

Abstract

The habilitation thesis “**Advances in the Development and Optimization of the Composite Polymeric Membrane Material for Environmental and Biomedical Applications**” summarizes the candidate's scientific achievements after acquiring a Ph.D. title. It is divided into three parts.

The first part was dedicated to the contest and motivation for the development of the Habilitation thesis, as well as the presentation of the candidate's major professional and scientific achievements (projects, scientific papers, books, conferences, and other relevant activities).

The second part presents the main scientific results of the thesis and it is structured on two chapters. Chapter 1 - **Polymeric composite membranes for water treatment** presents the results obtained from the derivatization of cellulose acetate membrane surface for water treatment and also the increase of the polymeric membrane efficiency by introduction within the polymeric matrices' various complex inorganic fillers such as HA, LDH, and dopped GO with TiO₂. The synthesized membrane and composite membranes were structural and morphologically characterized using complex characterization methods. The membrane's performances were tested in terms of water flux, permeability, and drug retention. Chapter 2 – **Polymeric composite membranes for the biomedical field** describes a new application for biopolymeric composite membranes containing a biopolymer and various fillers or derivatized fillers. This chapter involves the synthesis of the composite biopolymeric membranes by incorporation of the reinforcing agent within the polymer matrices using ultrasonication. In the first part of the chapter, it is described the derivatization of the cellulose acetate membrane with resveratrol for osseointegration. In the second part of the chapter, the mechanical properties of the biopolymer were increased by incorporating various fillers, such as hydroxyapatite and mesoporous silica. In the last part of the chapter, to increase the compatibility and adhesion between the biopolymer matrices and the fillers we derivatized the surface of the carbonaceous material with a surfactant and metallic nanoparticles. The synthesized materials were characterized in terms of structural and morphological point of view. Thermal, mechanical, and antimicrobial activity of the as-synthesized materials were also tested.

The third section of the Habilitation Thesis offers the plans of evolution and development for scientific activity, including comprehensive future research directions that are expected to boost the candidate's scientific impact.