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Electrokinetic Micropumping Flow Model using Membrane Contraction DHARMENDRA TRIPATHI, Department of Mathematics, National Institute of Technology Uttarakhand, Srinagar, 246174,, V. K. NARLA, Department of Mathematics, GITAM Deemed to be University, Hyderabad, 502329,, YASSER ABOELKASSEM, Department of Mechanical Engineering, San Diego State University, California, 92182, — An electrokinetic micropumping flow model is developed to study the transient electroosmotic flow in a microchannel/capillary. A theoretical analysis based on the lubrication theory and the electrokinetic phenomena is derived to govern the flow motion. The pumping mechanism is generated by the rhythmic double membrane contractions on upper and lower walls of the microchannel/capillary. Symmetric and asymmetric membrane contraction with compression and expansion phases are considered to enhance the pumping efficiency. To implement the lubrication theory, ratio of tube radius to the tube length is assumed to be less than unity. Poisson-Boltzmann equations are employed to describe the electric potential function. The effect of parameters such as the electric double layer (EDL) thickness, electric field, membrane geometry on the pressure distribution, flow field characteristics, wall shear stress, and pumping flow rate are investigated. The results show that the induced pumping flow rate can be improved by incorporating the electro-osmosis mechanisms. This novel pump paradigm can be easily fabricated and customized for the use of micro transport of small volume liquid which can be utilized in many biomedical applications.

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