

**"VICTOR BABEȘ" UNIVERSITY OF
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**POLYURETHANE CARRIERS FOR HERBAL
EXTRACTS, DRUGS AND GENETIC MATERIALS**

ABSTRACT

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**Timișoara
2024**

The habilitation thesis is regarded as an important component of academic career advancement in today's scientific culture, especially in the medical domain. Based on the study conducted among postdoctoral medical lecturers and published by H. Sorg *et al.* in "Die Chirurgie" in 2016, the majority of respondents strongly regarded and considered the postdoctoral qualification, which includes the habilitation thesis, to be vital for professional progress. The majority of people still pursue and recommend the qualification, despite having moderate to low hopes for achieving a full professorship, suggesting its considered value for professional growth.

The accreditation of an individual's capacity to carry out doctorate work is the qualification in a world where everything is changing at an ever-increasing rate. As a result, the candidate's research and teaching talents are demonstrated in their habilitation thesis.

Structured in accordance with the National Council for the Attestation of Academic Degrees, Diplomas and Certificates (CNATDCU) recommendations, the habilitation thesis titled "Polyurethane carriers for herbal extracts, drugs and genetic materials" includes three main sections that outline the plan for the development of the academic career in addition to the main research directions. A long-winded description of the postdoctoral scientific activities is given in Part I. Future initiatives pertaining to educational, professional, and scientific endeavors are discussed in Part II, while the dissertation's bibliographic references are included in Part III.

The first section of Part I provides an overview of polymeric materials, emphasizing their place in the worldwide market for drug delivery systems and the medical uses and research of polyurethanes. The presentation is therefore focused on four different directions:

- subchapter 1.1 - the encapsulation technique has been refined in the development of the biopharmaceutical qualities of substances of different classes and of different origins (natural, semi-synthetic, synthetic), with a low solubility in water, through a series of studies under the first research direction, "Development of modified structures". They range from computational studies to investigations into the effects of various synthesis factors (the influence of raw materials' chemical structure, temperature, and stirring speed) on the properties of the finished products;

- subchapter 1.2 - this section explains the various disadvantages of herbal extracts that may restrict their application in therapeutic contexts; among these include low bioavailability, stability, solubility, and sensitivity to stomach breakdown, which can lead to a decrease in biological activity. To tackle these problems, encapsulation techniques have been developed, which has been a major breakthrough in pharmaceutical science. The use of my encapsulation technique is then presented to increase the bioavailability, protect against degradation, and improve the distribution of a few herbal extracts such as genistein, oleanolic and ursolic acids, eugenol, bromelain, mistletoe, garlic, *Reynoutria japonica*, birch bark, chili peppers, ginger, and propolis extracts;
- subchapter 1.3 - this part begins with a general description of polyurethane-based drug delivery systems and their historical development in the last 3 decades. My contributions in this research field include the encapsulation of triclosan, 1,2,4-triazole derivatives, isosorbide mono- and dinitrate, acyclovir, and simvastatin.
- subchapter 1.4 - the development of a new polyurethane-based nonviral vector for the transport of diverse genetic materials is a recent advancement in my research. My institution provided first funding for this method through a project funded for experienced researchers (the director of which has had a PhD for more than ten years). The personal contributions consist of the encapsulation of 2'-deoxycytidine 5'-monophosphate sodium salt and DNA inside various polyurethane structures.

In addition to the synthesis of the polyurethane-based delivery systems, Part I covers a preliminary characterization of each sample that comprises a variety of findings from physico-chemical assessments as well as *in vitro* and *in vivo* examinations. A few examples of the physico-chemical techniques used to characterize the obtained samples include pH, solubility, refractivity index, and stability in time measurements, thermal decompositions, Zetasizer, HPLC and MALDI-TOF, FTIR and UV-Vis, SEM and SANS. On the other hand, cell viability and irritation monitoring were the methods employed to characterize my samples' safety.

Part II of the current habilitation thesis contains a few aspects on my academic achievement, professional activity, future initiatives pertaining to educational, professional, and scientific attempts. This section includes Chapters 2, 3, and 4 and briefly presents my contributions in writing project proposals, academic books,

scientific articles, and patents. My career is describes using three different periods: the first 10 years as a high-school teacher, the period when I was a member of Pharmaceutical Chemistry dept. before 2014, and the last ten years as member of Analytical Chemistry department. The future perspectives are presented by objectives and corelated educational and research activities.

Nearly 25 % of the more than 160 citations that make up the last section, the list of references, are my articles and patents. It is important to note that about 70 % of the references are current, dating back to the last 10 years, and the remaining quotes mostly discussed the development of polyurethane-based drug delivery systems during the previous 30 years historically (subchapter 1.3).