Abstrakt

This thesis focuses on the development of supramolecular biocompatible polymer nanosystems for biomedical applications. Infectious diseases and inflammation pose significant challenges today, further exacerbated by the increasing prevalence of antibiotic resistance. Motivated by these urgent issues, this work aims to address these challenges comprehensively through the use of advanced polymeric systems. The thesis is organized into three main objectives, each targeting a specific aspect of this overarching problem. The first part of the thesis involves the design and characterization of block copolymers based on poly(ethylene oxide)-*b*-poly(*ε*-caprolactone), with a modification to the hydrophobic segment by introducing a second monomer, *γ*-butyrolactone. This modification aims to tailor the copolymer's biological behavior, particularly its enzymatic degradation, to optimize it for use as a drug delivery system for the antibacterial antibiotic rifampicin. The second objective explores the self-assembly behavior of chloroxine, an antimicrobial drug, focusing on the preparation of stable nanocrystalline particles via precipitation using polymeric non-ionic surfactants. This approach is intended to enhance the solubility and bioavailability of chloroxine, thereby improving its therapeutic efficacy. The third part of the thesis is dedicated to the development of a polymer-based potentiometric sensor designed for in situ detection of inflammation-related reactive oxygen species (ROS). The sensor features a layer composed of porphyrin cores linked by bis(thiophene) bridges, with metal ions embedded within the porphyrin structure. The entire sensor layer is shielded by covalently bonded poly(2-methyl-2-oxazoline) to prevent the adsorption of serum proteins. Upon exposure to specific ROS, the sensor exhibits a measurable change in electrical potential, with sensitivity sufficient to detect the early stages of inflammation and infection. This thesis presents a comprehensive approach to the development of polymer-based nanosystems for the treatment and detection of infectious diseases and inflammation, addressing key challenges in modern medicine.

Key words: controlled polymerization, self-assembly, nanoprecipitation, enzymatic degradation, antibacterial drug delivery, early detection of inflammation