Silk Fibroin as an Aqueous Coating Material for the Sustained Delivery of Hydrophilic Drugs

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Purpose: Currently, in the pharmaceutical industry, the most prominent carrier system for drug encapsulation is liposomal technology. With a 10% drug loading efficiency, this technology has proved to be inefficient in the encapsulation of hydrophilic drugs. Its use of ultrasound technology and sonication have makes it extremely cost inefficient and, thus accessible to only a select number of individuals. Using the amphiphilic properties of silk fibroin, I decided to test my hypothesis that silk fibroin can be used as an aqueous coating material for water-soluble drugs. Procedure: A hydrophilic drug substrate was co-precipitated with the silk fibroin solution in distilled water. A droplet of this drug/fibroin/water solution was immersed in Silicone Oil in order to allow for an emulsion. Results: Upon the accumulation of the silk fibroin microparticles at the interface between the water and Silicone oil, the silk proteins began to form beta sheets, with an amino acid sequence different from that found in the natural fibroin protein. The accumulation of the beta sheets eventually formed a silk film surrounding the water droplet. This silk film has low toxicity in the body, is chemically stable, biocompatible, and attains excellent degradation rates, which contribute to the controlled release of the drug. Conclusions: Compared with the 10% loading efficiency of the liposome vesicle, my fibroin film attains a 100% drug loading efficiency, is cheaper than the liposome, and aids in the controlled release of the drug. Additionally, this coating method is well suited for the encapsulation and stabilization of hydrophobic components and anti-cancer drugs.

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