

NUMERICAL MODELING OF SUSPENSION FLOW WITH DEPOSITION IN POROUS MEDIA

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Suspension flow in porous media occurs with two kinds of particles deposition: irreversible and reversible [1]. The process is modeled by differential equations: describing full mass balance equation, kinetic equations for each kinds of accumulation and Darcy's law. In the one-dimensional case equations are:

$$m_0 \frac{\partial c}{\partial t} + v_0 \frac{\partial c}{\partial x} + \frac{\partial \rho_a}{\partial t} + \frac{\partial \rho_n}{\partial t} = D \frac{\partial^2 c}{\partial x^2}, \quad \frac{\partial \rho_a}{\partial t} = \frac{\beta_a}{1 + \gamma |\nabla p|} c - \beta_a \frac{\rho_a (\omega + |\nabla p|)}{\rho_{a0}} c_0,$$

$$\frac{\partial \rho_n}{\partial t} = \beta_n (\rho_n) c, \quad v_0 = K(\eta) |\nabla p|, \quad m = m_0 - (\rho_a + \rho_n), \quad K(\eta) = k_0 m^3 / (\epsilon - m)^3.$$

$$\beta_n(\rho_n) = \begin{cases} \beta_{n0} & \text{for } \rho_n \leq \rho_{n1}, \\ \beta_{n0} \frac{\rho_{n1}}{\rho_{n0} - \rho_{n1}} \left(\frac{\rho_{n0}}{\rho_n} - 1 \right) & \text{for } \rho_{n1} \leq \rho_n \leq \rho_{n0}, \\ 0 & \text{for } \rho_n > \rho_{n0}, \end{cases}$$

where, c is volume concentration of particles in suspension, v_0 is filtration velocity, ρ_a , ρ_n are concentrations of deposited particles in active and passive zones, respectively, D is diffusion coefficient, β_a , β_n are rate coefficients of deposition active and passive zones, respectively, $|\nabla p|$ is module of the pressure gradient, m is porosity, $K(\eta)$ is filtration coefficient.

Here dynamic factors in the washable part and "oldening" phenomena in the non-washable part are taken into account. The problem is numerically solved. The influences of these factors on filtration characteristics are analyzed.

References

1. Gitis V., Rubinstein I., Livshits M., Ziskind M. Deep-bed filtration model with multistage deposition kinetics // *Chemical Engineering Journal* 2010, **163**. 78-85.