

ABSTRACT

PhD THESIS

RESEARCHES ON THE DEVELOPMENT OF ACTIVE AND BIODEGRADABLE SYSTEMS FOR PACKAGING FOOD PRODUCTS

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Key words: active packaging, antimicrobial activity, essential oils, chitosan, polylactic acid, composite materials, biopolymers, sustainable, degradation, ecotoxicity, biodegradation, food packaging, conservability.

The doctoral thesis entitled "***Research on the Development of Active and Biodegradable Systems for Food Packaging***" is elaborated by PhD student Paul-Alexandru Popescu, under the coordination of Prof. Univ. Dr. Mona Elena Popa, within the Doctoral School of Engineering and Management of Vegetable and Animal Resources at the University of Agronomic Sciences and Veterinary Medicine Bucharest. The experimental researches were carried out within the doctoral thesis were carried out in the laboratories of the Faculty of Biotechnologies, within the University of Agronomic Sciences and Veterinary Medicine Bucharest. The purpose of the PhD thesis was to develop an active and biodegradable food packaging made of polymeric materials from renewable resources that have a polymeric chitosan matrix in order to pack and increase the consistency of meat products.

The PhD thesis is structured in 10 chapters, summing up 24 tables and 122 figures and graphical representations, with 127 bibliographic references from specialized books, scientific articles and other sources of recent information.

The paper is structured in three parts specific to a doctoral thesis, namely the first part of documentary research on the current state of knowledge in the field investigated, entitled "***Documentary study on the active packaging of food products***", the second part of the

experimental researches entitled "*Research experimental testing of biomaterials in terms of antimicrobial activity, sustainability and environmental protection*" and a third part containing the author's conclusions and original contributions, entitled "*General conclusions, own contributions and dissemination of the research results*".

In the first part of the Ph.D. thesis are described the new polymeric and biopolymer materials used in the food industry and the possibility that they are also used as active packaging material, thus helping to increase the consistency of the food products. The first part is structured on three chapters, as follows:

Chapter I entitled "*Literature review on the use of active and intelligent packaging in the food industry*" presents new active and intelligent packaging methods used successfully in the food packaging industry and their way of acting on packaged food.

Chapter II entitled "*Studies on sustainable packaging in the food industry*" presents new polymeric and biopolymer materials that are used in the food packaging industry and characterize their environmental degradation properties.

Chapter III, entitled "*State of the art - antimicrobial activity of chitosan based materials*" presents the antimicrobial properties of chitosan-based composite materials and the advantages and disadvantages of food packaging in such packaging systems. The second part of the doctoral dissertation consists of 5 chapters describing the researches carried out in order to determine the antimicrobial activity of the composite polymer materials and to determine the degree of their degradation and ecotoxicity. Also in Part II of the PhD thesis is the *in vivo* study to determine the increase in the conservability of a food product packaged in a commercial casserole compared to the food product packaged in the active and biodegradable casserole developed in the doctoral thesis.

Chapter IV entitled "*Materials, methods and equipment used in experiments*" presents the materials used in the experiments, the methods of physical, chemical and microbiological analysis of the composite polymer materials and the product packed in the developed packaging material.

Chapter V entitled "*Experimental research on the antimicrobial activity of the composite materials on different types of fungi*" shows the degree of inhibition of chitosan-based composite materials on the three fungal strains (*Aspergillus brasiliensis*, *Fusarium graminearum* and *Penicillium corylophilum*).

Chapter VI entitled "*Experimental research on the biodegradation rate of the composite materials*" shows the biodegradation degree of the composite materials and the biodegradation degree of the final composite materials from which the food packaging prototype was made.

Chapter VII entitled "*Ecotoxicity evaluation of the tested soils resulted after the biodegradation process on cucumber and radish seeds*" presents the ecotoxicity studies of soils resulting from biodegradation tests of the developed materials. After the soil biodegradation tests of the developed materials, this soil was tested for ecotoxicity by studying the potential phytotoxic effect on the germination capacity and development of two seed species (cucumbers and radishes).

Chapter VIII entitled "*In vivo experimental researches of the actibiosafe packaging material – chicken meat*" shows the comparison of physico-chemical and microbiological analyzes on chicken meat (boned boneless chicken breast) packed once in the cassette prototype of active and biodegradable polymeric Actibiosafe comparative with chicken meat analyzes packed in a commercial casserole. The results of the analyzes showed an extension of the 5 day old chicken breast (sample packed in the commercial casserole) to 7 days (sample packed in the Actibiosafe system).

The third part of the doctoral dissertation includes the general conclusions of the experimental researches, the perspectives of the continuation of the research, the author's contributions and the dissemination and valorisation of the obtained results. The third part is made up of **Chapter IX** entitled "*General Conclusions*" and **Chapter X** entitled "*Authors contributions and valorification of the research results*".

At the end of the paper is presented the consulted bibliography in which all the authors are found in the thesis.