Title: Self-assembly in mixture of surfactants and stimuli-responsive polymers with complex architecture

Author: Anna Bogomolova
Department: Physical and Macromolecular Chemistry
Supervisor: PhD. Sergey K. Filippov, IMC AS CR, v.v.i.
Supervisor's e-mail address: filippov@imc.cas.cz

Abstract: The issue of construction of complex multi-block copolymers is currently one of the most researched areas. It became a logic consequence of the continuous development in polymer chemistry. Nowadays, a great interest is attracted to multi-responsive block copolymers. As a rule, they consist of hydrophilic, hydrophobic and responsive blocks. That responsive block can be either thermo-sensitive or pH-sensitive as well as sensitive to some other external stimuli. In the present work, we will try to cover topic of stimuli-responsive block copolymers and their interactions with different types of surfactants. Understanding of polymer/surfactant interactions can be a crucial step for future modeling of drug/polymer or protein(DNA)/surfactant interactions. There is a great interest in the investigation of polymer-surfactant interactions. However, while the homopolymer-surfactant interactions are characterized well enough, the same interactions for block copolymers are poorly described. The main development in the latter topic has been achieved for Pluronic molecules (block copolymers of PEO and PPO) in the presence of a variety of surfactants. In our work we took an attempt to expand our knowledge about polymer-surfactant interactions to the more complex systems and to figure out the driving forces for such processes.

Within this work we analyze two principal systems, thermo-sensitive block copolymers on the base of poly(2-alkyl-2-oxazolines) in the order of increase the structure complexity of polymers and their behavior in the presence of ionic and polymeric surfactants, and pH-sensitive polymers on the basis of amino acids in the presence of nonionic surfactant. Three articles devoted to the former topic and one article devoted to the latter one topic have been published and included in the current doctoral thesis.

We also pay a great attention to the careful analysis and interpretation of isothermal titration calorimetry data that is an important aspect of the present work. We took an attempt not only to qualitatively characterize the experimental results, but also to provide the quantitative analysis by using the modern regular solution theory.

We believe that the findings obtained in the present work can lift a veil in understanding the interaction mechanisms between polymers of the complex structure and different surfactants and also shed light on the methods of their characterization.

Keywords: self-assembly, polymer/surfactant interactions, calorimetry, light scattering, small angle X-ray scattering.