SciTech 2014 Summer Science Camp

Technion Israel Institute of Technology

Fighting Foes

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Introduction

People from all over the world aspire a comfortable life without suffering from diseases. In order to make it possible many drug delivery systems (DDS) where designed. DDS treating digestive system diseases maximize the efficacy of a specific drug by delivering it to the site of action (Fig.1) and minimizes adverse effects.

Chitosan (CS) is a natural hydrophilic polysaccharide that the body does not reject. CS forms dense network which can intercalate the drug in the DDS[1-2].

Montmorillonite clay (MMT) is a natural mineral which can increase the uptake of a drug due to its high surface area compared to its volume.

5-Aminosalicylic acid (5-ASA) treats colon diseases and can reduce cancer symptoms.

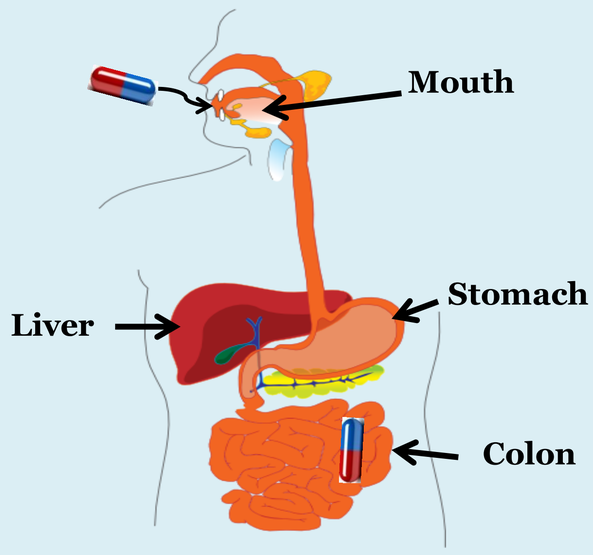

Figure 1. Specific drug delivery system

Materials and Methods

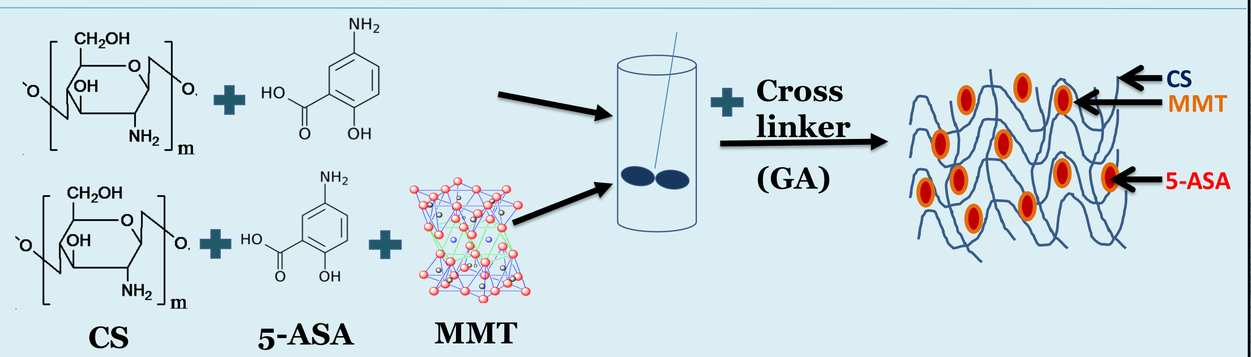

Figure 2. Schematic hydrogels preparation process

- CS, 5-ASA and MMT were dissolved in 2% acetic acid as shown in Fig.2 for 2 hours, then cross linked with Glutaraldehyde (GA) to form hydrogels.

Results and Discussion

A. Hydrogel Preparation

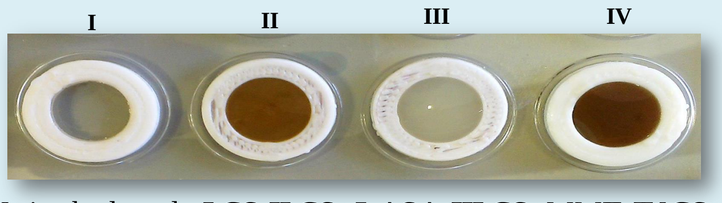

Figure 3. Varies hydrogels **I.**CS **II.**CS+5-ASA **III.**CS+MMT **IV.**CS+MMT+5-ASA

- Identical hydrogels were prepared in disk form (Fig.3).

