Developing Cyclodextrin Polymers for Antibiotic Delivery

Nouman, Areesha (School: Hathaway Brown School)

Drug delivery, especially for infectious diseases, presents a major challenge regarding the bioavailability and solubility of medications that are not effectively water-soluble. Infectious diseases such as tuberculosis (TB) are notoriously difficult to treat because of adverse medication side effects, high dosages, and patient non-compliance. Polymer drug delivery systems serve as a promising drug delivery mechanism. Cyclodextrin, classified as a biodegradable cyclic oligosaccharide, is a polymer formed by glucose molecules linking together. Because cyclodextrin is a cylindrical molecule with a hydrophilic exterior and hydrophobic interior, the polymer is able to increase the solubility of drugs such as antibiotics. Cyclodextrin presents in three main types: alpha, beta, and gamma cyclodextrin, characterized by their size. In this project, cyclodextrin discs' compositions were altered to optimize antibiotic delivery. To form the polymer medium, disc composition was varied in six different combinations. These discs were then loaded with rifampin, a TB antibiotic, by submerging them into the drug solution. Then, the discs were placed into phosphate buffer saline (PBS), and the solution was aliquoted and replaced daily. Using a UV spectrophotometer to collect concentration data, daily average absorbances were graphed to analyze the rate of drug release. Overall, our results demonstrate that varying the composition of the medium suggests promising drug delivery potential of antibiotics. All six types of discs performed well, demonstrating a burst release at the 24-hr mark followed by a sustained release. This suggests a promising capability for cyclodextrin to provide sustained release for treatment of infectious diseases.

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