“CAROL DAVILA” UNIVERSITY OF MEDICINE AND PHARMACY BUCHAREST
DOCTORAL SCHOOL
PHARMACY DOMAIN

Physico-chemical methods and experimental statistical design techniques in the pharmaceutical systems development and technological processes optimization

HABILITATION THESIS ABSTRACT

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The habilitation thesis entitled "Physico-chemical methods and experimental statistical design techniques in the pharmaceutical systems development and technological processes optimization" presents the didactic and professional activity along with its development plan, and respectively the scientific activity performed after 2008, when I defended the doctoral thesis - "Contributions to the study of drugs release from semi-solids with topical activity", coordinator Prof. Dr. Ștefan Moisescu, and I obtained the title of Doctor in Pharmacy, *Cum Laude* Distinction, detailing the research activity evolution plan.

Since 2002 I am performing **didactic activity** at the Physical and Colloidal Chemistry Department, Faculty of Pharmacy, "Carol Davila" University of Medicine and Pharmacy Bucharest (UMFCD), promoting all stages of the university career and obtaining the title of Professor in February 2017. In the period 2002-2004 I followed the Master of Applied Physical Chemistry and Radiochemistry, Faculty of Chemistry, University of Bucharest. In 2004 I obtained the title of specialist pharmacist and in 2009 of senior specialist pharmacist. The didactic activity includes the writing, development and teaching of courses and practical activities for students and residents of the Faculty of Pharmacy, PhD students from the Doctoral School of UMFCD and master students from a program developed jointly with the Faculty of Biotechnologies, USAMV, Bucharest. To support the didactic activity, I was involved in the writing of some specialized books; in this regard, I mention the series *Physical Chemistry of Drug* - 3 volumes, where I was co-author (Vol. I) and first author (Vol. II and III). Also, I supervised the experimental part and coordinated graduation thesis in Pharmacy (13/49), coordinated dissertation thesis (4) and studies presented at student sessions (26). I participated in various faculty committees as well as in the PhD steering committees for the Doctoral School of UMFCD and the Doctoral School of Applied Chemistry and Materials Science, Politehnica University of Bucharest.

Concerning the **development plan for the didactic and professional activity**, I am proposing a continuous improvement of the specialized knowledge accumulated that will allow me to permanently update the information sent to students, residents, master students and PhD students, which will increase the academic performance. In this regard, I intend to periodically improve the specialized books and to develop new course and practical activities materials. I will also focus on the teaching activity addressed to the pharmacists enrolled in the postgraduate training courses, given the high dynamics in the pharmaceutical field. I also propose to increase the educational process quality by modernizing our discipline laboratory with new equipment that will allow the introduction of new experimental activities adapted to current requirements.

At the same time, I intend to integrate in the courses as many examples from pharmaceutical practice and research as possible, and especially from my own scientific research activity, this teaching method allowing for a more effective understanding of the theoretical notions, resulting in a better knowledge accumulation and an interest of students for the scientific research activity.

The **scientific activity** I conducted during the post-doctoral period focused on the following main research directions:

1. *Application of physico-chemical methods and classical experimental statistical design techniques combined with response surface methodology and Taguchi technique in the development of drug systems*. I targeted the design and characterization of some topical delivery systems based on collagen (hydrogels and spongious matrices), collagen biocomposites obtained from collagen and other polymeric or non-polymeric biomaterials, collagenated textile meshes, in which I incorporated drugs in various forms (free, encapsulated, free and encapsulated). I set the kinetic mechanism of drug release from the designed delivery systems. In addition, collagen biocomposites with an anti-inflammatory drug incorporated in various forms proved therapeutic potential after healing of burns induced to experimental animals. I also characterized other drug delivery systems based on various biopolymers, intended for topical or oral administration. Part of the these researches were accomplished within 4 projects won following CNCSIS/UEFISCDI competition (as Director - 2 and UMFCD Partner Responsible - 2).

2. *Valorization of the biopharmaceutical potential of medicinal and aromatic plants*. Within this direction, I followed the incorporation of essential oils / tinctures from medicinal or aromatic plants into various collagen-based release supports in the absence / presence of drugs, and their evaluation. Also, I targeted the design and characterization of some cosmetic formulations based on vegetable oils, essential oils, collagen hydrolysate or seaweed.

3. *Use of experimental statistical design techniques to optimize the operational parameters in various technological processes*. Considering the low yield of essential oil extraction, I sought to optimize the operational conditions for the production of essential oils from medicinal and aromatic plants. In the frame of a UEFISCDI competition research project (UMFCD Partner Responsible) I optimized the biotechnological process for obtaining yeast and derived products.

In parallel with these research directions I was / am involved as member in the teams of several projects coordinated by professors from the Faculty of Pharmacy, UMFCD.

The scientific results from the post-doctoral period were disseminated through: chapters in specialized books at international publishing houses (3); papers in ISI journals (58 from which 2 *in press*, for 37 - main author), BDI (26), Proceedings not BDI indexed (13); studies (137) presented as conferences, oral communications and posters at scientific meetings and published as abstracts in journals and abstracts volumes with ISBN / ISSN (72), in ISI journals (3), in journals and abstract volumes without ISBN/ISSN (21), in meeting program (41); 1 patent and 4 patent applications (OSIM).

Concerning the **scientific activity evolution plan**, I intend to continue the researches in the field of hydrogels and, in this respect, I aim at the characterization of hydrogels obtained by methods other than those used up to now. I intend to continue the researches in the constantly expanding field of collagen biomaterials processed in various forms but also to approach other types of polymeric and non-polymeric biomaterials; in this context, I will pay a particular attention to the design and evaluation of new drug delivery supports for cancer therapy. The experience in the use of experimental statistical design techniques will allow me further a rational approach both for the formulation of new drug systems with different administration routes, of nutraceutical / veterinary bioproducts and for different technological processes. A new research direction I intend to develop is the use of thermal analysis techniques to assess drug stability, drug - excipients blends, or combinations of drugs. In this respect I underline the introduction in Vol. III from the series *Physical Chemistry of Drug*, of the subchapter Thermal Methods (Chapter 4 - Polymers characterization techniques), where I presented basic elements of this method.

I intend to disseminate the results of future studies by further publishing in ISI or BDI journals, by filing patent applications, thus foreseeing an increased scientific impact. I would also like to point out that in the coming years new subjects of utmost importance for the field may arise, so I will review and adapt to these novelties the main research directions mentioned above.

The References chapter also contains the own bibliographic references that supported the postdoctoral scientific activity presented in the habilitation thesis.

The elements presented emphasize the will to further develop the field of Physical and Colloidal Chemistry at the Faculty of Pharmacy, University of Medicine and Pharmacy “Carol Davila” Bucharest, a field with dynamic evolution and major importance for the pharmaceutical sciences, involving a continuous specialization of academic activity.