Optimization of Rhodamine-B Nanoparticle Synthesis for Drug Delivery

Wang, Ethan (School: Ames High School)

This study represents the synthesis and optimization of drug-loaded PLGA nanoparticles, and analysis of the structure, release, and in vitro kinetic studies. To enhance the bioavailability and biodistribution of different drug therapeutics, PLGA nanoparticles were utilized. PLGA is an FDA-approved polymer for pharmaceutical applications, and its biodegradability in the human metabolic pathway makes it a perfect material for nanoparticles. Nanoparticles loaded with the fluorescent Rhodamine-B were synthesized by using a double emulsion process known as water-in-oil-in-water solvent evaporation. Optimizing the ratio of the PLGA polymer and utilizing sucrose will best balance release, nanoparticle size, and degradation. A DLS assay scans the surface of the nanoparticles to determine the size, zeta potential, PDI, and slight charge, to determine the success and effectiveness of the nanoparticle synthesis and applications. The study of nanoparticle release kinetics utilized hydrogels for drug delivery using iontophoresis, and using a standard curve, we determined the kinetics and encapsulation efficiency. The synthesis of the nanoparticles using the double emulsion technique proved successful, with a standard deviation of the size being 334.90 ± 3.39nm. The encapsulation and in vitro release assay of the PLGA-NPs showed a successful controlled, slow release of the drug and nanoparticles within the hydrogel using iontophoresis for primarily hydrogel medicine delivery applications. These findings indicate the ability of our nanoparticles to deliver chemotherapeutic drugs with different properties for enhancing drug delivery and theraputic affects.

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