OPTIMIZATION AND EVALUATION OF MICROFLUIDIC- BASED HIGH THROUGHPUT SYTHNESIS OF LIPID- POLYMER HYBRID NANOPARTICLES

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Nanoparticles (NPs) are microscopic particles (<200) designed for drug transportation to target cells within the human body. NPs are effective for cancer therapy because the microscopic size of the NPs allows them to slip through the pockets between blood vessels surrounding cancer tumors and to the cancer cells themselves. The two most common types of NPs are polymer NPs and liposomes (Zhang, et al. 2008).

Polymeric NPs are known best for their drug encapsulation abilities but are hydrophobic in nature making traveling through the blood stream more difficult. However, liposomes are amphiphilic in nature but lack the ability to encapsulate and contain drugs over long periods of time (at least 24- 72 hours). A new lipid- polymer hybrid NP has been created which brings the best of both lipid and polymeric NPs.

To determine the most effective hybrid NP for drug loading, multiple parameters were tested and the Z- Average Size (d.nm) and Polydispersity Index (PDI) were calculated. These parameters included: polymer and lipid concentration changes, Total Flow Rate (TFR) variations, and Flo Rate Ratio (FRR) alterations. It was hypothesized that the hybrid NPs with the most consistently low Z- Average size and PDI distributions would be potent for drug encapsulation.

In this project, hybrid NPs were effectively mass produced over a short period of time using a One- Step Method of staggered rapid mixing. Optimization of such hybrid nanoparticles were conducted and evaluated by testing the Drug Loading and Encapsulation Efficiency of Curcumin in optimal batches of hybrid NPs.

Keywords: Hybrid Nanoparticles, High Throughput, One- Step Method, Encapsulation Efficiency, Drug Loading