Polymer particle formation using inkjet printing

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1. Introduction

- Rational design of new biomaterials is still hindered
  - Lack of knowledge on physiochemical parameters controlling cellular responses
- Aims:
  - Production of combinatorial library of microparticles with wide range of chemistry using photopolymerisation in combination with inkjet printing
  - Effect of particle chemistry on cellular attachment and control of cell phenotype
- Particulate formation with application as cell carriers in regenerative medicine strategies

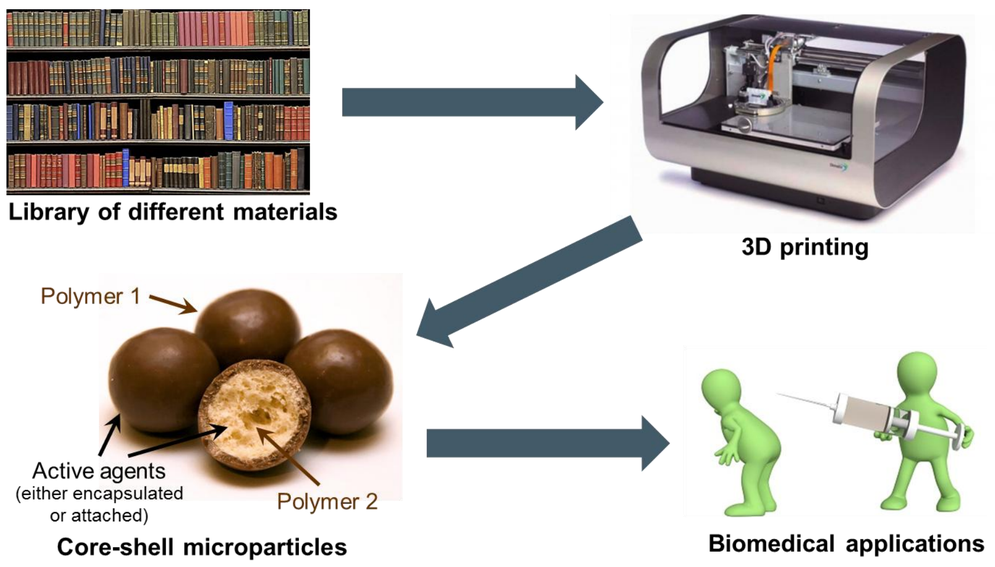

Figure 1: PhD project overview

2. Materials and Methods

- Microsphere formation
  - Photocrosslinkable polymerisation solutions were piezoelectric inkjet printed into aqueous collecting fluids and simultaneously cured by exposure to UV light (λ=365 nm)

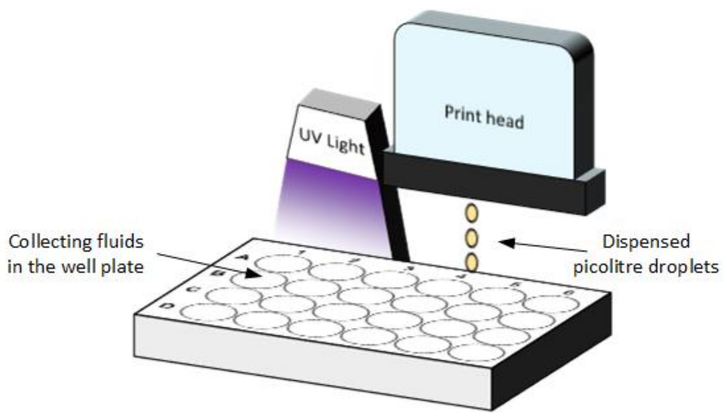

Figure 2: Schematic representation of the inkjet set-up

- Particle characterisation
  - Optical and scanning electron microscopy (SEM), focussed ion beam (FIB) and CPS disc centrifuge were applied to analyse shape, size and size distribution of the microparticles

