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Non-Confidential Description - PSU No. 2497
"A Novel System Consisting of Two Immiscible Solvents and Surfactants for Separating Nanoparticles from By-Products, Controlling Particle Agglomeration and Promoting Crystallinity of Particles"

Keywords:

Nanoparticles, capacitors, double injection

Links:

Inventor website

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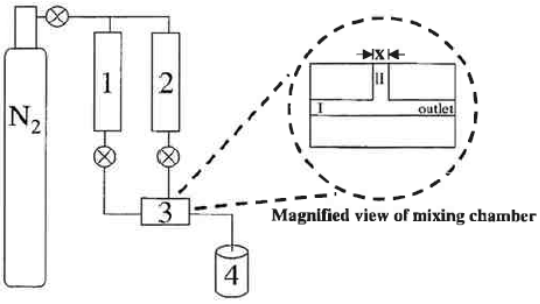

Fig. 1. Schematic of double injection system. The $BaCl_2/TiCl_4$ solution and the oxalic acid solution are placed in holding chambers (1) and (2), respectively. The solutions are released from the holding chambers and mixed in (3), where the diameter of the channels in the mixing chamber (X) are 2 mm. The final product is collected in (4).

Background

The production of nanoparticles offers many challenges which must be overcome before nanoparticles can become an important technological tool. One such challenge involves viable methods for purifying nanoparticles after synthesis and separating the resulting nanoparticles by size.

Invention Description

The present invention relates a system for generating nano-sized particles through vigorous mixing in a double injection apparatus to form nanoparticles within an aqueous solution. Surfactant(s) added to the nanoparticle solution immediately form a hydrophobic coating, preventing agglomeration and Ostwald coarsening of the particles. Mixing the nanoparticle aqueous solution with an immiscible nonpolar solvent such as toluene or octane forms an unstable emulsion, which then settles into two immiscible phases. The salts and many of the by-products remain in the aqueous phase for easy removal of the undesirable components The nanoparticles with a hydrophobic coating are extracted into the nonpolar solvent phase while the aqueous by-products are left inside the aqueous phase. The nanoparticle-containing phase is separated from the aqueous phase by a separation funnel or similar easy to use approaches. From this point nanoparticles can be manipulated, allowing for changes in crystallinity and composition.

Advantages/Applications

- Easy and quick solid-liquid separation using evaporation of organic solvent
- Reduced opportunities for decomposition and agglomeration of nanoparticles
- Applicable to many nanoparticle systems
- Quick processing times and reduced production cost

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