ABSTRACT

Microfluidics and process intensification are two research areas interested in the study and development of new micrometric-scale devices capable of manipulating and processing small quantities of reagents. These processes have to deal with small scale equipment and at the same time be as reliable and efficient as the large-scale one. Because of the scale of this equipment and the material it is made of, large pressure differential is not possible, as a consequence in the interior of the micromixers, as they are known; a laminar flow develops, under those circumstances the mixing process is controlled by the diffusion mechanism between the two components. One way to suppress this deficiency is to generate a chaotic flow on the micromixer, which can be done by using external energy (active micromixer) or its own flow energy (passive micromixer) through special geometry construction. The experimental development of such microdevices demands time and, generally, is very expensive. The main alternative for this activity is the use of computational fluid dynamics; this tool was employed on this work with the aim of studying three geometries proposed by Cunha (2007). To characterize their working process, four different volumetric flows were simulated and analyzed the pressure, velocity and mass fraction profiles. Two parameters were calculated in order to characterize their efficiency: the mixture quality along the micromixers cross sections and the pressure drop for different operational conditions. Although we have mesh size limitations and a mesh independent results were not obtained it was possible to compare the three micromixers geometries and it was found out that both M2 and M3 micromixers had the best performance under operational conditions tested ($120 < Re < 1200$).