There is much interest in the development and fabrication of new effective drug delivery systems that are intended to transport hydrophobic active agents to the site of action and release the content in a controlled manner by the influence of endogeneous or exogeneous triggers as pH, redox potential, light, ultrasounds, temperature changes, lysosomal enzymes etc. For the formation of such carriers structures grafted by reactive sensitive functions are used that allows the release characteristics of active payloads to vary in the response to distinctive stimuli, either internal (changes in pH, enzymes or redox gradients) or external (variations in ultrasound intensity, magnetic field, or light irradiation).

The present project focuses on the development of the scientific background for design and formation of pH sensitive nanostructures, including thin films or nanocapsules membranes. An important issue in this context is related with syntheses and comprehensive physico-chemical characterization of adsorption and aggregation properties, of new amphoteric surfactants and amphiphilic polyelectrolytes, obtained by chemical conjugation of a hydrophobic chain or an antimicrobial function to the polyelectrolyte backbone via a pH-labile moiety. Then, using a mixture of the obtained surfactants and polyelectrolytes, we will construct nanostructures sensitive to the pH trigger. Formation of thin films with pH-sensitive polyelectrolytes or surfactant/polymer complexes will allow to achieve antimicrobial or hydrophobicity modifying coatings that upon changing pH of the environment can be removed in a desired and controlled way. If such films are used as micro- or nanocapsules coatings their active ingedients can be released with the rate controlled by external pH. Systematic studies will be performed on the type of pH-labile linker and the length of the hydrophobic moiety, either in the surfactant structure, or in the functionalized polyelectrolyte, on their adsorption and aggregation behavior at the interfaces and in solution. The proposed project will also attempt to provide the description of experimental results data by theoretical model. That will allow physical interpretation of the results and elaborating principles of the design of pH-sensitive nanosystems sensitive to pH. That type of integrated approach is rather scarce in the literature of this subject.

New materials, obtained in the project, will make possible to form pH-triggered nanostructures such as thin films or nanocapsules. The acquired results will extend our knowledge and broaden ability to design pH-responding functional materials for e.g. biomedical applications as pH-triggered release nanocapsules.