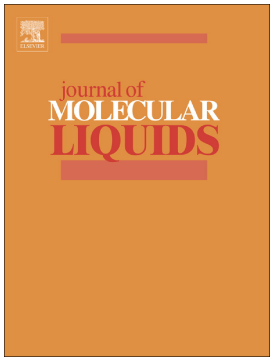

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ELECTRO-MAGNETO-HYDRODYNAMIC PERISTALTIC PUMPING OF COUPLE STRESS BIOFLUIDS THROUGH A COMPLEX WAVY MICRO-CHANNEL

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ABSTRACT

Biomimetic propulsion mechanisms are increasingly being explored in engineering sciences. Peristalsis is one of the most efficient of these mechanisms and offers considerable promise in microscale fluidics. Electrokinetic peristalsis has recently also stimulated significant attention. Electrical and magnetic fields also offer an excellent mode for regulating flows. Motivated by novel applications in electro-conductive microchannel transport systems, the current article investigates analytically the electromagnetic pumping of non-Newtonian aqueous electrolytes via peristaltic waves in a two-dimensional microchannel with different peristaltic waves propagating at the upper and lower channel wall (complex wavy scenario). The Stokes couple stress model is deployed to capture micro-structural characteristics of real working fluids. The unsteady two-dimensional conservation equations for mass and momentum conservation, electro-kinetic and magnetic body forces, are formulated in two dimensional Cartesian co-ordinates. The transport equations are transformed from the wave frame to the laboratory frame and the electrical field terms rendered into electrical potential terms via the Poisson-Boltzmann equation, Debye length approximation and ionic Nernst Planck equation. The dimensionless emerging linearized electro-magnetic boundary value problem is solved using integral methods. The influence of Helmholtz-Smoluchowski velocity (characteristic electro-osmotic velocity), couple stress length parameter (measure of the polarity of the fluid), Hartmann magnetic number, and electro-osmotic parameter on axial velocity, volumetric flow rate, time-averaged flow rate and streamline distribution are visualized and interpreted at length.

Keywords: *Peristalsis; Electro-Osmosis; Magnetohydrodynamics; Trapping; Biomimetic Propulsion; Bioinspired EMHD Micropumps.*