Encapsulating viruses (bacteriophages) to treat life-threatening bacterial infection of the colon [Poster].

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Encapsulating bacteriophages (viruses) to treat life-threatening bacterial infections

1. Introduction

Clostridium difficile is an infection causing bacterium common in patients being treated with broad spectrum antibiotics. It causes inflammation of the colon and severe diarrhoea which can be life threatening. Bacteriophages (phages) are viruses that have co-evolved such that they selectively infect bacteria to replicate and kill the bacteria upon their release (2,3). The advantage of phage therapy compared with antibiotics is that it is highly selective and does not disrupt gut flora. The challenge is to deliver the phages to the site of infection. This means bypassing the acidic environment and enzymes present in the stomach. The aim of this project is to encapsulate Clostridium difficile specific bacteriophages for controlled release in the colon.

2. Methodology

- An inverted microscope with a camera is used to visualise the formation of particles, allowing accurate measurement and analysis of the forming particles (1,4).
- A two phase glass microfluidic device is used to produce uniform droplets encapsulating the bacteriophage (2a).
- The size of the particles is controlled by changing the orifice of the collection capillary as well as the flow rates and phase concentrations.
- A pH responsive polymer, Eudragit S100 is used to protect the phages from the harsh acidic environment of the upper GI-tract and allow controlled release in the colon.

3. Results

- Production of monodispersed particles achieved over a time lapse of 6 hours with a co-efficient variance of less than 5 %. Long-term stability of the device observed through little change in the device integrity over 6 hours.
- Elongation with subsequent pinching results in the formation of stable particles known as the ‘dripping regime’.
- SEM analysis show the production and solid structure of Eudragit S100 particles.

4. Future work

- Control size and shell thickness of particles by changing experimental parameters.
- Observe phage release in simulated gastric fluid.
- Calculate encapsulation efficiency by releasing phage in colon simulated conditions.
- Look at application of membrane emulsification as a scale-up processes for the production of a larger volume of encapsulated phage.
- Analyse the effect of phage encapsulation and bacterial lysis in situ by using mammalian cell lines.

References