Design of High Performance Micromixer for Lab on a Chip (LOC) Applications

Karthikeyan K*, Dr Natteri M Sudharsan, Dr L Sujatha
National MEMS Design Center (NMDC), Rajalakshmi Engineering College, Chennai, TamilNadu, India - 602105
Email ID: karthikeyan.k@rajalakshmi.edu.in

Introduction:

This poster presents the design and simulation of high performance micromixer for lab on chip (LOC) applications. We investigate micro fluidic flow characterization in straight and bended structures of micro channels. Compared to conventional diagnosis method in laboratories, these micro fluidics devices are biocompatible, minimal invasive, better performance, fast and well mixing in short time duration due to miniaturization along with cost reduction.

Computational Methods:

The Navier-Stokes equations solved by default in all single phase flow interfaces are the compressible formation of the continuity,

$$\rho(u.\nabla)u = \nabla.\left[-\rho l + \mu(\nabla u + (\nabla u)^T) - \frac{2}{3}\mu\,(\nabla.u)l\right] + F$$

$$\nabla.(\rho u) = 0$$

Transport of Diluted Species for studying the evolution of chemical species transported by diffusion and convection. Fick's law governs the diffusion of the solutes dilute mixture or solution,

$$\nabla.(-D_i\nabla c_i) + u.\nabla c_i = R_i$$

$$N_i = -D_i\nabla c_i + uc_i$$

Model Geometry:

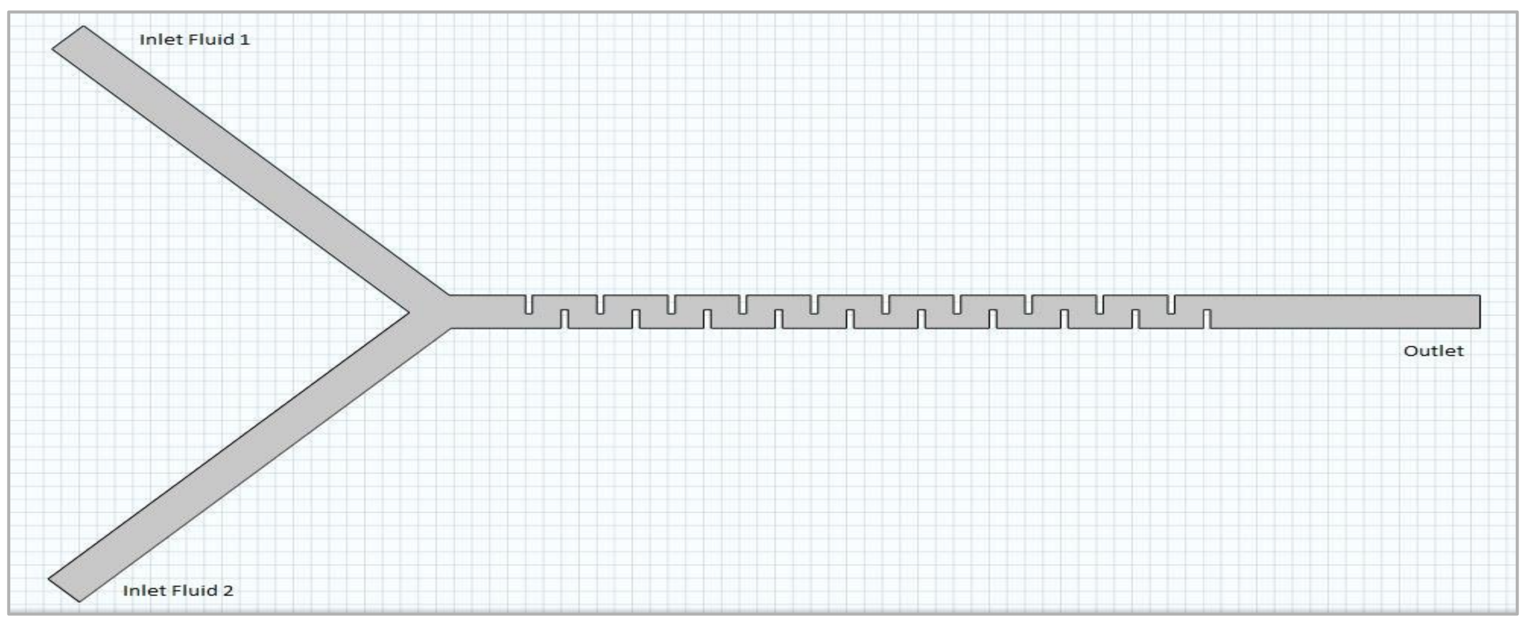

Figure 1. Model Geometry – Bended Channel

Results:

