Metal microcapsules – finding a cost effective alternative to gold shells

Background: Polymer microcapsules have been used to provide protection of the core contents from the external environment, and to allow controlled release. However, the inherent porous nature of polymer shells means that they are unable to prevent unwanted release, particularly of small volatile molecules in challenging environments, such as when the core molecules are soluble in the bulk phase.

We have developed a technology whereby we can prevent unwanted leakage of such volatile molecules, by growing a metal shell on the polymer using electroless plating techniques. We first adsorb metal nanoparticles to the polymer and use them as catalytic sites for the nucleation and growth of the secondary metal, forming a complete, non-porous shell around the capsule. To date we have successfully grown gold shells using platinum nanoparticles as the catalyst, however the cost implications of using gold limits the potential applications of this technology.

Aims: This project will focus on exploring potential metal pairings to grow impermeable shells onto polymer microcapsules in order to allow full retention of the core oil.

Expected outcomes and deliverables: Students can expect to develop skills in nanotechnology and electron microscopy, as well as data collection and analysis. A review of the literature should be conducted prior to commencing lab work. There may be an opportunity to publish work from the research conducted. A written report will be required at the end of the research project.

Suitable for: Students with a chemistry or chemical engineering background with an interest in colloids/nanotechnology
Availability and Project duration: 8-12 weeks
Primary supervisor: Dr Alison Tasker a.tasker@uq.edu.au

Localised, actively triggered, drug delivery using metal microcapsules for the treatment of high grade glioma

Background: Brain and central nervous system cancers are the third most commonly occurring cancer in adolescents and young adults, and the third most common cause of cancer death. The prognosis of patients with brain tumours, particularly high-grade tumours (glioma) is devastatingly poor. Our project aims to improve the prognosis of patients with high grade glioma by providing an alternative, more effective treatment to those currently available. Typical treatment of brain tumours involves surgical removal of as much of the tumour as possible, followed by both radiotherapy and chemotherapy. However, the residual tumour left following surgery shows considerable resistance to traditional chemo/radiotherapy and recurrence is common, often resulting in patient mortality. A significant improvement to the current treatment approach could be gained by actively triggering drug release at the site of tumour recurrence. Our research team has made considerable progress in the development of metal-shell microcapsules as responsive drug delivery vehicles. Using such vehicles, we can deliver high doses of drug to recurrent tumours in a highly localised, controlled and non-invasive fashion.

Aims: This project will focus on exploring the potential of using a peptide-stabilised emulsion as a template to form metal-shell microcapsules for drug delivery.

Expected outcomes and deliverables: Students can expect to develop skills in nanotechnology and electron microscopy, as well as data collection and analysis. A review of the literature should be conducted prior to commencing lab work. There may be an opportunity to publish work from the research conducted. A written report will be required at the end of the research project.

Suitable for: Students with a chemistry or chemical engineering background with an interest in colloids/nanotechnology and polymers.
Publication potential: Yes
Availability and Project duration: 10-12 weeks
Primary supervisor: Dr Alison Tasker a.tasker@uq.edu.au, Dr Frank Sainsbury