Numerical analysis of liquid mixing in a T-micromixer with Taylor dispersion obstructions

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Micromixers play an important role in µTAS (micro-Total Analysis Systems) or lab-on-chips to carry out chemical, biomedical and biomedical analyses. Recently, they are also widely being used in the field of chemical processing for organic synthesis, reaction kinetic studies and chemical production. Passive micromixers are always preferred over active micromixers for micromixing applications as they are cheap, easy to fabricate and easy to integrate into complex systems. The inherent laminar nature of microfluidic flows and the absence of turbulence make mixing very difficult in passive mixers, particularly for liquids due to their very low diffusion coefficients. It is known that mixing can be enhanced due to velocity gradients in the flow known as Taylor dispersion effect. In the present study, this concept has been implemented in a passive T-micromixer by employing Taylor Dispersion Obstructions (TDOs) in the mixing channel. The mixing performance of T-mixer with TDOs (thin rectangular slabs) oriented in the flow direction has been evaluated in the *Re* range of 0 to 350. It is observed that in the low *Re*, the velocity gradients created in the flow by the presence of TDOs in the mixing channel are quickly damped due to the dominant viscous effects. This resulted only in a small improvement in the mixing quality in the *Re* range 0 to 100. The vortex nature of the flow in the *Re* range of 100 to 220 did not favor the creation of velocity gradients in the flow and therefore there is negligible effect due to the presence of TDOs in the mixing channel. However, a significant improvement in the mixing quality is obtained at high *Re* (250 to 350) with the presence of TDOs in the mixer. The increasing inertial effects in the flow with the increase in *Re* have sustained the velocity gradients generated in the flow due to the presence of TDOs in the mixer and thereby a considerable enhancement in mixing performance is obtained.

***Keywords*:** CFD; micromixer; mixing quality; obstructions; Taylor dispersion; T-mixer.