Production of polymeric nanoparticles using Tesla valve microfluidic device fabricated by 3D-printer

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A challenge of microfluidic devices is the low flow rates of the fluids which results in a laminar regime generated inside the microchannels, indicating the mixing of fluids mainly depends on diffusion. Therefore, the addition of micromixer is important to increase the mixing performance of microfluidic devices. Tesla valve can allow fluid transverse dispersed by splitting and recombining, led to an improved blending. However, the production of complicated designed microfluidic devices as Tesla valve using conventional methods such as soft lithography supposed time-consuming, complex, and high-priced. In this work, Tesla structure microfluidic devices have been easily fabricated by using digital light processing 3D-printer within a short time (3 hours per device) in a single step. We focused on optimizing the mixing performance in microchannels by adding different obstructions inside the device. The 3D printed Tesla valve microfluidic device with cone-shaped obstructions showed the highest blending efficiency (100%). The polymeric nanoparticles synthesized by this platform present some physical properties which are possible using in drug delivery such as high homogeneity (PDI < 0.2) and small average size (<100 nm).