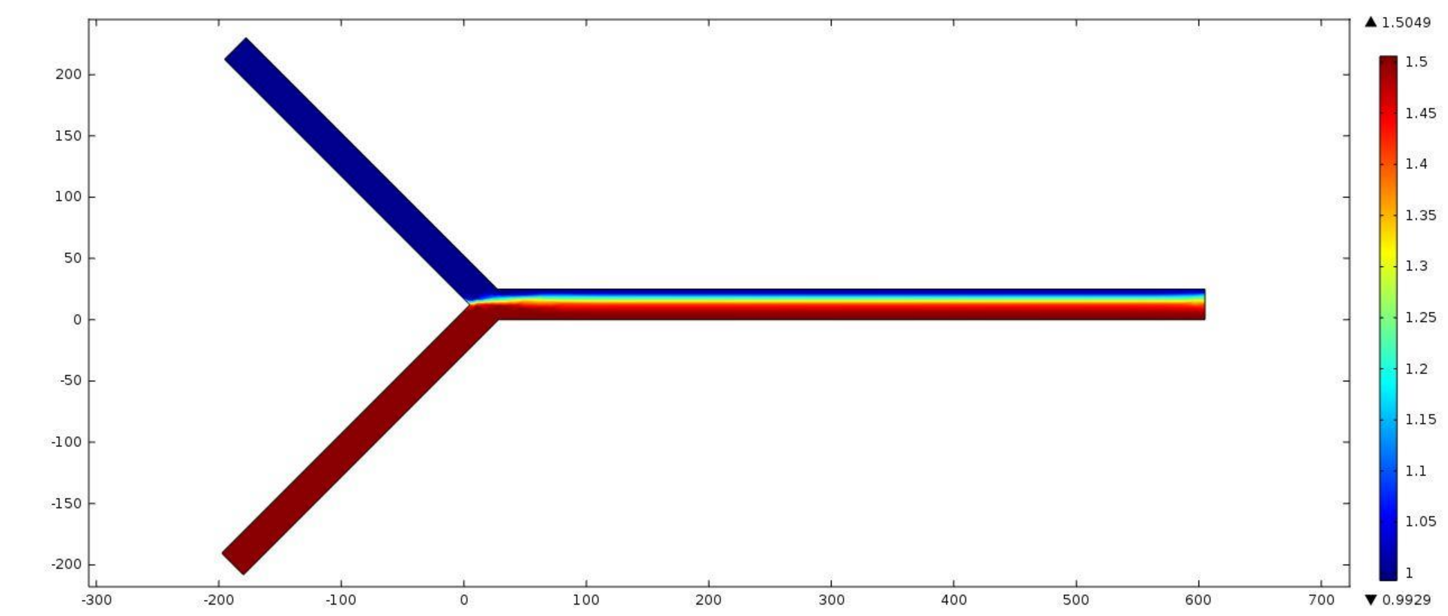

Figure 2. Straight Channel

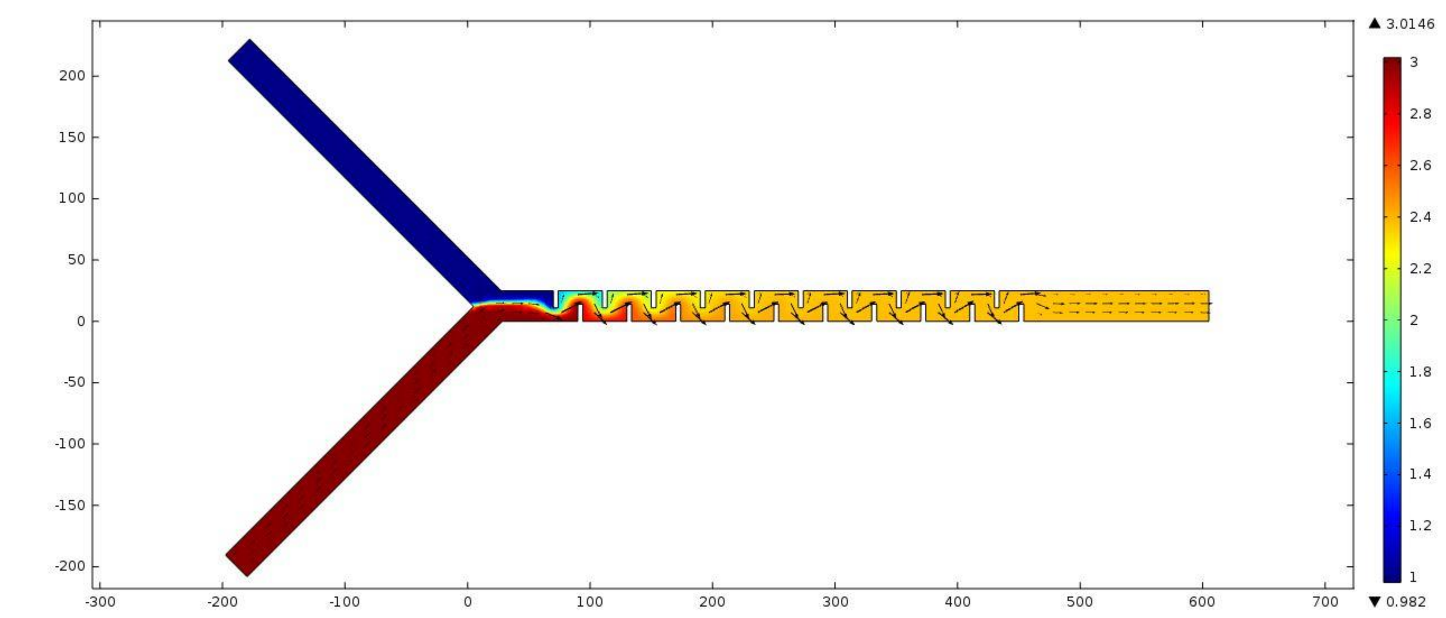

Figure 3. Bended Channel

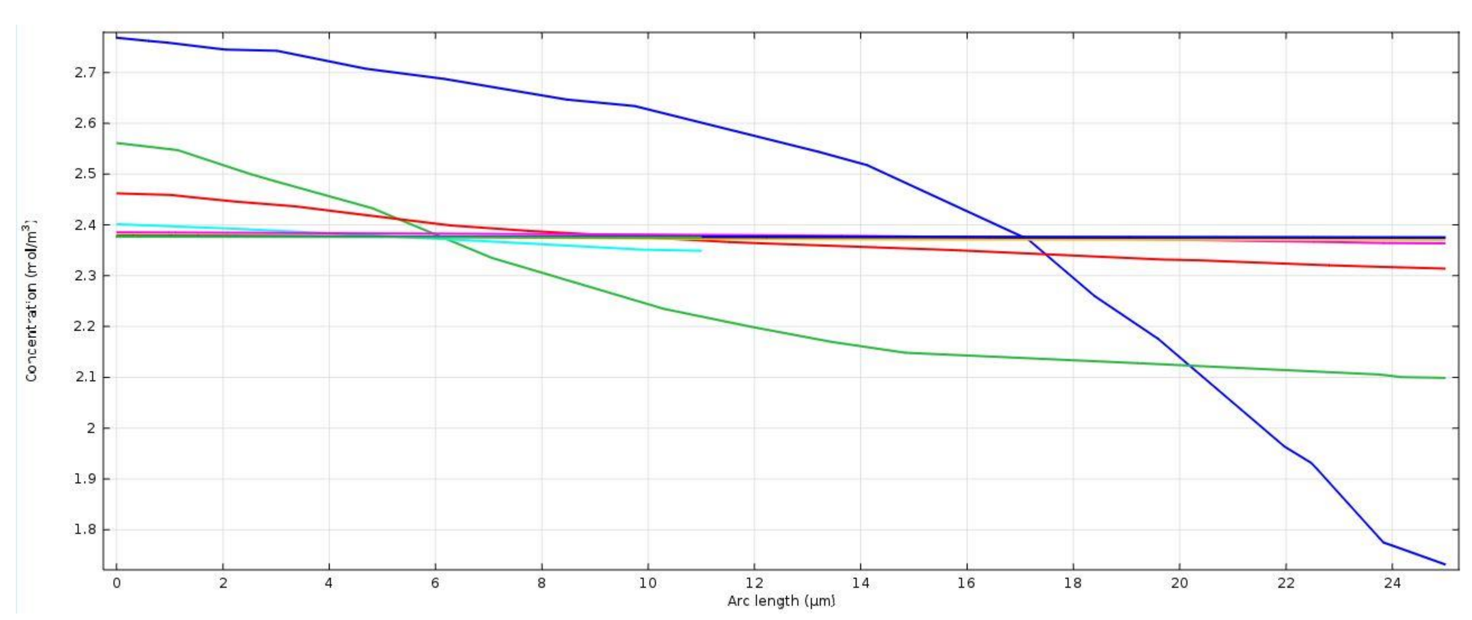

Figure 4. Graph for Concentration vs arc length (µm)

