Polymeric antimicrobial systems used in the treatment of skin conditions

PhD. Student Chim. Alina Ionela STANCU

PhD. Advisor Prof. Dr. Ing. Anton FICAI

Abstract

Infections remain a major cause of morbidity, mortality and healthcare costs, and the rise of antimicrobial resistance significantly amplifies this burden. Globally, in 2019, bacterial resistance was primarily responsible for approximately 1.27 million deaths and was associated with about 4.95 million deaths, exceeding the burden of priority infectious diseases such as HIV/AIDS or malaria. These data validate the need for research into new strategies for the prevention and treatment of infections, including the development of formulations with local action and a superior safety profile. Beyond the rise of antimicrobial resistance, the clinical burden of severe infectious syndromes also remains very high. In this context, the choice of a theme focused on the treatment of infections is both scientifically and societally justified. Skin health depends on the integrity and balance of its microbiome. Imbalances favor the establishment of infections, delay healing, and increase the risk of recurrence. At the same time, the alarming increase in antibiotic resistance reduces the effectiveness of conventional topical therapies, and their prolonged use can affect the commensal flora and barrier integrity. In this context, it becomes essential to identify effective antimicrobial alternatives, "microbiome friendly," and well tolerated locally. This thesis addressed a current clinical and technological problem: the need for "microbiome friendly" topical alternatives for the control and treatment of skin infections, in the context of increasing antibiotic resistance and the limitations of conventional therapies. The proposed strategy, the integration of natural compounds (particularly essential oils and plant tinctures) into polymer-based delivery systems and/or β-cyclodextrin inclusion complexes, proved to be feasible, reproducible, and compatible with the requirements of skin application.