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Optimization of thermosolutal convection in vertical porous annulus with a circular baffle

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Abstract

An enclosed annular geometry with a conducting baffle attached to one of the thermally active walls aptly represents many scientific applications. This article reports the thermosolutal convection in a vertical cylindrical porous annulus with a thin baffle attached to an inner cylinder. The vertical left and right walls of the annular space are differently heated, whereas the top and bottom walls are thermally insulated. A finite difference method based numerical technique has been adapted to solve the governing model equations. Numerical simulations are carried out for various parameter ranges in the interest of capturing the influence of thermal Rayleigh, Darcy and Lewis numbers, buoyancy ratio, baffle length and location on flow pattern, heat and mass transport. From the numerical results it is found that, the heat and mass transport can be effectively enhanced or suppressed by the appropriate choices of baffle length and location. In particular, the thermal and solute transport rates are suppressed with the length of baffle. However, transport rates can be enhanced by positioning the baffle towards top adiabatic wall. Numerical predictions made in this analysis can be utilized for the design of heat exchangers and chemical impellers.

Keywords:
Thermosolutal convection, Porosity, Annulus, Baffle

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