Investigating cross-linking of sodium alginate and calcium chloride for use in a microfluidic kit.

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Background: Standardised microcapsules have many potential medical uses, for example drug delivery, diagnostics and NGS. This project in particular will be looking at encapsulating essential oils to provide antimicrobial properties to materials such as healthcare uses and textiles. A novel smart microfluidic control system (*Fluigent, Fr*) will be used to standardise the materials, size (95-160μm) and production rate of the microcapsules produced. However, this system recommends oil surfactant to result in a water-in-oil microbead. This project seeks to investigate replacing this oil phase with sodium alginate and a cross-linking agent such as calcium chloride ($CaCl_2$). It is paramount that instantaneous polymerisation causing clogging of the microscopic fluidic chamber does not occur, however still producing strong and reliable gels to be used as an encapsulant. Although this has been achieved in research through using self-made and 3D printed models, there has yet been a standard protocol in which researchers can produce monodispersed beads using their own core materials with the kit.

Methods: Testing a range of sodium alginate concentrations from 0.5% - 3% against $CaCl_2$ of 5mM to 20mM using the Luer lock syringe method to determine how many cycles and minutes it takes for a gel to form. The endpoint was when a thicker gel was apparent, but not solid.

Results: It was found that $CaCl_2$ in concentrations of 15mM or lower prolonged the gelation of sodium alginate concentrations of 1 – 1.5% to around 3 – 8 minutes. Further investigation using a range of ratios with these concentrations is currently underway.

Conclusions: This study can provide a set of cross-linking timings ranging from seconds to minutes, making it possible to use in a microfluidic kit without setting and blocking the system.