Manufacturing of paclitaxel encapsulated liposomes by microfluidics

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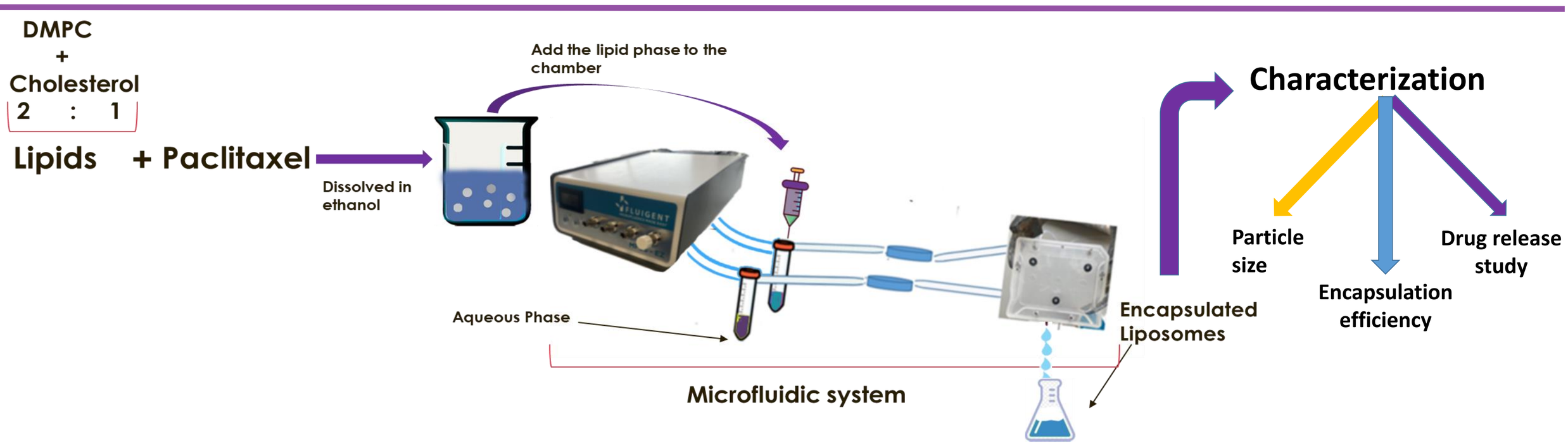
Background

- Among the different platforms of NPs that used for drug delivery applications, lipid NPs (e.g., liposomes) reported as the less toxic *in vivo*, besides the ability to carry hydrophobic and hydrophilic molecules.
- For effective used to target cell intake, liposomes should possess particle sizing < 200 nm and low PDI.
- In this study, the power of microfluidics have been investigated providing high-level control on the process's parameters, which enables the production of liposomes with controlled particle size, low PDI and high encapsulation efficiency.

Methods



Particle size

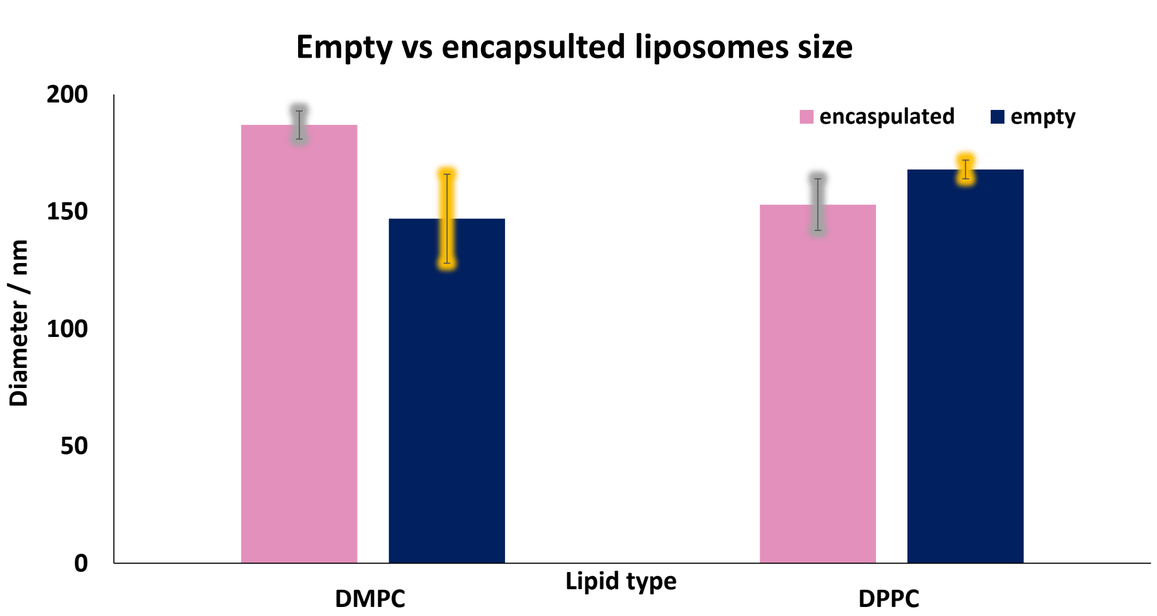


Figure 1: Comparison between the DMPC and DPPC liposomes diameter before and after encapsulation.

