

Formation of Microcapsules in Microchannel through Droplet Merging

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Abstract : Microparticles and microcapsules are basically used as a carrier for cells, tissues, drugs, and chemicals. Due to its biocompatibility, non-toxicity and biodegradability, alginate based microparticles have numerous applications in drug delivery, tissue engineering, organ repair and transplantation, etc. The production of uniform monodispersed microparticles was a challenge for the past few decades. However, emergence of microfluidics has provided controlled methods for the generation of the uniform monodispersed microparticles. In this work, we present a successful method for the generation of both microparticles and microcapsules (single and double core) using merging approach of two droplets, completely inside the microfluidic device. We have fabricated hybrid glass- PDMS (polydimethylsiloxane) based microfluidic device which has coflow geometry as well as the T junction channel. Coflow is used to generate the single as well as double oil-alginate emulsion in oil and T junction helps to form the calcium chloride droplets in oil. The basic idea is to match the frequency of the alginate droplets and calcium chloride droplets perfectly for controlled generation. Using the merging of droplets technique, we have successfully generated the microparticles and the microcapsules having single core as well as double and multiple cores. The cores in the microcapsules are very stable, well separated from each other and very intact as seen through cross-sectional confocal images. The size and the number of the cores along with the thickness of the shell can be easily controlled by controlling the flowrate of the liquids.

Keywords : double-core, droplets, microcapsules, microparticles

Conference Title : ICMN 2017 : International Conference on Microfluidics and Nanofluidics

Conference Location : Tokyo, Japan

Conference Dates : September 07-08, 2017