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Microfluidics manufacture of Verteporfin loaded liposomes composed of natural and synthetic lipids using a scalable microfluidic platform

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Liposomes are attractive drug delivery systems for formulating low solubility drugs. While several liposomal drugs are presently marketed, liposome production is commonly a multi-step processes that requires significant process development to scale up production through preclinical and clinical development. Here, we leverage the reproducible, continuous flow nature of a microfluidic platform to control the nanoprecipitation of liposomes, rapidly tune liposome size and drug loading and reduce process development associated with increasing scale of production. Two liposome formulations of the hydrophobic photosensitizer Verteporfin were produced as model systems and scaled up in batch volume by an order of magnitude. A process for liposome formation and simultaneous drug loading was initially developed at bench scale, on a system designed for rapid formulation optimization at volumes between 1 mL and 15 mL. A Soy-PC/cholesterol/DSPE-PEG formulation was optimized by systematically varying the flow rate ratio between the aqueous and organic phases at the input of the microfluidic mixer and their total follow rate. Optimized formulation parameters were also used to produce a DMPC/Egg-PG formulation the more closely resembles commercially available formulations. Both formulations were transferred directly to a larger system designed for producing pre-clinical batches between 10 mL and 1000 mL. As a consequence of conserved microfluidic geometry between the two systems, formulation conditions were replicated exactly. Hence, the physical characteristics and encapsulation efficiency were found to be identical between formulations produced on the two systems. This reduces the burden of process development commonly encountered when scaling up traditional liposome production methods.

Biography

Tim Leaver is the Director of Product Management and Commercialization at Precision NanoSystems Inc. He has over ten years of experience in developing automation and microfluidic products and solutions in life sciences fields. He has worked on problems ranging from drug delivery to single cell genomics.

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