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The summary of PhD thesis pt. "The description of mass transport phenomena in channels of chosen natural and synthetic membranes"

Membrane processes play an import role both in industry and many biological processes. The goal of this thesis is to describe the mass transport phenomena in channels of chosen natural and synthetic membranes. For natural membranes two types of channels were investigated: KcsA and BK, both belonging to potassium ion channels family. For synthetic systems transport phenomena of nitrogen and oxygen ions through magnetic membranes were investigated.

KcsA channel is a prokaryotic potassium ion channel, which is activated by internal concentration of H^+ ions and gated by transmembrane potential. Selectivity filter in an important part of this channel and it is responsible for selectivity of this channel. A transport model of potassium ions through the selectivity chains is proposed. The model is based on absorption Markov chains and includes electrostatic interactions between potassium ions and carbonyl groups.

In the next part of the thesis the BK channel was analyzed. BK channels are potassium ionic channels, which are gated by internal Ca^{2+} concentration and transmembrane potential. Two kinetic models based on diffusion approach were proposed in order to describe the gating kinetics and reproduce experimentally measured current records. The obtained models predict dichotomous traces, which are concurrent with experimental measurements.

For synthetic system magnetic membranes were investigate. Magnetics membranes are able to separate oxygen molecules from air based on different magnetic properties of nitrogen and oxygen gases. Few theoretical concepts are proposed in the thesis like magnetic channels and magnetic aggregation. The obtained model is able to reproduce experimentally recorded streams of both gases through the magnetic membranes and is able to predict the properties of the system in the cases not studied experimentally.