# MATHEMATICAL SIMULATION OF THE COUNTER-CURRENT ION-EXCHANGE.

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Ion-exchange processes, which are realized in counter-current columns [1,2], find industrial use. So, the mathematical simulation of these processes and control parameters optimization are of great interest [3].

In this work the non-stationary ion-exchange processes in counter-current columns are simulated, taking into account interphase (ionite-solution) transfer, convection, and diffusion [1].

The propagation of the artificial disturbance of the exchanged substance concentration in the counter-current column is investigated. Then it is possible to get the information on the dynamical parameters using measured and calculated component concentration time-dependent distributions for the column cross-section. This disturbance is either generated by the instantaneous introduction of the exchanging substance portion, or the concentration distribution is taken as a step function at the initial moment. Then, the initial conditions are either singular, or are the discontinuous one.

In the first case the mathematical problem is to find the solution of the system of two differential equation of the parabolic kind with an initial condition assigned by Dirac delta-function. The algorithm of this problem consists of two stages: the approximate analytical solution is constructed for the initial period and then the problem is solved by finite-difference method.

Small parameter limit change to the simpler mathematical models, for which the approximate analytical solution can be found, was investigated numerically. Concentration distributions were calculated with the help of this algorithm, being well with experimental data. Dynamical parameters of the counter-current ion-exchange processes were found using the calculation results [4].

In the case of the investigation of the component-concentration step-like disturbance, the mathematical problem is to find the solution of two hyperbolical quasi-linear differential equations with the initial conditions with discontinuity of the first kind. This problem was solved numerically by the finite-difference method [5].

Mathematical features of the problem were studied, such as the transformation of the strong solution break into the weak one with limited derivatives, existence of the solution in the form of traveling waves and so on.

The problem of the component accumulation was solved for the two-section ion-exchange column, in sections of which there were different physical-chemical conditions. The influence of the equilibrium isotherm non-linearity was investigated and the optimal parameter values were found.

**References**


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