for this are legislative restrictions and a lack of

knowledge about acceptability to European consumers, as well as the efficacy of such systems and the economic and environmental impact such systems may have.

The fast growth of carbonated soft drinks in many parts of the world has been driven by polyethylene terephthalate (PET). There is a relatively large demand for oxygen scavengers in plastic bottles for non-carbonated drinks such as juices, sports and functional drinks, the ingredients of which can be sensitive to oxygen.

## Contents

### INTRODUCTION

Study Goal and Objectives  
Reasons for Doing the Study  
Contributions of the Study  
Scope and Format  
Methodology  
Information Sources  
Whom the Study Caters to  
Author's Credentials

### EXECUTIVE SUMMARY

Summary Table Nano-enabled Packaging in the Food and Beverage Market  
Segmented by Technology, 2008, 2009 and 2014 (\$ Billions)  
Summary Figure Nano-enabled Packaging in the Food and Beverage Market  
Segmented by Technology in 2009 and 2014 (%)

### INDUSTRY OVERVIEW

Industry Players  
Market Segments  
Market by Type  
Table 1 Market for Nano-enabled Packaging by Food and Beverage, 2008, 2009 and  
2014 (\$ Billions)  
Figure 1 Market for Nano-enabled Packaging by Food and Beverage, 2009 and 2014  
(%)  
Table 2 Market for Nano-enabled Packaging by Types of Food and Beverage Products,  
2008, 2009 and 2014 (\$ Billions)  
Figure 2 Market for Nano-enabled Packaging by Types of Food and Beverage Products,  
2009 and 2014 (%)  
Market by Technology  
Market by Region  
Table 3 Market for Nano-enabled Packaging by Regions, 2008, 2009 and 2014 (\$  
Billions)  
Figure 3 Market for Nano-enabled Packaging by Regions, 2009 and 2014 (%)  
Regulatory Issues

## TECHNOLOGY OVERVIEW

Packaging Technology

Active Packaging Technology

Table 4 Classification of Active Packaging Technology

Table 5 Application of Active Technologies in Various Food and Beverage Groups

Oxygen Scavengers

Carbon Dioxide Absorbers and Emitters

Moisture Scavengers

Ethylene Absorbers

Flavor and Aroma Absorbing or Releasing Systems

Ethanol Emitters

Anti-fogging and Anti-sticking Films

Light Absorbers and Emitters

gas Permeable and Breathable Packages

Microwave Susceptors

Temperature Control: Self-heating and Cooling

Barrier Enhancement

Beverage Packaging

Potential Barrier Choices

Intelligent Packaging (IP)

Table 6 Types of Intelligent Packaging

Time/temperature Indicator

Ripeness Indicator

Biosensors

gas Indicators

Barcode Label/invisible Ink

Radio Frequency Identification Data (RFID) Tags

Controlled Release Packaging (CRP)

Antimicrobial Packaging

Table 7 Application of Biopolymers in Antimicrobial Food Packaging

Antioxidants

Packaging Materials

Nanocomposites

Honeywell's Aegis® ROLE

Honeywell's Aegis® HFX

Honeywell's Aegis® CSD

Nanocor-mitsubishi's gas Chemical Company, Incorporated M9



Bayer's Durethan®  
Triton Systems, Incorporated Ormlastm  
Nanocoatings  
Nano-enabled Thin Films  
Table 8 Commercial Examples of Films  
OS2000TMOXYGEN Scavenging Film  
Oxbar®  
Honeywell's Specialty Films

## **NANO-ENABLED PACKAGING APPLICATIONS**

Packaging Applications  
Barrier Enhancement  
Monitoring/communication  
Future Trends

## **INDUSTRY STRUCTURE AND MARKET ANALYSIS**

Global Industry Structure  
Market by Technology  
Active Packaging Technologies  
Table 9 Market for Active Packaging Technologies in the Food and Beverage Industry, 2008, 2009 and 2014 (\$ Billions)  
Figure 4 Market for Active Packaging Technologies, 2009 and 2014 (%)  
Intelligent Packaging Technologies  
Table 10 Market for Intelligent Packaging Technologies in the Food and Beverage Industry, 2008, 2009 and 2014 (\$ Billions)  
Figure 5 Market for Intelligent Packaging Technologies, 2009 and 2014 (%)  
Controlled Release Packaging  
Table 11 Market for Controlled Packaging Technologies in the Food and Beverage Industry, 2008, 2009 and 2014 (\$ Billions)  
Figure 6 Market for Controlled Release Packaging Technologies, 2009 and 2014 (%)  
Technology Market Summary  
Table 12 Current & Future Markets for Nano-enabled Packaging in the Food and Beverage Market, Segmented by Technology, 2008, 2009 and 2014 (\$ Billions)  
Figure 7 Current & Future of Nano-enabled Packaging in Food and Beverage Market Segmented by Technology in 2009 and 2014 (%)  
Market by Regions  
Asia/pacific Region

