Product Information

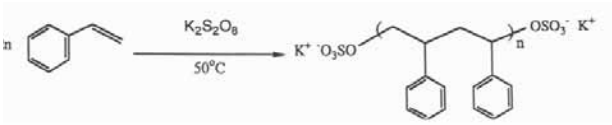
SPHERO™ Polystyrene Particles

- Uniform Shape and Size
- Multi-liter Capabilities
- Available from 0.05 to 200 µm.

The SPHERO™ polystyrene particles are prepared by conventional emulsion polymerization with styrene as the monomer and potassium persulfate or benzoyl peroxide as polymerization initiator. In general, microparticles less than 0.5 µm are prepared in one step. Larger particles are prepared by step wise growing of smaller particles with the addition of styrene monomer and initiator without any additional detergent. The microparticles are cleaned by repeated centrifugation. Cleaned microparticles are resuspended in deionized water. Sodium azide (0.02%) is added as a bacteriostatic. As a result, the **SPHERO**™ microparticles can be coated with proteins without further cleaning.

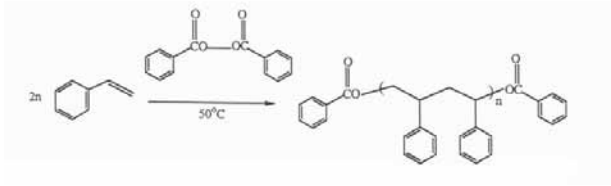
Microparticles made using potassium persulfate as initiator have sulfate groups on their surface. As a result, these particles are negatively charged and are hydrophilic, as shown in equation (1).

(1)



The **SPHERO**™ polystyrene particles greater than 3 µm are usually prepared using benzoyl peroxide as the initiator. These particles are relatively more hydrophobic, as shown in equation (2).

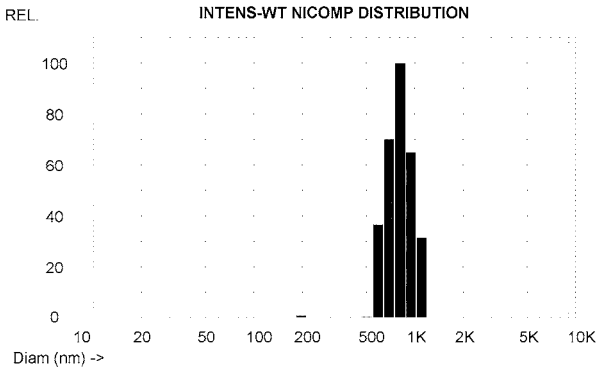
(2)



SPHERO™ polystyrene particles are composed of linear polystyrene without any cross-linking agent. These particles cannot tolerate organic solvents such as toluene, xylene, chloroform, methylene chloride, acetonitrile, dimethyl formamide or acetone. However, SPHERO™ polystyrene particles are stable in the presence of some water miscible solvents such as dimethyl sulfoxide and alcohols. Uniform size cross-linked polystyrene particles that are stable in the presence of organic solvents are also available.

Uniform SPHERO™ polystyrene particles are ideal for use in immunoassays such as latex agglutination, particle base enzyme immunoassays and fluorescence immunoassays. A tight size range of SPHERO™ polystyrene particles is maintained by monitoring size using a NICOMP Laser Particle Sizer (for particles less than 3 µm) and a Scanning Electron Microscope and/or Beckman Coulter Multisizer™ 3 for larger particles. Although the size measurements are accurate, these particles are not certified for use as calibration standard for size measurements or pore size analysis.

Figure 2 Histogram of SPHERO™ 0.8 µm Polystyrene Particles from the NICOMP Laser Particle Sizer.

