Synthesis of Encapsulated Chemical and Biological Catalysts

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Biological reactions are generally catalysed with enzymes. However, these enzymes are often rendered ineffective during use if the immobilisation method (e.g. entrapment, cross-linking, covalent binding, etc) fails to provide essential protection against a denaturing environment. This 3-year research project is aimed at fabricating an integrated chemical catalytic-biocatalytic polymer system, which will provide the following functions:

- Protection for the enzyme from harsh, denaturing environment.
- Matching catalyst and biocatalyst for effective overall reaction progress.
- Control over reactions and mass transfer.
- Potential reduction of unit operations complexity.
- Ease of downstream separations.

We will synthesise a particle that will contain an enzyme ("biocatalyst") in an aqueous core. Surrounding this droplet will be nano-size metal oxide ("catalyst"), which co-catalyses the biocatalytic reaction of the enzyme. The entire particle is then encased in a net-like polymeric shell to provide rigidity. The shell will also be made swellable to allow user-specified control over the mass transfer. This configuration will permit the particles to be placed in an environment that may otherwise be denaturing for the enzyme.

So far, we have synthesised the aqueous core particles with titania in the polymeric shell. The particles have been characterised by microscopy.