Construction of mathematical models of extraction processes with non-local conditions by a spatial variable

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Abstract: In this paper we consider issues of constructing mathematical models of extraction processes from solid polydisperse porous materials considering the porosity of structure of particles, taking into account the connection of the residence time of fractions with particle size in the extractant, based on inverse problems of recovery of coefficients of diffusion processes under various variants of boundary conditions by a spatial variable.

We consider a mathematical model which models the extraction process of a target component from the polydispersed porous material. The suggested model is demonstrated by the example of a at solid material with bidispersed pores of different size in the form of a system of channels of macropores with micropores facing their walls. The macropores and the micropores in the material have homogeneous size. We model a case when micropores of the solid material (dispersed medium) are initially filled with an oil (dispersion phase), which is our target component. And the macropores are filled in with a pure solvent. In the process of extraction the oil diffuses from the micropore to the macropore, and then from the micropores to the external solvent volume, wherein the ratio of concentrations in the macropore and the micropore is taken in accordance with the linear law of adsorption. The well-posedness of the formulated mathematical model has been justified.

The theoretical mathematical science has deep enough advanced in solving inverse problems for diffusion processes. And besides, as a rule, the problems are researched under simplest selfadjoint boundary conditions by a spatial variable. Unlike the mentioned works we propose to consider the problems with more general boundary conditions by a spatial variable. The selfadjointness of the boundary conditions is not assumed, only requirement of their regularity by Birkhoff is sufficient. The inverse problems researched by us are directly obtained from mathematical models of technological processes.

Keywords: extraction processes, non-local conditions, inverse problems

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