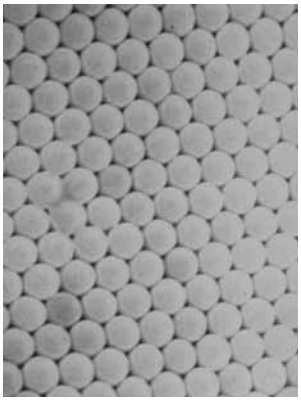


SPHERO™ Polystyrene Particles

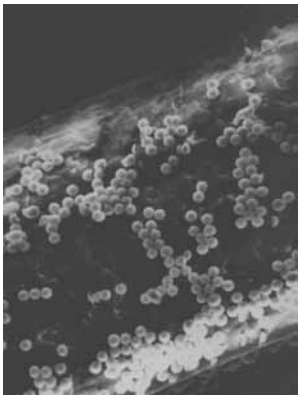
Particle Type and Surface	Size, µm	% w/v	Catalog No.	Unit
Polystyrene	0.05-0.1	5.0	PP-008-10	10 mL
			PP-008-100	100 mL
Polystyrene	0.105-0.199	5.0	PP-015-10	10 mL
Polystyrene	0.2-0.3	5.0	PP-025-10	10 mL
			PP-025-100	100 mL
Polystyrene	0.4-0.6	5.0	PP-05-10	10 mL
			PP-05-100	100 mL
Polystyrene	0.7-0.9	5.0	PP-08-10	10 mL
			PP-08-100	100 mL
Polystyrene	1.0-1.4	5.0	PP-10-10	10 mL
			PP-10-100	100 mL
Polystyrene	1.5-1.9	5.0	PP-15-10	10 mL
			PP-15-100	100 mL
Polystyrene	2.0-2.4	5.0	PP-20-10	10 mL
			PP-20-100	100 mL
Polystyrene	2.5-2.9	5.0	PP-25-10	10 mL
			PP-25-100	100 mL
Polystyrene	3.0-3.4	5.0	PP-30-10	10 mL
			PP-30-100	100 mL
Polystyrene	3.5-3.9	5.0	PP-35-10	10 mL
			PP-35-100	100 mL
Polystyrene	4.0-4.4	5.0	PP-40-10	10 mL
			PP-40-100	100 mL
Polystyrene	4.5-4.9	5.0	PP-45-10	10 mL
			PP-45-100	100 mL
Polystyrene	5.0-5.9	5.0	PP-50-10	10 mL
			PP-50-100	100 mL
Polystyrene	6.0-8.0	5.0	PP-60-10	10 mL
			PP-60-100	100 mL
Polystyrene	8.0-12.9	2.5	PP-100-10	10 mL

Figure 3 Scanning Electron Microscope (SEM) photos of polystyrene particles are shown below to illustrate the uniformity of their size. (a) Single sheet of 0.8 µm polystyrene particles. (b) 3.4 µm polystyrene particles on the surface of a human hair, which is about 100 µm in diameter. (c) Face-centered-cubic packing of 0.86 µm particles. Theoretically, particles fill ~74% of the space regardless of their size.

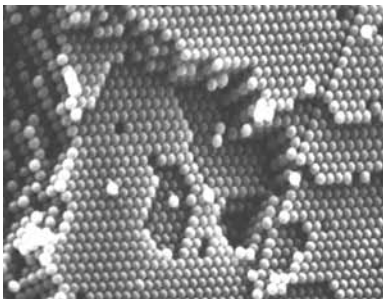
(A)



(B)



(C)



SPHERO™ Nano Polystyrene Particle Size Standard Kit

- Consists of blank beads with 4 different diameters from ~200 nm to ~1.5 µm
- Designed to estimate the size of microparticles (MPs, 0.5-0.9µm), aquatic bacteria (0.2-0.6µm), and platelets (0.9-3µm) with analytical sizing instrumentation
- Provides a cost effective submicron size standardization substitute for validating instruments when NIST beads are not necessary.

Particle Type and Surface	Size, µm	Catalog No.	Unit
Nano Polystyrene Size Standard Kit, Analytical Grade, 10^6/mL	0.1-0.3 µm, 0.4-0.6 µm, 0.7-0.9 µm, &1.0-1.9 µm,	NPPS-6K	4x5 mL

SPHERO™ Cross-linked Polystyrene Particles

Non-Uniform Crosslinked Particles

- Cost effective alternative if uniform shape is not required
- Uniform size distributions
- Stable in organic solvent.