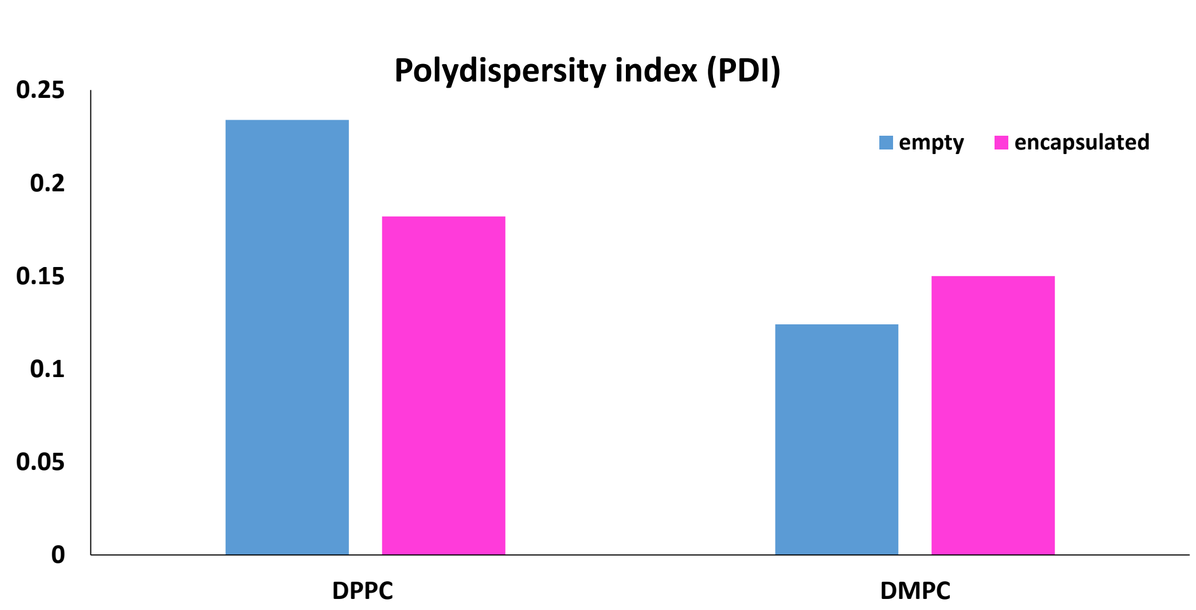


Figure 2: Comparison between the DMPC and DPPC liposomes polydispersity before and after encapsulation

- All formulations are obtained using TFR 1 ml min^{-1}.
- The flow rate ratio between the lipid phase and aqueous phase 1:4.

- All the formulation kept their diameter below 200 nm after encapsulation.
- The (PDI) values kept > 0.25 after encapsulation.

Encapsulation efficiency

- The encapsulation efficiency of the liposomes calculated using the following equation:

$$\text{Encapsulation efficiency (EE\%)} = \frac{Total\ amount\ of\ the\ add\ drug\ (mg) - free\ drug\ amount(mg)}{Total\ amount\ of\ the\ drug\ (mg)} \times 100$$

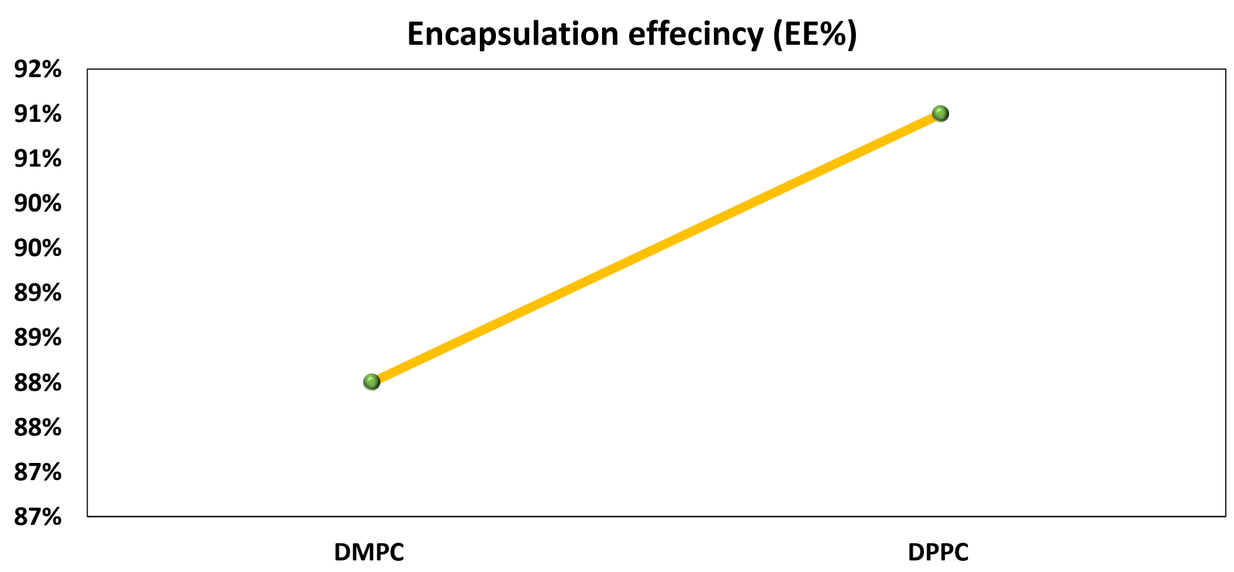


Figure 3: The encapsulation efficiency of DMPC and DPPC formulation.

Conclusion

- The microfluidic system, is a computerized, flexible, and highly controlled system, allows the modifying of parameters that affect liposomes properties.
- The most optimum FTR, FRR, and phospholipid type and ratios are determined to encapsulate and release paclitaxel.
- The EE% of DMPC and DPPC formulations was high in both formulation but the DPPC liposomes EE% was higher.