Macro-, micro- and nano-polymeric particles: Preparation and selected applications

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We have prepared polymeric particles of various sizes, ranging from nanoparticles to large beads, often uniform in size, for different applications.

(1) Nanospheres (100-600 nm) based on N-alkylacrylamide and methacrylate monomers were synthesized by emulsion polymerization and coupled with biotin. These particles can form colloidal crystalline arrays. The thermostensitivity of the gel particles changed considerably in the presence of streptavidin. The reduction in thermostensitivity caused by the bioconjugation can be reversed by the incorporation of free biotin.

(2) Microspheres (40-50 µm) of polyacrolein were prepared by suspension polymerization. Smooth and rugged surfaces can be created by varying the polymerization procedure. Porous poly(vinyl alcohol) (PVA) resins were crosslinked during an inverse suspension polymerization and used as supports for peptide synthesis and as scavengers in different organic reactions. The very high loading of functional groups of these resins makes them efficient scavengers and they may also serve as support materials in solid phase synthesis.

(3) Large uniform-sized polymeric macro-beads (>1 mm) were prepared by free radical polymerization in an ascending process through a heated column. The size of the beads can be adjusted and the beads can be made porous by the incorporation of porogen during the preparation. The large polymer beads are desirable for the “one-bead-one-compound” applications in combinatorial synthesis of libraries of compounds.

(4) New hydrophilic and thermostensitive polymer resins were also prepared by inverse suspension polymerization. The thermostensitivity of the cross-linked resins were tested to facilitate their use as supports in the solid phase synthesis.

(5) Nano-porous polymers with well defined pore sizes were prepared by using reverse micelles as imprints. The pore size can be controlled by the amount of water added in the reverse micelles dissolved in the mixture of monomers prior to polymerization and functional groups can be introduced into the pores. These resins showed better separation of structurally-related compounds because of their size specificity.

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References: