

Electromagnetic Hybrid Nano–Blood Pumping via Peristalsis Through an Endoscope Having Blood Clotting in Presence of Hall and Ion Slip Currents

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Abstract

This article refers to an investigation of peristaltic transport of hybrid nanoparticle suspended blood through an endoscopic annulus with elastic walls in the existence of blood clotting under electromagnetic forces (EMF). The dual effects of Hall and ion-slip currents are accounted for. The energy equation is formulated invoking internal heat source and viscous–Ohmic dissipation terms. Blood is used as a base fluid, and silver and aluminum oxide nanoparticles are dispersed in order to have a hybrid blood suspension. The impacts of the geometrical shape of nanoparticles are examined. The governing partial differential equations (PDEs) for the proposed flow model are simplified under the assumption of long wavelength and low Reynolds number. The transformed non-linear coupled PDEs are solved analytically by employing the homotopy perturbation method (HPM) with Mathematica computational software. The graphical illustrations are presented to interpret various flow constraints of interest. Outcomes reflect that the Hall and ion slip parameters have diminishing behavior on the blood flow while the opposite fashion prevails on it for increasing Hartmann number. Augmenting Hall and ion slip parameters result in an upsurge in the blood temperature. Expanding the volume fraction of nanoparticles enhances the blood temperature. Hall and ion slip effects are to reduce the wall shear stress (WSS) at the peristaltic wall. The maximum amplitude of the heat transfer coefficient is computed for the brick shape of nanoparticles when compared to the other shapes of nanoparticles. The streamlines are configured with trapping ed bolus phenomena to outline the blood flow pattern in the endoscope. Our model may be pertinent to physiological systems, medical simulation devices, transport phenomena in pharmacology, nano-pharmacological delivery systems, surgical procedures, etc. In endoscopy, a magnetic force field is used in order to detect or treat diseases.