Implementation of a Reverse Staggered-Herringbone Microfluidic Mixer for High-throughput Polymeric Nanoparticles Synthesis

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Abstract

The goal of this research is to implement and optimize the operating conditions of a microfluidic mixer to synthesize polymeric nanoparticles (NPs) in a high-throughput fashion. Using a reverse staggered-herringbone microfluidic mixer that we recently designed, the effects of experimental conditions such as flowrate and reactant composition on NP characteristics were investigated and optimized. The device design allowed for physical contact between two streams of fluids – one containing poly(lactic-co-glycolic acid; PLGA) in acetonitrile and the other deionized water, to allow for efficient mixing and NP precipitation to occur. The resulting NPs were characterized using dynamic light scattering (DLS) and field-emission scanning electron microscope (FESEM) to determine the size distribution and shape. Results suggest that 0.1 wt% PLGA solution at 70 μL/min flowrate yielded the smallest diameter range and uniformly spherical particles. These optimized experimental conditions will be used to encapsulate drugs for controlled release studies and cell delivery *in vitro*. The project outcomes could lead to controlled-synthesis of efficient nanocarriers of drugs for targeted delivery applications.