3. Results and Discussion

- Pipetting of inks as a preliminary study

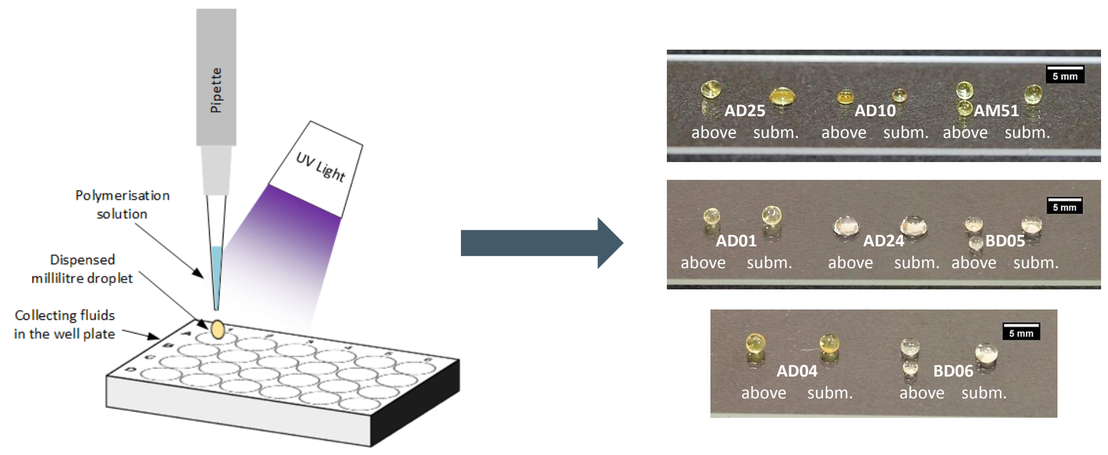

Figure 3: Pipetting various polymerisation solutions above and submerged into different collecting fluids to examine feasibility of particle formation

  - Cured drop formation was possible with some inks but mostly in solely one collecting fluid
- Microparticle formation and analysis
  - Polymerisation solutions from the pipetting experiment were inkjet printed into collecting fluids
  - Successful inks were analysed for the following properties (viscosity, surface tension, partition coefficient) in order to generate a library of biodegradable and photocurable polymers

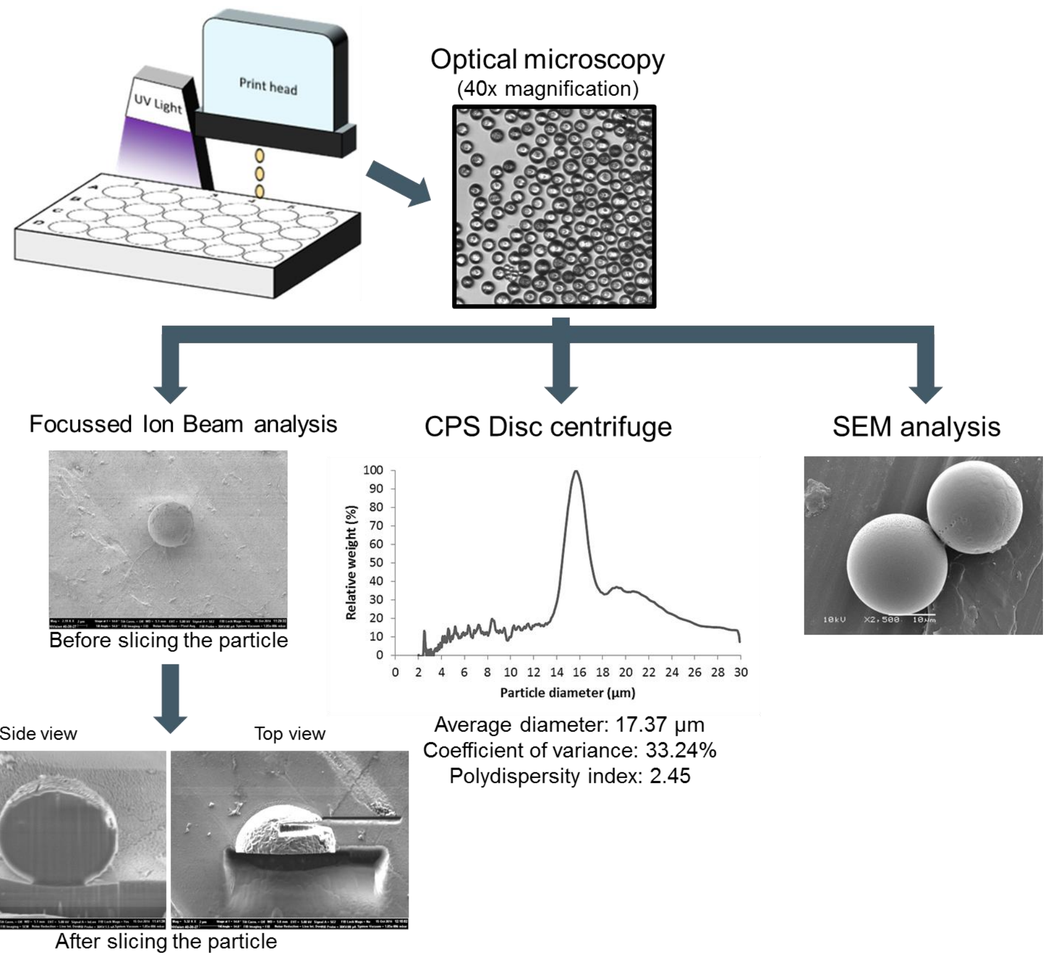

Figure 4: Characterising the shape, size and size distribution of inkjet printed and cured particles using different techniques

  - Highly uniform particles with an average diameter of 17.37 µm were produced using inkjet printing
  - Microparticles are solid in the interior

4. Conclusion / Future work

- Particulate formation with a wide range of chemistry is feasible using a combination of photopolymerisation and inkjet printing
- Future work: studying the effect of diverse particles on cellular attachment and control of cell phenotype as well as developing core-shell particles