UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE BUCHAREST

FACULTY OF BIOTECHNOLOGY

PHD THESIS

UNCONVENTIONAL TREATMENTS USED TO PRESERVE AND IMPROVE THE QUALITY OF AGRI-FOOD PRODUCTS

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SUMMARY

Keywords: non-thermal plasma, essential oils, terpene compounds, nerol, chitosan, natural compounds, microorganisms, food quality, food safety

The PhD thesis entitled "***Unconventional treatments used to preserve and improve the quality of agri-food products"*** is developed by PhD student Eng. Mihai Adriana Laura under the scientific coordination of Prof. Univ. Dr. Popa Mona Elena, within the framework of the Doctoral School Plant and Animal Resources Management and Engineering from the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The experimental researches realized during the PhD studies were conducted in modern laboratories from the University of Agronomic Sciences and Veterinary Medicine of Bucharest, National Institute for Laser, Plasma Physics and Radiation from Bucharest, Magurele, but also within the laboratories of the Institute of Food Bioresources from Bucharest.

The aim of the thesis was to investigate the effect of unconventional non-thermal treatments on biological systems in terms of improving the quality of the tested products.

The doctoral thesis is structured on 11 chapters, including 43 tables, 86 figures and graphics, and a list of 253 references from books, scientific articles, and other sources of information.

The work is structured in three parts, the first part entitled "***Literature review regarding the curent status of unconventional non-thermal treatments used to preserve and improve the food products quality*****"** presenting a detailed bibliographic analysis of the literature in the area studied and the current state of knowledge of these treatments, a second part entitled "***Experimental research regarding the effect of unconventional treatments used on preservation and improvement of some food products quality***", and a third part entitled "***General conclusions, author's contributions, valorization and dissemination of research results***".

In the first part of the thesis are presented the general notions about unconventional non-thermal treatments selected for study, this part being divided into three distinct chapters.

The **first chapter** of the thesis entitled „***Literature review regarding the curent status of plasma treatment"*** presents a detailed study of the literature regarding the term of plasma physics, the mechanism of action of non-thermal plasma and industrial applications of this treatment.

In **chapter II**, „***Literature review regarding the current status on general aspects of essential oils***" are presented general notions about essential oils, their chemical composition, mechanism of action and inhibition of microorganisms but also their applications both *in vitro* and *in vivo*.

Chapter III entitled „***Literature review regarding the curent status on general aspects of chitosan"*** presents a documentary study of literature concerning the general characteristics of chitosan, the mechanism of action of this natural compound against spoilage microorganisms and its applications in food industry.

In the second part of the thesis, which comprises five chapters are presented experimental researches carried out in order to assess the effects of unconventional treatments selected for the improvement and preservation of certain agri-food products.

Chapter IV entitled „***Experimental research regarding the non-thermal plasma treatment effect on germination and growth of some biological materials"*** presents materials, methods used, the equipment with which it was generated non-thermal plasma and the results obtained after biological materials were exposed to non-thermal plasma at atmospheric pressure. As a result of the plasma effect over the selected seeds it was determined that plasma does not affect the germination rate but by exposing the seeds a longer time to plasma it shows a positive effect on the early growth of the plants.

In **chapter V**, entitled „***Experimental research regarding the in vitro antimicrobial effect of some essential oils and natural antimicrobial compounds on some spoilage microorganims***" are listed the active compounds tested, the methods used, the effect of essential oils and terpene compounds selected upon some spoilage microorganisms of the *Aspergillus* genus, in the end being presented the main conclusions drawn from the analysis of experimental data. Experimental results have demonstrated the antimicrobial effect of nerol, eugenol and pinene against the fungi *Aspergillus flavus, A. ochraceus,* and *A. niger*, these natural compounds retarted the sporulation and delayed the cells reproduction.

In **chapter VI**, „***Experimental research regarding the antimicrobial effect of chitosan on some spoilage microorganisms***", is has been studied the antifungal effect of chitosan solutions on some molds of the genus *Aspergillus* by using five methods, and the antimicrobial effect of chitosan films. It has been determined that the antifungal activity of chitosan depends on preparation method. From the five methods tested only one was effective, inhibiting or slowing down the development of the tested fungi.

Chapter VII, „***Experimental research regarding the synergic effect between nerol and chitosan on some spoilage microorganisms***" presents the method used to evaluate the potential

synergism between nerol and chitosan and the results obtained. By combining nerol with chitosan has been observed that there is not a synergistic effect between these natural compounds tested.

In **Chapter VIII**, entitled „***Experimental research regarding the nerol and chitosan effect on some vegetable products quality”*** are presented the materials used, methods of work, the effect of chitosan, mixtures of chitosan and nerol and nerol vapour upon physico-chemical, microbiological, sensory and nutritional characteristics of the material selected for study, finally being presented the main conclusions arising from the analyses carried out. The results obtained showed that these natural substances with antimicrobial potentially have maintained some physico-chemical properties of raw materials (grapes) and inhibited the development of yeasts. From a sensory point of view, the samples have undergone qualitative depreciation over time.

In the third part of the thesis are presented the conclusions of the documentary and experimental research, the author's contributions, valorisation and dissemination of results. Chapters contained in this part of the thesis are entitled "***General conclusions***" (**chapter IX**), and „***Author’s contributions and valorisation and dissemination of research results”*** (**chapter X**).

At the end of the thesis is presented the consulted bibliography, articles, books and the papers studied and mentioned in the text.

The experimental researches aim to improve the quality of agri-food products through the reduction of risk factors for the health of consumers, by obtaining of free of harmful agents products.