

Fabrication of Self-assembled Colloidosomes for the Encapsulation of Enzymes

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The encapsulation of active agents like drugs, biocatalysts, flavours, fragrances and others is of increasing interest for biomedical, pharmaceutical, cosmetic and food industries. The attraction of encapsulation comes from its perceived ability to both stabilise sensitive substances by providing a protective surrounding and to control mass transfers of encapsulated substances with the external environment. A variety of creative microcapsule designs have been proposed in the literature during the last decade. However, ways of preparation, which include high temperature processes or aggressive chemical reagents, are not compatible with the use of sensitive compounds. Consequently, our interest is to explore the applicability of new microcapsule designs for the encapsulation of enzymes, and their use as micro-bioreactors. Enzymes often suffer from denaturing or isolation and recycling difficulties when they are used in bio-catalytic reactions. As several methods of immobilisation, like entrapment or covalent binding, have not shown enough efficiency, encapsulation in hollow/shell micro-spheres constitute an attractive alternative strategy.

For that purpose, we particularly focus on colloidosomes and on the work of A.D. Dinsmore *et al.*¹, which describes preparation of controlled-permeable microcapsules by self-assembly of polymeric colloids at emulsion droplet interfaces. The interconnection of particles and the resulting porosity of the shell are achieved by a partial sintering step at high temperature (105°C). The rigid controlled-sized pore shell is then transferable to a solvent miscible with the interior of the capsule, conducting to an efficient interfacial mass transfer.

Our work is to adapt the process parameters of the above template to be compatible with the nature of the material we want to encapsulate: enzymes. For that, we propose to modify the chemical nature of the polymeric colloids to permit a sintering step at lower temperature in order to avoid the denaturing of enzymes. Also, we chose to use non-polluting solvents and a simple manufacturing process to permit large-scale production in easy conditions. The results of the chosen parameters will be presented and discussed.

¹ *Science*, **298**, 1006 (2002); *Langmuir*, **21**, 2963 (2005)