Spherotech offers a wide range of cross-linked polystyrene particles. Both non-uniform and uniform shaped cross-linked polystyrene particles are manufactured at Spherotech. The low cost non-uniform particles are useful when particle shape does not matter. These non-uniform cross-linked polystyrene particles are stable in the presence of organic solvents. Figure 4 shows the differences between the polymeric particles consisting of polystyrene and particles made from copolymers, styrene/divinylbezene.

Uniform Crosslinked Particles

- Highly uniform and monodispersed
- Available from 3 to 30 micron
- Stable in only aqueous solvent.

If highly spherical monosized polymer particles are needed, Spherotech also has cross-linked polystyrene particles that are uniform in size and shape. Figures 5 and 6 show Beckman Coulter Multisizer™ 3 histograms for Cat. No. PPX-150-10 (Polystyrene Particles, Crosslinked, 2.5% w/v, 15.2 µm, 10 mL) and Cat. No. CPX-30-10 (Carboxyl Polystyrene Particles, 0.5% DVB Crosslinked, 5% w/v, 3.3 µm, 10 mL).

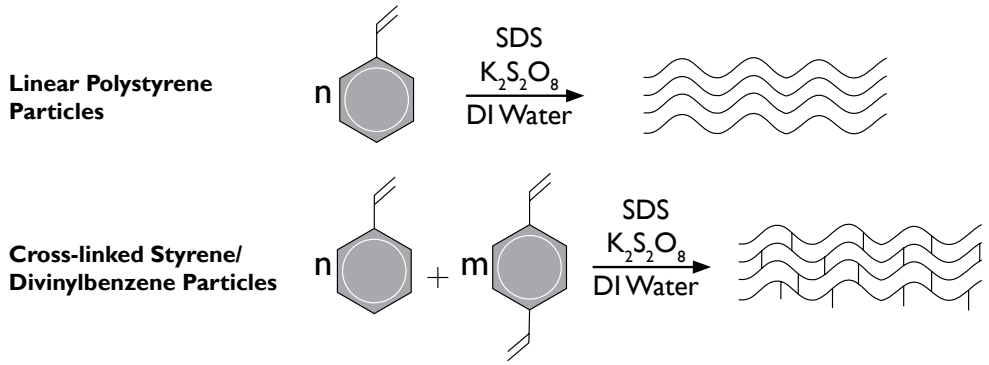
SPHERO™ Non-Uniform Cross-linked Polystyrene Particles

Particle Type and Surface	Size, µm	% w/v	Catalog No.	Unit
Polystyrene, Cross-linked, non-uniform shape	0.4-0.6	5.0	PPX-05-10	10 mL
Polystyrene, Cross-linked, non-uniform shape	0.7-0.9	5.0	PPX-08-10	100 mL
Polystyrene, Cross-linked, non-uniform shape	1.0-1.9	5.0	PPX-10-10	10 mL
Polystyrene, Cross-linked, non-uniform shape	2.0-2.4	5.0	PPX-20-10	10 mL
Polystyrene, Cross-linked, non-uniform shape	2.5-2.9	5.0	PPX-25-10	10 mL

SPHERO™ Uniform Cross-linked Polystyrene Particles

Particle Type and Surface	Size, µm	% w/v	Catalog No.	Unit
Polystyrene, Cross-linked	5.0-5.9	5.0	PPX-50-10	10 mL
Polystyrene, Cross-linked	8.0-12.9	2.5	PPX-100-10	10 mL
Polystyrene, Cross-linked	13.0-17.9	2.5	PPX-150-10	10 mL
Polystyrene, Cross-linked	18.0-24.9	2.5	PPX-200-10	10 mL
Polystyrene, Cross-linked	25.0-37.0	2.5	PPX-250-10	10 mL

Figure 4 Comparison of linear polystyrene particles and cross-linked copolymers particles made of styrene/divinylbenzene.



