Concentration Modulation Effect on Weak Non-linear Thermal Instability in a Rotating Porous Layer

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ABSTRACT

The present article is to study mass transfer in a rotating porous layer subjected to impose time-periodic solutal boundaries. A weakly nonlinear analysis to investigate mass transfer in a porous medium. The mass transfer coefficient is calculated by the cubic Ginzburg Landau (GLE) amplitude equation. In this article, stationary and oscillatory convection are discussed in the presence of the rotating solutal Rayleigh number. The amplitude equation (GLE) is solved numerically to calculate finite temporal convective amplitude. This amplitude is used to find the Sherwood number in terms of the various system parameters. The effect of individual parameters on mass transport is discussed in detail in the presence of lower rotational rates. The onset of convection is discussed through the stability curves for stationary and oscillatory solutal critical Rayleigh number as a function of wavenumber. Further, it is found that the mass transfer enhances for the modulated system rather than the un-modulated system. Internal solutal number Si is to enhance for higher values and diminishes the mass transfer for lower values. Finally, it is also found that rotation and solutal modulation can be effectively used to enhance or diminish mass transfer.

Keywords: Darcy convection; Concentration modulation; Rotation; Nonlinear theory.

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