Fabrication of injectable silk hydrogel for controlling the release of various anticancer drugs

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Silk protein hydrogels are inherently suitable for biological applications due to their permeability, water content, and structural and viscoelastic properties compatible with cell membranes. In particular, its biodegradability can also be modified and subsequently control the drug release behavior, making silk hydrogel a potential drug-loading material.[1] In vivo, hydrogels can be broken down by proteases. By changing the properties of the hydrogel, the degradation rate of the silk hydrogel can be tuned, therefore achieving control over the drug release. The study of injectable silk protein hydrogels as drug delivery systems has achieved good results in breast and gastric cancers, but the research focus of controlling various drug loading and drug release properties of hydrogels has not yet been realized. The aim of this study was to fabricate silk protein hydrogels that could be used as multiple-drug carriers.

To this end, systematic changes in silk hydrogel preparation conditions were screened, and the obtained hydrogels were then used to load and release various types of drugs. Changes in dissolution conditions and gel parameters such as temperature, sonication time, shaking, stirring time, etc., during the preparation of hydrogels are considered to be factors that affect the performance of hydrogels. The properties of silk protein hydrogels were analyzed by swelling ratio, degradation ratio, FT-IR, XRD, rheometer and so on.

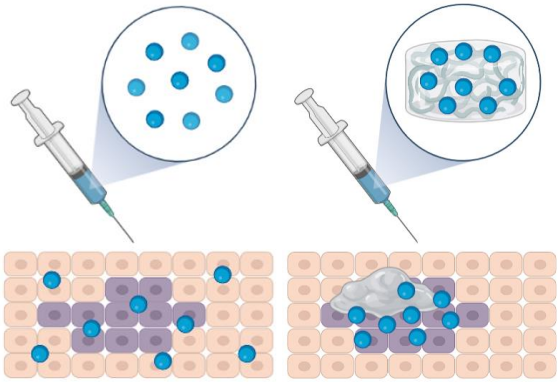

Fig 1. Left: drug diffuse in vivo leads to side effect
Right: drug release control through hydrogel

In this report, aqueous solutions were used to dissolve silk protein and followed by gelation with controllable time from 36 to 48 hours. By changing the dissolution method, hydrogels with different properties were obtained. In addition, the loading and release of various drugs will be investigated. We expect to create an injectable hydrogel in which degradability can be controlled in vivo. This means that drug release can be manually controlled.

1) A. T. N. Dao *et al.*, *Polym. Chem.* **2017**, *8*, 1049-1060.