# Evaluation of the Tesla valve as a micromixer for $Fe_3O_4$ nanoparticles and contaminated water

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Plenty microfluidic applications are based on effective mixing among them water purification, where contaminated water needs to be mixed with water loaded with nanoparticles. In accordance with this, here, series of simulations are performed to succeed an effective mixing of iron oxide nanoparticles and contaminated water in the duct. The selected geometry for the simulations is the Tesla valve which is an alternative for usage as micromixer (Fig.1). In the present work, a stream loaded with $Fe_3O_4$ nanoparticles and a stream with contaminated water is numerically studied for various inlet velocity ratios and initial concentrations of the two streams. The Navier-Stokes equations are solved for the water flow while the discrete motion of particles is evaluated by a Lagrangian method. Outcomes are very promising since mixing efficiency reached up to 63% for $V_p/V_c$=20 under various inlet nanoparticles rates for two Tesla units (Fig. 2). Moreover, nanoparticles occupied a large percent of the height and the width of the micromixer near the common exit. In addition, the quantification of results exhibits a significant role of inlet rates to mixing efficiency for lower velocity ratio. Additionally, the crucial factor for mixing efficiency is the velocity ratio, which acquires a decisive role as increases.

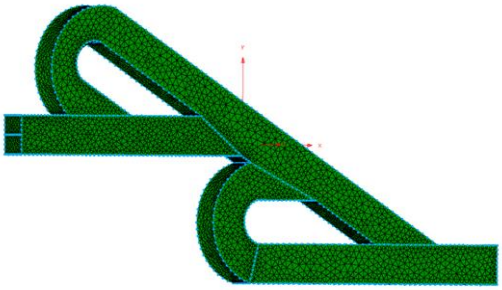

Fig. 1: Micromixer geometry with computational mesh.

Fig. 2: Distribution of nanoparticles (D = 13.5 nm) into micromixer for rate equal to 1000 particles/s under $V_p/V_c$ = 20

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## References

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