Hydrophobic Drug Delivery From Alginate Gels

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Introduction

The continuous development of new drug delivery systems is driven by the need to maximize therapeutic activity while minimizing negative side effects. A known drug delivery device is polymeric hydrogels. In our project we used alginate, a polysaccharide isolated from brown algae. In order to create the hydrogel, various divalent cations such as calcium can be used as cross-linkers (Figure 1).

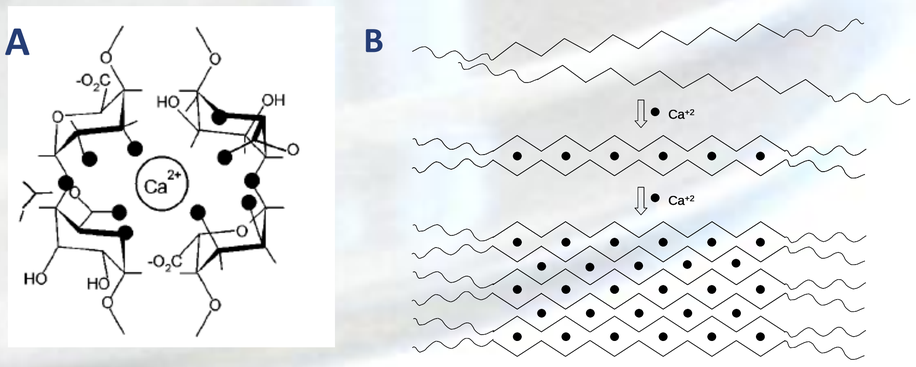
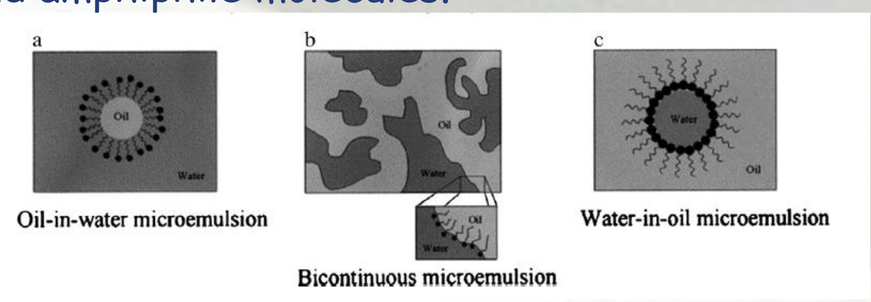


Figure 1: (A) Calcium ions occupy the cavity between adjacent G-blocks. (B) Lateral chain association.

Our focus was hydrophobic drugs, to increase their water solubility one can incorporate them in an oil in water microemulsion (ME). ME is a single optically isotropic and thermodynamically stable liquid solution, consisting oil, water and amphiphile molecules.



Types of microemulsions

Research Objective

The goal of our research was to investigate the influence of different alginate hydrogel characteristics on the release rate of the hydrophobic entity, Nile Red (NR).

Materials and Methods

Microemulsion formulation

Surfactants were mixed with Isopropyl Myristate and double distilled water.

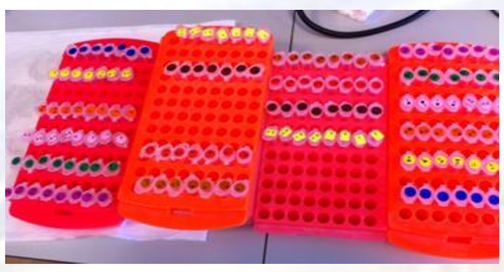
Oil in water microemulsion

Gel preparation

Alginate hydrogels were prepared with final concentrations of 10-20 mg/ml alginate, 20-40 mM calcium and 0.05 mg/ml NR.

Drug release experiment

The gels were put in water at 37° C and shaken at a rate of 100 rpm.
At each time interval the surrounding medium was sampled and replaced with double distilled water (DDW). The concentration of the NR was calculated from a calibration curve, from ultraviolet (UV) measurements.



Samples taken during the experiment

The UV spectroscopy experiment

Drug release system

Results

Effect of alginate concentration on the release rate

The release rate from the lowest alginate concentration is the highest after 2 hours of release.

