Application of an egg white protein in drug delivery

A. Akbari and J. Wu

Project timeline: May 2012 – February 2013

Summary

Ovomucin, an egg white protein, forms gel at room temperature. Due to the fibrous structure of the formed gel, heat-sensitive drugs can be entrapped in the gel matrix. Ovomucin nanoparticles can adhere to the body's mucus and slowly release the loaded drugs.

Problem

Drug delivery is a technology for transporting drugs in the body and overcoming some problems associated with conventional drugs, such as:

- Orally-administrated drugs move along with food in the gastrointestinal tract and as a result, they do not have enough time to be absorbed in the intestine.

- Conventional drugs are released rapidly from tablets or capsules after administration and increase drug level in the blood, but after a short time the drug level falls down and consequently, the drugs should be administrated frequently.

To overcome these problems, some polymer-based particles are employed to encapsulate the drugs, adhere to mucus and release the drugs slowly.

Study Objective:

Evaluating the potential of ovomucin for encapsulting drugs, adhering to mucus and controlled release of the drugs was our objective in this study.

Our Approach

- The ability of adhesion to mucus (mucoadhesive property) of ovomucin and three well-known mucoadhesive polymers (chitosan, poly acrylic acid, and alginate) were compared.

- Ovomucin particles were prepared and ciprofloxacin (an antibiotic), as a model drug, was encapsulated in the particles.

- Drug encapsulation efficiency, drug release (in two media: phosphate-buffered saline (pH 7) and simulated intestinal fluid (pH 7 + pancreatin enzyme)), size and shape of the particles were evaluated.

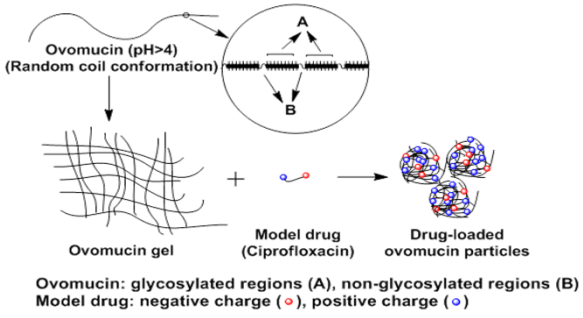

Figure 1. Schematic illustration of preparation of the drug- loaded ovomucin particles

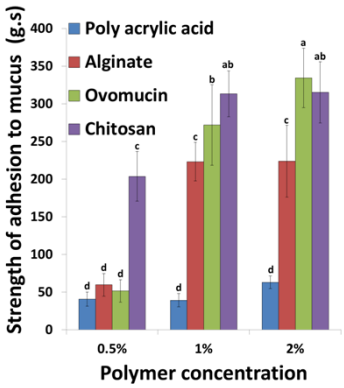

Figure 2. Adhesion strength of different polymers to mucus

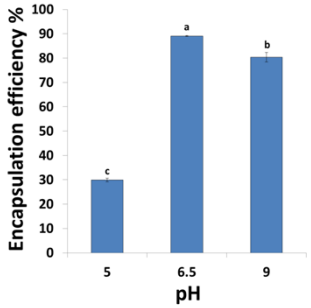

Figure 3. Encapsulation efficiency of ciprofloxacin at different pHs

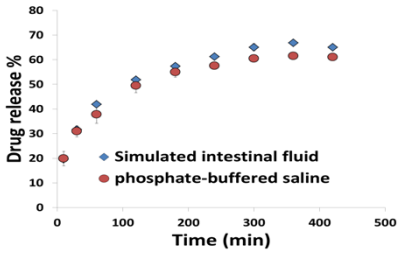

Figure 4. Release profile of ciprofloxacin from ovomucin nanoparticles in two media: phosphate-buffered saline and simulated intestinal fluid

Our Observations

We observed that the mucoadhesive property of ovomucin was comparable with that of chitosan. Chitosan is one of the best mucoadhesive polymers in drug delivery systems. Nanoparticles (100-150 nm) of ovomucin were basically spherical in shape. In addition, 89.1% of the model drug (ciprofloxacin) was encapsulated in the particles. The drug-loaded particles released slowly 60-65% of the drug over a period of 6 hours in two media of phosphate-buffered saline and simulated intestinal fluid.

What Does this mean?

Ovomucin particles can be employed as a carrier for delivery and controlled release of drugs through mucus. The mucus could be intestinal, nasal, or pulmonary mucus.

Acknowledgements

We thank Dr. Mirko Betti for permision to access the rheometer and texture analyser in his lab. In addition, we acknowledge the following funding organisations.

UNIVERSITY OF ALBERTA DEPARTMENT OF AGRICULTURAL, FOOD & NUTRITIONAL SCIENCE
NSERC CRSNG
Canada Foundation for Innovation
Fondation canadienne pour l'innovation

Contact Information

Jianping Wu (PhD)
Agricultural, Food & Nutritional Science, 3-18D Ag/For Centre, 780.492.6885, Jianping.Wu@ales.ualberta.ca