Table 13 Market for Nano-enabled Packaging Technologies in the Asia/pacific Region, 2008, 2009 and 2014 (\$ Billions)

Figure 8 Market for Nano-enabled Packaging Technologies in the Asia/pacific Region, 2009 and 2014 (%)

Europe

Table 14 Market for Nano-enabled Packaging Technologies in the European Region, 2008, 2009 and 2014 (\$ Billions)

Figure 9 Current & Future of Nano-enabled Packaging Technologies in Europe Region, 2009 and 2014 (%)

North America

Table 15 Market for Nano-enabled Packaging Technologies in the North American Region, 2008, 2009 and 2014 (\$ Billions)

Figure 10 Market for Nano-enabled Packaging Technologies in the North American Region, 2009 and 2014 (%)

Regional Market Summary

Table 16 Market for Nano-enabled Packaging by Regions, 2008, 2009 and 2014 (\$ Billions)

Figure 11 Market for Nano-enabled Packaging by Regions, 2009 and 2014 (%)

## **PATENTS AND PATENT ANALYSIS**

List of Patents

Preparation of Fast Reheats Bottle-grade pet Resin

Method for Recycling pet Bottles

Oxygen Detection System for a Rigid Container

Sensor for Monitoring an Analyte

tag Including Rfid Circuit Storing Data

Multilayer Oriented Antimicrobial and Antifogging Films

Oxygen Scavenging Film With Cyclic Olefin Copolymer

Conductive Nanocomposite Films

Methods for Making pet Food Bottles

Blend Systems of Oxygen Barrier and Oxygen Scavenging Polymers

Causing an Extensible Polymer Film on pet Bottle Edges

System and a Method for an Edible, Optically Invisible Ink

Organic Acids Incorporated Edible Antimicrobial Films

Sensor Method to Display Weight

Sensing Gaseous Substances Using Metal Complexes

Transporting a Product Using an Environmental Sensor

Methods of Using an Oxygen Scavenger

Methods to View and Analyze the Results From Sensors  
Thermal History Indicators  
Food Quality and Safety Model for Refrigerated Food  
Wraparound Carrier for Petaloid pet Bottles  
Oxygen Scavenging  
Changed Condition Indicator  
Method of Making a Polymeric Food Spoilage Sensor  
Critical Temperature Indicator  
Triggering, Storing, and Distributing an Oxygen Scavenger  
Oxygen Scavenging Polymers as Active Barrier TIE Layers  
Recording the Temperature of Perishable Products  
Food Temperature Measuring Device With Audible Signal  
In-situ Standard for Temperature-indicating Labels  
Antimicrobial Sol-gel Films Comprising Specific Metal-containing Antimicrobial Agents  
Oxygen Scavenging Polyamide Compositions  
Metal Catalyzed Ascorbate as Oxygen Scavengers  
Packages for Differential Oxygen Scavenging  
Patent Analysis  
Table 17 Number of U.s. Patents Granted to Companies in the Oxygen Scavenging Category From 2004 to 2008  
Figure 12 top Companies in Terms of U.s. Patents Granted for Oxygen Scavenging From 2004 Through 2008

## **COMPANY PROFILES**

3M Company  
Agion Technologies  
AMCOR Global  
Baltimore Chemicals  
BASF  
Bayer Material Science AG  
BP Corporation  
CHUO Kagaku Company, Ltd  
Chevron Phillips Chemical Company Llc  
CSP Technologies., Inc.  
Chantler Packaging Inc.  
Continental pet Technologies  
Cryovac Sealed air Corporation  
Food Science Australia

Grofit Plastics  
Honeywell International Inc.  
Hotcan  
Innovia Films Inc.  
Johnson Matthey Plc  
Kraft Foods  
Kureha Plastics Co., Ltd  
Maxwell Chase, Inc  
Mitsubishi Chemical USA, Inc.  
Marks & Spencer Ltd  
Multisorb Technologies, Inc.  
Nippon Soda Co., Ltd  
Nanocor, Inc.  
Pactiv Corporation  
Pliant Corp.  
ppg Industries  
Ripesense Limited  
Sinanen Zeomic Co., Ltd  
Sidel Inc.  
Sira Food Sentinel System  
Sonoco Corporation  
Southern Clay Products  
Steam to Go  
Tetra Pack Inc  
Timestrip Plc.  
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Toxin Alert  
Triton Systems, Inc.  
United Desiccants  
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