B. Mechanical Characterization

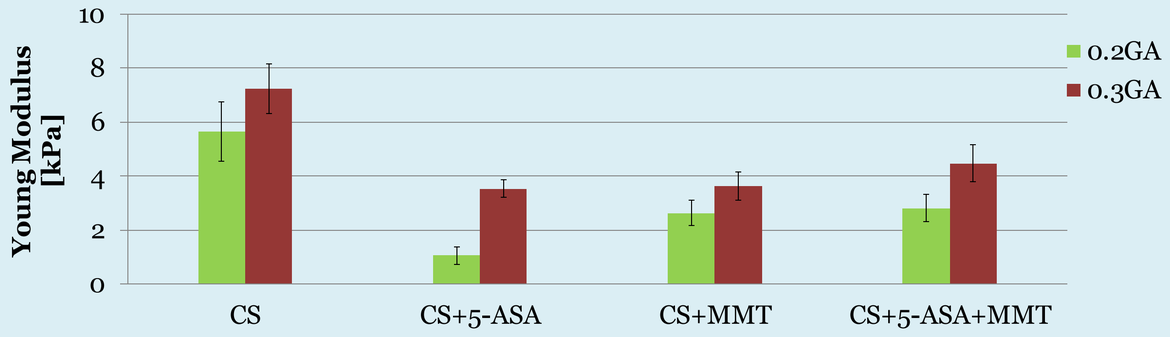

Figure 4. The mechanical strength of the hydrogels in different concentration of GA

- According to Fig.4 the mechanical strength decreases when mixing chitosan with 5-ASA / MMT.
- As the concentration of GA increased the mechanical strength of the hydrogels exceed.
- GA makes chemical cross linking between amino groups which are located in the polymer chain. However, the drug has amino groups as well and the GA may react with the drug instead of the polymer causing the mechanical strength of the hydrogels decrease.

C. Drug Release Experiments

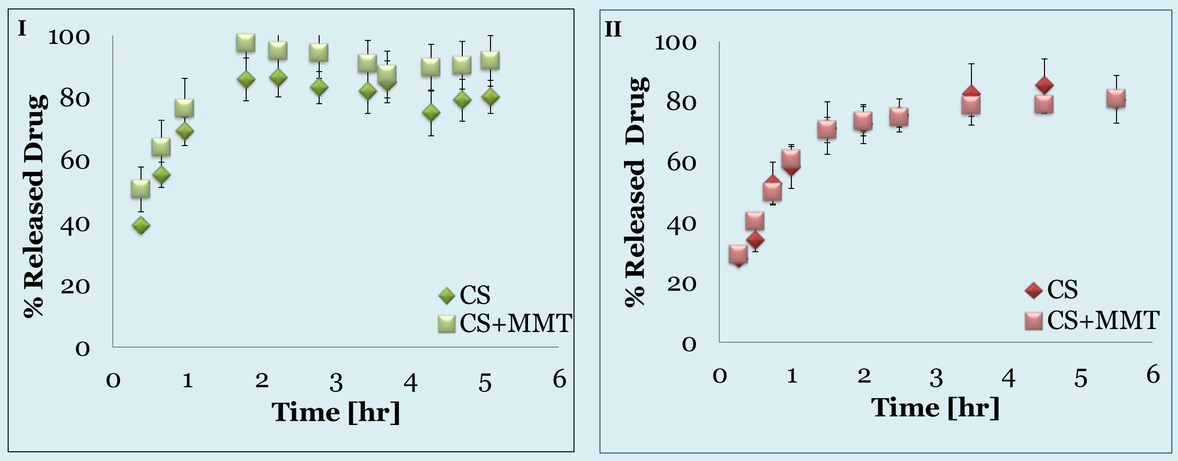

Figure 5. Realse profiles from Chitosan hydrogels cross linked with **I.** 0.2% GA **II.**0.3%GA

- According to Fig.5 the drug release rate is faster in 0.2% GA compered to 0.3% GA.
- In 0.2% GA hydrogels the drug release rate increases when using MMT, while in 0.3% GA hydrogels there is no significant difference between hydrogels with or without MMT.

Conclusions

- According to the mechanical characterization and the drug release experiments, we can conclude that MMT impairs the density of the CS's network. As a result, the hydrogels are brittle and the drug releases faster.
- In future experiments we would recommend to increase the concentration of GA or CS in order to get slower drug release rate.
- Decreasing the concentration of MMT will prevent its negative effects on the drug release rate.

References

1. C. Aguzzi et al., "Chitosan-silica bio composites to be used in modified drug release of 5-aminosalicylic acid (5-ASA)", *Applied Clay Science* (2010) 106-111.
2. C. Aguzzi et al., "Current challenges in clay minerals for drug delivery", *Applied Clay Science* (2010) 291-295.

Acknowledgments

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