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The topic of the doctoral dissertation: **Macroscopic rheological properties of macromolecular solutions**

Particle transport in complex fluids is often determined not only by the chemical composition and properties of the particles but also by the length scale of the particles present in a given system. Processes limited by the rate of diffusion in living organisms strongly depend on the transport possibilities of the environment, e.g., cytoplasm viscosity. Macromolecular crowding in cells influences the macroviscosity of the cytoplasm and the viscosity felt by proteins on the nanoscale. The approach to scaling mixtures of macromolecules allowing for a standardized description of their scale-dependent viscosity seems essential.

The aim of the research presented in this dissertation will be to determine empirical scaling equations that define the viscous flow of macromolecules in solution. I will consider macroviscosity in various concentration regimes for aqueous polymer solutions and lysates of *Escherichia coli* bacteria.

In the literature part, I will discuss theories describing macromolecular solutions and prepare a review of the work to date on the above subject. This chapter will also explain the model complex systems that were used for the research: aqueous polymer solutions and bacterial lysates being an example of living organisms. The next step will be to present the theoretical basis of the methods used in the research work. I will describe the apparatus and materials used to conduct the experiments.

The experimental part will be devoted to the obtained results and their analysis. Dependencies of macroviscosity on the length scale and concentration of polymer solutions will be discussed, as well as rheological measurements (both viscosity measurements and viscoelastic measurements) in complex biological systems such as Escherichia coli lysates. I will present an empirical scaling equation for mixtures of macromolecules.

The work will end with a summary in which the essential conclusions will be presented.