SPHERO™ Large Research Grade Cross-linked Polystyrene

Particle Type and Surface	Size, µm	% w/v	Catalog No.	Unit
Polystyrene, Cross-linked, Research Grade	38.0-52.0	5.0	PPX-400-10	10 mL
Polystyrene, Cross-linked, Research Grade	53.0-69.0	5.0	PPX-600-10	10 mL
Polystyrene, Cross-linked, Research Grade	70.0-89.0	5.0	PPX-800-10	10 mL
Polystyrene, Cross-linked, Research Grade	90.0-105.0	5.0	PPX-1000-10	10 mL
Polystyrene, Cross-linked, Research Grade,	106.0-124.0	5.0	PPX-1200-10	10 mL
Polystyrene, Cross-linked, Research Grade,	125.0-149.0	5.0	PPX-1400-10	10 mL
Polystyrene, Cross-linked, Research Grade,	150.0-175.0	5.0	PPX-1600-10	10 mL
Polystyrene, Cross-linked, Research Grade,	176.0-195.0	5.0	PPX-1800-10	10 mL
Polystyrene, Cross-linked, Research Grade,	196.0-211.0	5.0	PPX-2000-10	10 mL
Polystyrene, Cross-linked, Research Grade	212.0-249.0	5.0	PPX-2200-10	10 mL

SPHERO™ Functionalized Cross-linked Polystyrene Particles

Particle Type and Surface	Size, µm	% w/v	Catalog No.	Unit
Carboxyl-polystyrene, Cross-linked	3.0-3.4	5.0	CPX-30-10	10 mL
Carboxyl-polystyrene, Cross-linked	5.0-5.9	2.5	CPX-50-10	10 mL
Carboxyl-polystyrene, Cross-linked	6.0-6.9	2.5	CPX-60-10	10 mL
Carboxyl-polystyrene, Cross-linked	8.0-12.9	2.5	CPX-100-10	10 mL
Carboxyl-polystyrene, Cross-linked	13.0-17.9	2.5	CPX-150-10	10 mL
Carboxyl-polystyrene, Cross-linked	18.0-24.9	2.5	CPX-200-10	10 mL
Amino-polystyrene, Cross-linked	2.0-2.9	1.0	APX-20-10	10 mL
Amino-polystyrene, Cross-linked	3.0-3.4	2.5	APX-30-10	10 mL
Amino-polystyrene, Cross-linked	6.0-6.9	2.5	APX-60-10	10 mL
Amino-polystyrene, Cross-linked	8.0-12.9	2.5	APX-100-10	10 mL

Figure 5 Histogram of SPHERO™ Cat. No. PPX-150-10, 15.2 µm Polystyrene Cross-linked Particles from a Beckman Coulter Multisizer™ 3 Coulter Counter.

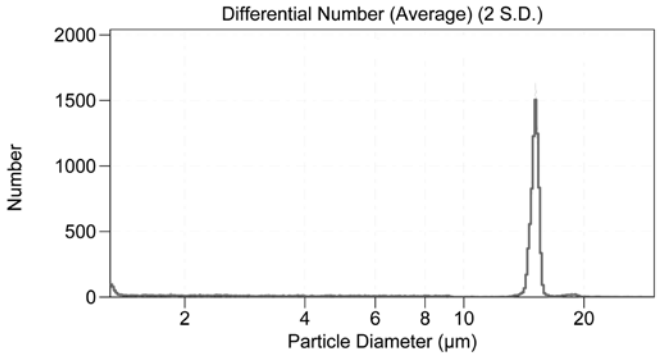
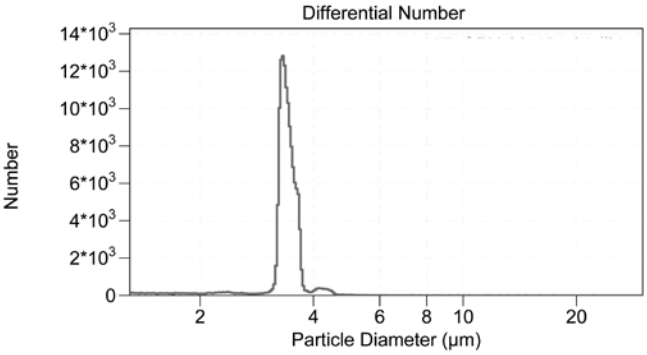



Figure 6 Histogram of SPHERO™ Cat. No. CPX-30-10, 3.3 µm Carboxyl-Polystyrene Cross-linked Particles from a Beckman Coulter Multisizer™ 3 Coulter Counter.