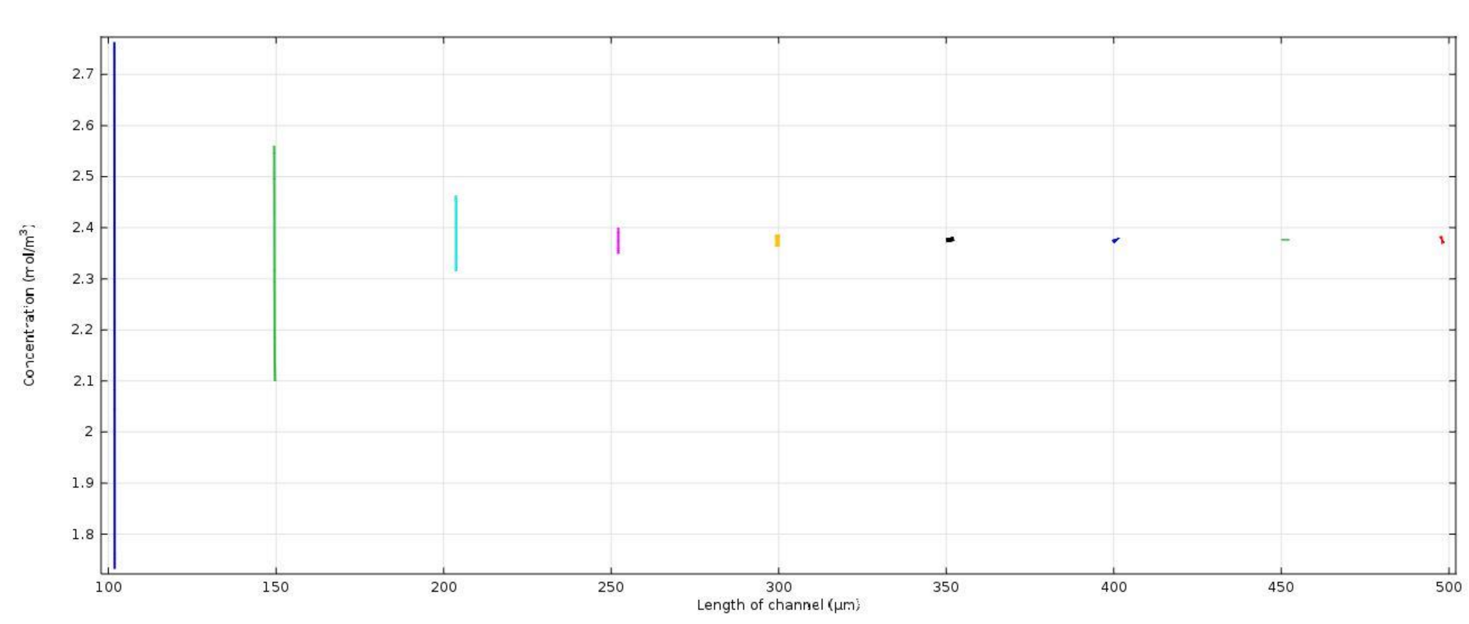

Figure 5. Graph for Concentration vs Length of channel

Conclusion:

When we are increasing the number of bends, the mixing takes place at a shorter length. Mixing is improved by providing bendings in the micro channel. In our case, the optimum length for mixing is found to be 300µm in bended channel compared to 600 µm in straight channel.

References:

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Excerpt from the Proceedings of the 2014 COMSOL Conference in Bangalore