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THE DEVICE AND PROPERTIES OF MEMBRANE MINI-REACTORS IN THE TASKS OF SORPTION PURIFICATION OF SOLUTIONS AND SUSPENSIONS FROM MICROELEMENT IONS

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Abstract. The article discusses the design and properties of a new class of chemical technology devices – membrane mini-reactors (MR), designed to implement sorption processes in heterogeneous systems based on the principle of "minimum intervention and energy consumption". MR is able to accommodate a relatively small volume of the working suspension of the sorbent (1–10 ml) and allows to carry out sorption processes in relation to liquids and their suspensions located behind the outer wall of such a mini-reactor. The walls of MR are a semi-permeable membrane that provides mass transfer through its surface of ions and sorbate molecules, but prevents the transfer of sorbent / extractant particles. As an example, the article considers membrane MR filled with a suspension / powder of a highly selective sorbent of the Prussian Blue class (PB), the walls of which are made of a semi-permeable track membrane with a pore diameter of 1 nm – 50 μm. The operation of the reactor when placed in the purified medium is carried out spontaneously due to the creation of a gradient of the chemical potential of the extracted ions inside the MR and in the external environment. It is shown that the sorption of ions Cs(I) by the sorbent PB placed in the MR proceeds in the diffusion mode of mass transfer of ions, the influence of the lateral flow rate of the solution along the membrane surface, the area of the porous medium, pore size and temperature on the coefficient of mass transfer rate of cesium ions through the membrane is established. A comparison of static and kinetic parameters of sorption of CsCl sorbents in MR with the data of the model of statics and kinetics of competitive purification of silica gel suspension with sorted cesium ions ($SiO_2(Cs^+)$) at contact of the mini-reactor with the sorbent PB is carried out. It is concluded that it is possible to autonomously purify silica gel and soil samples in contact with MR containing sorbents of the PB class.