Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supporting Information

Anionic/Nonionic Surfactants for Controlled Synthesis of Highly Concentrated Sub-50 nm Polystyrene Spheres

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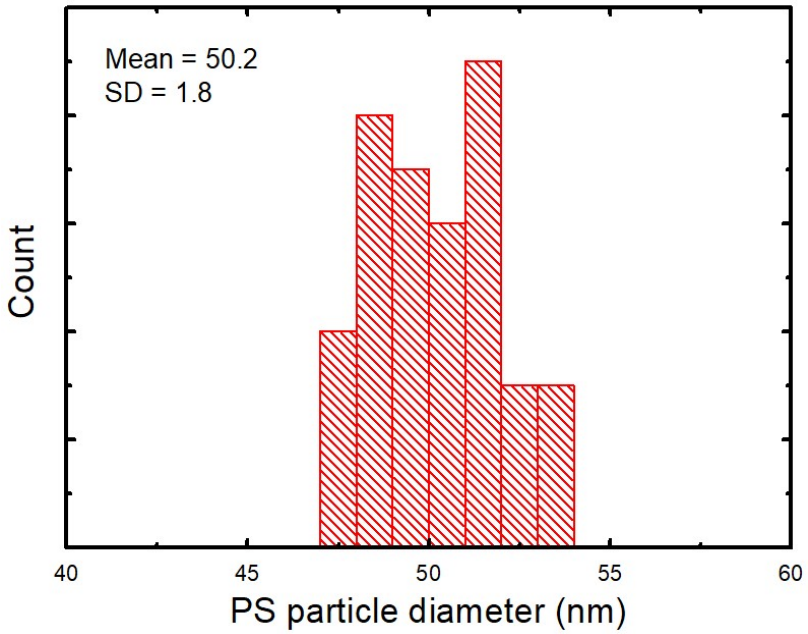

Figure S1: A histogram for randomly selected 40 particles (M9 recipe, Figure 4d) whose diameter was measured manually using ImageJ software. According to the histogram, the particle size is 50.2±1.7 nm which is very similar to the DLS results.

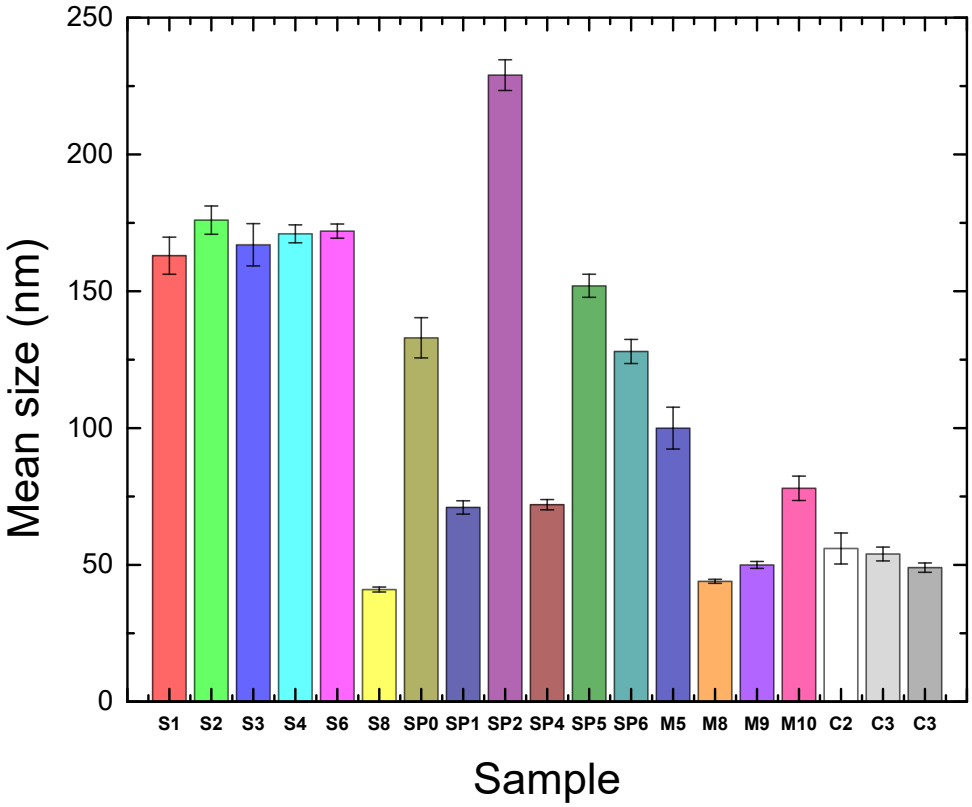

Figure S2: Bar graph illustrating the standard errors of the size means calculated for three experiments for each recipe.

Tables:

Table S1: Common methods for the preparation of polystyrene

Method	Description	Advantages	Disadvantages
Emulsion polymerization	- Radical polymerization - Poorly water-soluble monomer - Water-soluble initiator - Final polymer is poorly soluble in the reaction medium PS size between 40 nm to 5 μm	- Uniform heat transfer and easily controlled reaction temperature - Low viscosity (almost like water), polymer molecules are inside the particles, and viscosity is not dependent on molecular weight. - The resulting polymer may be used directly if wanted. - It produces high molecular weight colloidal polymers at short times. - Water is the medium.	- A Surfactant is needed - Need extra process to remove the surfactant and other contaminates and in drying. - Works only for addition polymerization using a hydrophilic initiator. - Water removal consumes a lot of energy. - Cannot be used for condensation, ionic, or Ziegler-Natta polymerization
Surfactant free emulsion polymerization	- Radical polymerization - Poorly water-soluble monomer - Water-soluble initiator Initiator work as a stabilizing agent. - Final polymer is poorly soluble in the reaction medium. - PS size down to 100 nm	- Almost the same as emulsion polymerization - No surfactant molecules adsorbed on the surface of the particles meaning less proccing time to remove them. - Environmentally friendly.	- Almost the same as emulsion polymerization - Usually results in wide size distribution. - Particle size smaller than 100 are hard to obtain.
Dispersion polymerization	- Radical polymerization - Monomer and Initiator dissolve in the reaction medium - Final polymer is poorly soluble in the reaction medium - PS size between 200 nm to 15 μm	- Can produce micron size monodisperse polymer Particles in a single batch process - polymer is easily separated - Obtain polymer in a directly useful form.	- Stabilizers or surfactants needs to be used. - Organic solvent must be used.