Outlining Impact of Hybrid Composition of Nanoparticles Suspended in Blood Flowing in an Inclined Stenosed Artery Under Magnetic Field Orientation

Published: 23 November 2020

Volume 11, pages 99–115, (2021) Cite this article

S. Das ✉, T. K. Pal & R. N. Jana

Abstract

In this theoretical analysis, our main concern is to explore the physical consequences of hybrid nanoparticle (NP) suspension in blood flowing through an inclined artery with mild stenosis filled with porous substances under the influence of a uniform magnetic field and heat source or sink. Darcy's law is employed to predict the flow characteristics in the porous medium. The basic transported equations of blood flow in the diseased artery are formulated in a cylindrical coordinate system and simplified under the assumption of mild stenosis. The approximated analytical solutions based on the homotopy perturbation method (HPM) are achieved. Influences of significant physical parameters on the blood flow characteristics are displayed graphically and physical aspects are analyzed in detail. Graphical results based on the semi-analytical solutions reveal that the blood flow is appreciably influenced by the existence of stenosis at the arterial wall. The high concentration of hybrid nanoparticles significantly reduces the resistance impedance to the blood flow in a stenotic artery. The blood temperature due to the suspension of hybrid nanoparticles is found to be lower in comparison to copper blood or pure blood. The blood trapping pattern also manifests that the impulsion of hybrid nanoparticles speeds up the blood flow in the stenotic region. The rheological behavior of blood with hybrid nanoparticle (copper and alumina) suspension is examined because of decisive importance of nanoparticles in biomedicine, diagnosis, and treatment of arterial and cardiovascular diseases. It is believed that the simulated results hold key towards designing and analysis of bio-medical instruments or devices for great potential treatment modalities, nanodrug delivery systems, and anticancer drug industry, etc.