The Effect of Liposomes on Drug Delivery of Ascorbic Acid

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Ascorbic acid, or vitamin C, has been identified as a potential cancer therapeutic due to its abundance, specificity to cancer cells, and low toxicity. In high doses, it has the capacity to induce oxidative stress in cancer cells, which tend to lack catalase, resulting in apoptosis. However, vitamin C tends to be unstable. Liposomes may be a promising carrier to stabilize vitamin C due to their low cost, high versatility, and ability to exhibit the enhanced permeability and retention (EPR) effect in tumors. The purpose of this project is to determine the efficacy of liposome-encapsulated vitamin C as a therapeutic by measuring encapsulation efficiency and drug delivery rate. Liposomes were created by using the pro-liposome method, where the lipid phosphatidylcholine was mixed with Tris HCl buffer and ethanol. Then, a solution of Tris HCl buffer and vitamin C was added to the solution to be encapsulated. Encapsulation efficiency was determined by centrifuging the liposome solution in an ultrafiltration tube. In order to measure drug delivery, the liposome solution was dialyzed, with 10 mL samples of the external solution being extracted every hour for 24 hours. Each of these samples was titrated with iodine with starch solution as an indicator. Compared to vitamin C alone, liposomal vitamin C returned a much more stable delivery rate with greater retention in solution. Each hour, beginning with hour 18, revealed a statistically significant difference in drug release rate ($p < 0.05$), with the exception of hour 20, where the p-value was 0.103. The encapsulation efficiency of the liposomes was 81.67% on average. The results indicate that liposomes can be an effective method to stabilize and deliver vitamin C for cancer therapeutic applications.

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