Summary: A comprehensive numerical study of convective instability of nanofluid flow in a vertical channel filled with a highly permeable porous material is investigated due to internal heat source effect. The Brinkman-Darcy model has been taken which incorporates the influences of thermophoresis and Brownian motion. A normal mode technique has been employed on the disturbances equations to get the generalized eigenvalue problem and which is solved by Chebyshev spectral collocation method via QZ algorithm in MATLAB. Finally, the critical modified Grashof number \((Gr'_c)\) and corresponding wavenumber \((\alpha_c)\) have been calculated and portrayed for the flow-governed parameters. It is found that instability boundaries can be reduced or increased by the governing parameters due to the heat source effect. Further, it is discovered that the shape of the isotherms and isonanoconcentrations changes from a bi-cellular structure to a tetra-cellular structure as strength of the internal heat increases, but the streamlines remain at bi-cellular structure.

MSC:
76E06 Convection in hydrodynamic stability
76S05 Flows in porous media; filtration; seepage
76T20 Suspensions
76M22 Spectral methods applied to problems in fluid mechanics
80A19 Diffusive and convective heat and mass transfer, heat flow

Keywords:
Brinkman-Darcy model; Brownian motion; linear stability analysis; thermophoresis; normal mode method; Chebyshev spectral collocation method

Software:
Matlab

Full Text: DOI

References:


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