

Preface

According to the latest official data, the global market of food packaging is worth 440 billion dollars worldwide, (about 2% of the Gross National product of the developed countries), with an annual increase of 10%. The food industry uses almost 65% of all packaging placed on the market and the impact of the packaging on the retail cost of food is between 19 and 50%. Almost 40 % of the total packaging is made of plastic. The growth rate of the market of plastic packaging in the last few years for both flexible and rigid plastic packages has been about 7%, the highest compared with other materials (glass 2%, metal 6%, paper 6%, other including wood 3 %).

The impressive numbers reported above clearly explained why many of the world's largest food packaging companies are actively exploring the potential of polymer nanotechnology in order to obtain new food packaging materials with improved properties and also able to trace and monitor the condition of food during transport and storage.

Polymer nanotechnology, described as the next great frontier of material science in food packaging, with applications predicted to grow rapidly in the coming years is currently developed to mainly improve barrier performance pertaining to gases, such as oxygen and carbon dioxide. Once perfected, sure from a safety point of view and produced at a competitive ratio cost/performances the new PNFP will be very attractive for use in several food packaging applications.

The book aims at looking at the complete life cycle of the packaging based on polymer nanomaterials (raw material selection, production, structure and properties characterization, analysis of interaction with food, marketing, application, use, and disposal) by the contribution of several experts with the final aim to consider the balance between cost and performance, and risk and benefit and the health and environmental issues and the assessment of risk benefit and to contribute to identify the barriers (in research and technology, safety, technology transfer, communication) that prevent a complete successful development of the new technology and the strategies to proceed further.

In the book, divided in 13 chapters, the current developments in nanotechnology for food packaging application are identified and addressed by providing a comprehensive review focusing specifically on applications which are most likely to enjoy consumer acceptance and regulatory attention in the immediate future.

After a general introduction of the topic with a focus on current issues and future trends soon an 'ethical design' is introduced (Chapter 2) as a concept which puts into practice key ideas like the precautionary principle and presents a model of accountability, responsibility, and ethical consideration commensurate with the current understanding of all sorts of risks and hazards, whether they are known, unknown or unknowable. The book then dwells into *science*: Two chapters are dedicated to characterization of these novel materials investigating the evolution of the rheology and of the structure and morphology in dependence of processing conditions and kind of constituents. The interesting application of plasma technologies in the field of production of food packaging materials for production of barrier coatings on polymeric materials by non-equilibrium gas discharges is illustrated in chapter 5. The main aspects of nanomaterials for food packaging from oil polymers (polyolefins) and from renewable resources polymers are reported in a sequence (chapter 6 and 7) in order to better compare both kinds of materials. Chapter 8 and 9 are dealing with two specific innovative applications as the use of cellulose nanowhiskers for food biopackaging and edible nano-laminate coatings. The general issues linked to interactions of nanomaterials with food are reported in chapter 10. Some examples of degradation under natural weathering exposure and recycling are reported in the chapters 11 and 12. The final chapter concludes the book with an overview about the rapidly evolving and expanding field of the usage of polymer nanocomposite materials for food packaging application. Each chapter contains a complete list of references related to the topic.

The book intends to show the reader that nanomaterials offer some exciting benefits to the food industry, including better materials for food packaging and also safer foods on supermarket shelves that have lower incidences of contamination with chemical adulterants and potentially life-threatening microorganisms. The applications reviewed here were specifically chosen because they are the most likely nanofood products to be accepted by consumers in the short-term. The science community must continue to be stalwart against the potential dangers that the use of this new technology will pose, and successful and safe implementation of these applications will require constant dialogue between scientists, technologists and consumers. If these endeavours will be successful, then the benefits of nanotechnology may play an important role in making the world's food supply healthier, safer, and more plentiful.

The book is therefore addressed not only to researchers and engineers that actively work in the field of nanocomposites for food packaging, but also to newcomers and students who have just started investigations in this multidisciplinary field of science

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All the authors are participating in the European activity Cost Action FA 0904 “*Eco-sustainable Food Packaging Based on Polymer Nanomaterials*” and they thankfully acknowledge the support of the Action, that is making possible the constitution of an impressive international scientific and technology network on issues related to the preservation, conservation and distribution of high quality and safe food through polymer nanomaterials.