Gravitactic Bio-Thermal Convection Oscillates Vertically in a Porous Layer

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Abstract The onset of stationary convection is examined in a homogeneous suspension of gravitactic micro-swimmers in a thermally stratified porous layer subject to vertical oscillation. For the situation of high-frequency and low-amplitude vertical oscillation, the governed model-averaged differential equations are presented. The monotonic stability boundary for stationary convection was obtained using the Galerkin method. The influence of the altered thermal Rayleigh-Darcy number, R_a, on the modified bioconvection Rayleigh-Darcy number, R_b, is numerically examined. Due to porous media, the bioconvection strength is less in results than its non-existence.

Keywords Gravitactic · Stability · Time-averaging technique · Thermal · Porous

Nomenclature

$\tilde{b}$	Vibration amplitude [s]
c_a	Measure of acceleration [–]
c_p	Specific heat at constant pressure [J/kg.K]
D_a	Darcy number [–]
$\overline{D_c}$	Mean Diffusivity of gravitactic swimmers [m²/s]
$\mathbf{g}$	Gravity [m/s²]
h	Depth of the layer [m]

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