Numerical Investigation of Electroosmotic Flow in Convergent Divergent Micronozzle

V.Gnanaraj [1*],V.Mohan [2], B.Vellaikannan[3]

1. *Lecturer in Mathematics, Thiagarajar College of Engineering, Madurai Tamilnadu, India.*
2. *Professor of Mathematics, Thiagarajar College of Engineering,Madurai, Tamilnadu, India.*
3. *Lecturer in Mathematics, Thiagarajar College of Engineering, Madurai, Tamilnadu, India*

*Email: vgmat@tce.edu

A fundamental understanding of the transport phenomena in microfluidic channels is critical for systematic design and precise control of such miniaturized devices towards the integration and automation of Lab-on- a-chip devices. Electroosmotic flow is widely used to transport and mix fluids in microfluidic systems. Electroosmotic transport in convergent divergent micronozzle is significant in many applications, such as biomolecular transport, DNA transport in cell patch clamps. The goal of this paper is to develop a theoretical model of electroosmotic flow in micronozzle to gain a better understanding of transport phenomena in microfluidics channels. Numerical study of electroosmotic flow through convergent divergent nozzle microchannels has been developed in this paper. The governing equations consist of a 2D Poisson-Boltzman equation and a 2D Navier-Stoke's equation with Electric Double Layer(EDL) field. The potential distribution of the EDL in the channel is obtained by solving the non-linear 2D Poisson–Blotzmann equation using numerical technique. Then the solution for the 2D Navier-Stoke's equation for the velocity distribution is also obtained. The potential distribution of the EDL and the velocity distribution are compared with the results of COMSOL Multiphysics software. The comparison of numerical simulation results shows excellent agreement with the corresponding solution obtained using COMSOL results.

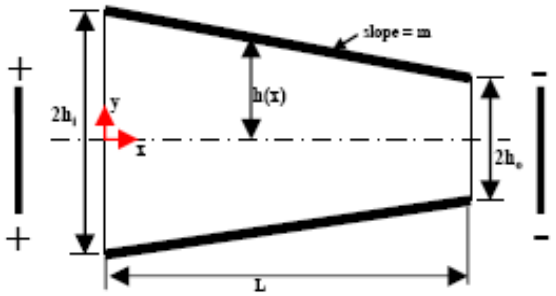

Figure 1: Geometry of the channel

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