

Summary

The habilitation thesis consists of four main parts: **I. Overview of the activities carried out and the results obtained, II. Results of the research activity, III. Evolution and development plan regarding the professional, scientific and academic career and IV. References.**

Part I summarizes the professional and academic activities carried out after the defense of PhD thesis on December 6, 2004 at INSA of Lyon - France and confirmed by the doctoral degree diploma issued on April 8, 2005 (diploma recognized at national level through the certificate issued by Ministry of Education and Research on March 29, 2007). The research areas pursued were: modeling, simulation and control of industrial processes; modeling and simulation of control and remediation processes of environmental components; modeling, simulation and optimization of renewable energies production and conversion; Chemical engineering applications using various programming languages. All the above can fit into the fields of chemical engineering and environmental engineering.

The research results were capitalized by publishing 86 articles in specialized journals or in the volumes of at national and international conferences (of which: 33 in ISI-ranked journals, 34 in BDI-ranked journals and 19 in the volumes of international scientific conferences), 2 books in recognized publishing houses (CNCSIS) and one practical work textbook. Also, I participated as a researcher member in the team of 8 national projects, 1 FP7 international project and 2 POSDRU projects.

Part II is the core of the thesis, in which the most important scientific results are described. It is divided into three sections: **1. Representative articles supporting the thesis, 2. Modeling and simulation of antibiotic residues in honey; antibacterial activity of honey and 3. Modeling and simulation of renewable energies production processes.**

The research in the field of honey quality was focused on mathematical modeling of thermal degradation phenomenon of streptomycin and tetracycline residues in honey, as well as on antibacterial activity of honey. On this topic, I have published 3 articles in ISI-ranked journals.

The subject of antibiotics in honey was approached because of the presence of two antagonistic aspects: the frequent use of antibiotics in the treatment of bacterial diseases in bees due to their effectiveness and the EU honey quality standards prohibiting the presence of antibiotics in honey. It has been shown that antibiotic residues in honey undergo a process of degradation over time, a phenomenon accentuated by temperature increase. The composition of honey (the type of honey) defines how the antibiotic concentration changes over time. The issue of antibacterial activity has been addressed in the idea of using honey as a drug capable of fighting with antibiotic-resistant infections. The results have proved that the native types of honey studied show antibacterial activity on some bacterial strains.

The studies in the field of renewable energies focused on the use of biomass for generation of electric and thermal energy in cogeneration plants, respectively for the production of biogas in anaerobic digestion plants. The subject had as starting point the energy vulnerability to which humanity is exposed by the depletion of fossil fuels reserves and the negative environmental impacts created by the processes of exploitation, processing and distribution of fossil fuels. On this topic, I have published 9 relevant articles (7 in ISI-ranked journals, one in ISI Proceedings volume and one in SCOPUS indexed volume).

The subject of biomass conversion into electricity and heat in a cogeneration plant was carried out within an European FP7 project (acronym UNIQUE). The results have led to the development of a mathematical model for the technical-economic assessment and numerical simulation of a biomass gasification technology, with the production of high purity syngas.

The degraded agricultural biomass tested proved to be a suitable raw material for biogas production through anaerobic digestion. The use of substrates obtained by mixing several types of biomass leads to a superior efficiency of the anaerobic digestion process, both in terms of the amount of biogas produced and its methane content. The amount of biogas obtained through anaerobic digestion and its methane composition is considerably increased if a mixture of degraded agricultural biomass and waste water from a treatment plant is used to achieve the digestion substrate. The total methane production for all investigated substrates could be described by a modified Gompertz model.

Part III shows the evolution and development plan regarding the professional, scientific and academic career. Here are presented the research topics that will be continued, as well as the new themes that are to be addressed in the future. In this regard, it is envisaged that young PhD

students will be included in the research team. Also, herein are presented the ways in which the professional and academic career development will be achieved.

The habilitation thesis ends with **Part IV** which groups the bibliographic references associated with the content of the thesis and **Annex 1** which contains the list of figures and tables.