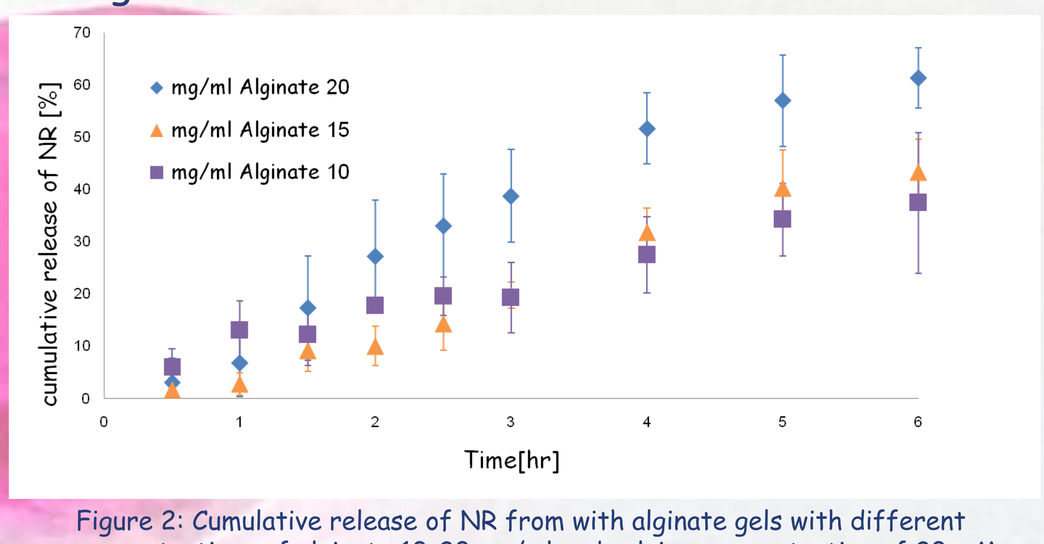


Figure 2: Cumulative release of NR from with alginate gels with different concentrations of alginate 10-20 mg/ml and calcium concentration of 20 mM.

Effect of calcium concentration on the release rate

The release rate from the highest calcium concentration is the lowest throughout the experiment.

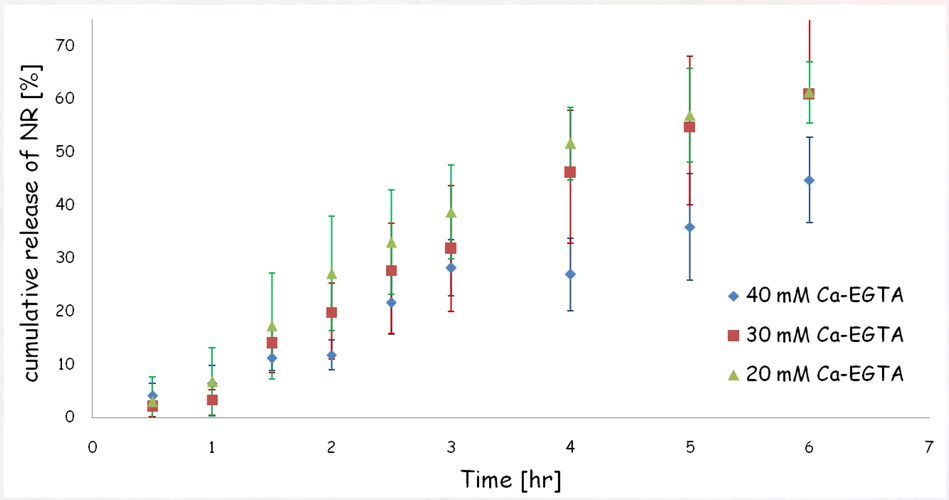


Figure 3: Cumulative release of NR from with alginate gels with different concentrations of calcium 20-40 mM and alginate concentration of 20 mg/ml.

Conclusions

- The use of microemulsion can increase the water solubility of hydrophobic entities.
- Increasing the alginate concentration led to a faster releasing rate.
- Increasing the calcium concentration led to a slower releasing rate.

References

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