Novel Colloidal Polymer Particles

Brian Vincent

School of Chemistry, University of Bristol, BS8 1TS, U.K.

The novel colloidal polymer particles, to be overviewed in this lecture, have all been designed to impart a desired functionality to the system. Several such systems will be discussed, including:

• *microgel particles* [1] : these are cross-liked polymer particles which are compact in a *poor* solvent environment (c.f. normal latex particles), but which swell in a *good* solvent environment, to a (maximum) extent determined by the cross-link density. A variety of such particles will be described, where swelling is induced by a decrease in temperature, or an increase in temperature, an increase in pH, or a decrease in pH or both (i.e. an amphoteric response). Other factors, e.g. a variation in ionic strength, may also induce size changes in microgel particles. Such microgel particles have found a variety of applications, e.g. in surface coatings, and in controlled uptake/release systems. They have several advantages over conventional *macrogels*, in terms of versatility of handling, and much quicker response times.

• *liquid core/ polymer shell composite particles* [2]: a method has been devised for preparing such systems by emulsifying a mixed organic solvent phase, containing the shell-forming polymer, into water using carefully selected surfactant stabilisers. The organic solvents comprise a mixture of a low-boiling point *good* solvent, and a high boiling point *poor* solvent, for the polymer in question. On rotary-evaporating the low-boiling good solvent from the system, the polymer separates from the poor solvent, and , if the interfacial wetting conditions are properly controlled, will form a shell around the oil droplets. These types of composite particles have been studied for their controlled release properties. In such cases an additional, "active" ingredient (e.g. an agrochemical active) is dissolved in the oil phase initially.

• *liquid latex particles* [3]: polydimethylsiloxane (PDMS) is a liquid polymer, whose bulk viscosity is primarily determined by its average molecular weight. Monodisperse, charge-stabilised PDMS droplets may be prepared by a condensation polymerisation reaction, based on the hydrolysis of the monomer dimethyldiethoxysilane. Unlike "normal" emulsions, these systems are prepared in a *surfactant-free* environment, although surfactants or polymers, which adsorb at the oil/water interface, may be added subsequently, if desired. By incorporating some of the equivalent tetra- or tri-functional monomer in the preparation stage, cross-linked *inorganic* microgel particles may be prepared. Also a silica shell, of controlled thickness, may be grown around the PDMS droplets, to form liquid core / hard shell composite particles, for potential use in pressure-release systems.

1] BR Saunders and B Vincent, *Adv. Colloid Interface Sci.*, 1999 **80** 1

2] A Loxley and B Vincent, *J.Colloid Interface Sci.*, 1998 **142** 281

3] T Obey and B Vincent, *J.Colloid Interface Sci.*, 1994 **163** 454