New microencapsulation systems produced with micro channel devices for food and pharmaceutical applications.

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Introduction

Efficient encapsulation and controlled release of drugs, vitamins, flavors, fragrances, catalyst materials or even living cells are of increasing importance to the biomedical, pharmaceutical, cosmetic, and food industries. A variety of techniques have been developed to fabricate hollow particles for this purpose. However, despite the enormous progress in encapsulation technologies, these methods are often limited in their applicability, in the range of materials that can be used, in the uniformity of the resulting sizes or in the ease of synthesis and production yield.

Recently, there has been an increased interest in using self-assembled colloids and polymers at emulsion droplet interfaces to form microcapsules called colloidosomes[1] or polymersomes[2] respectively (Figure 1) because of the resemblance of their topology to that of liposomes. In the conventional method to produce colloidosomes emulsion droplets are used as 3D colloidal "templates" whose size and shape determine the morphology of the obtained particle aggregates. The capsule surface is composed of a close-packed layer of colloidal particles linked together to form a solid shell and the interstices between the particles form an array of uniform pores. A similar approach can be used for the polymersomes. Unfortunately, current approaches rely on bulk emulsification methods that produce microcapsules with a broad size distribution, and further these methods are restrictive with respect to the materials employed because of the special characteristics needed in the water-solid-oil system. On the other hand, methods that exploit the great potential of interfacial assembly for producing microcapsules have been hampered by the lack of understanding of the self-assembly process.

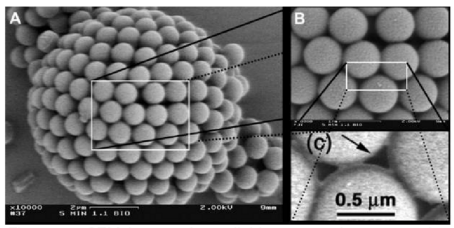

Figure 1: SEM image of a colloidosome; polystyrene spheres sintered by heating (Picture courtesy of Dinsmore et al.).

Aim

The main goal of this project is to develop new colloidosomes and polymersomes based on water-oil, oil-water, and water-water systems, together with microchannel processing technology. The production of the microcapsules will be approached experimentally and computationally.

References

1. Dinsmore, A. D. et al. Colloidosomes: Selectively permeable capsules composed of colloidal particles. Science 298, 1006 (2002).
2. Discher, B. M. et al. Polymersomes: Tough vesicles made from diblock copolymers. Science 284, 1143 (1999).

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