Polysciences, Inc.
Extraordinary chemistry. Superior beads.

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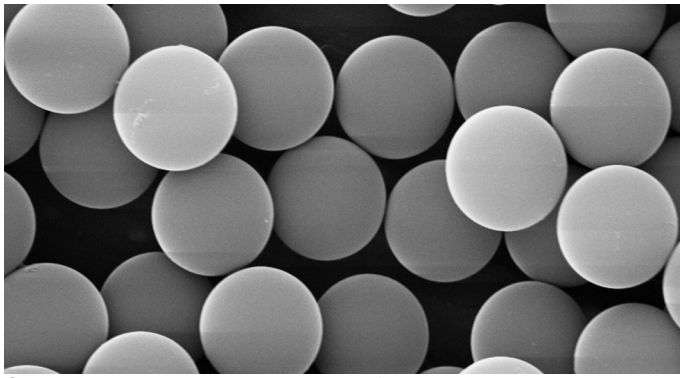
Uniform Silica Microspheres

Description

Polysciences, Inc. offers uniform, non-porous silica (SiO_2) microspheres available in diameters of ~150nm-5µm. These particles typically have size CVs of 10-15%. For applications that require highly stringent CVs (e.g. 2-5%), call for product availability.

Inorganic supports such as silica microspheres have become increasingly important for a variety of applications, including isolation of nucleic acids, cell separation, and immuno- and DNA-based assays. They offer the combined benefits of a bead platform and the unique properties of a silica substrate:

- Flexible silanization chemistries
- Unique refractive index and density
- Low autofluorescence
- Low nonspecific binding of many biomolecules
- Hydrophilicity
- Ease of handling



Scanning Electron Microscope image of Polysciences' (4.14µm) silica microsphere.

Characteristics

Composition:	SiO_2, nonporous
Surface groups:	SiOH (non-functionalized), NH_2, or COOH
Refractive index:	~1.43-1.46* (589nm)
Density:	2.0 g/cm^3
Glass Transition Temp:	>>1000°C**

* The differences between the refractive index and density of silica microspheres and true amorphous quartz have been attributed to the presence of microvoids within the spheres.

** Reported value for bulk silica.

Notes

1. *Aggregation:* If observed, aggregation may be treated using sonication (bath sonicator, ~10 min; probe sonicator, ~1 min).
2. *Washing:* Standard washing methodologies are recommended, i.e. centrifugation where practicable, and dialysis or filtration for microspheres <500nm. Please note that carboxyl (COOH) or amine (NH_2) surface groups are in equilibrium with those in the suspending solution. It is therefore expected that a negligible amount of surface groups will be removed with each wash; binding ability is not expected to be significantly affected.
3. *Transitioning Microspheres into a Solvent and Drying:* Silica microspheres >0.5µm in diameter may be dried to a powder. To dehydrate the surface (remove adsorbed water), the microspheres should first be washed with an organic solvent, such as ethanol or THF. Researchers should begin by transitioning the microspheres from an aqueous buffer to solutions of increasing solvent concentration, and then separating them from solution (via settling, centrifugation, or filtration). The microspheres are then dried from a moist cake, either in the open air or in a drying oven (e.g. 24 hours at 70°C). The dry cake may be crushed to a powder with a mortar and pestle.
4. *Suspending Dry Microspheres:* Dry silica microspheres can be readily dispersed in aqueous buffers or solvents (e.g. ethanol, methanol, THF, DMSO). An appropriate amount of silica powder should be added to the fluid of interest (dilute suspensions are easier to handle), and rigorously vortexed. The vial or tube containing the silica suspension should then be placed in a sonic bath. (Note: Probe sonicators are typically ineffective for dispersing powders.) Bath sonicate for ~10 minutes, and confirm that

the microspheres are dispersed by viewing a drop of suspension under a light microscope (400X magnification). Individual microspheres 1µm or larger may be discerned at this magnification, and clumps of smaller microspheres will be clearly visible. If clumps are visible, continue to bath sonicate for 10 minute cycles until the spheres are fully dispersed.

5. *Coating microspheres:* To covalently couple biomolecules to silica microspheres, the spheres must first be derivatized. This typically involves the regeneration of hydroxyl groups through an acid incubation followed by immediate silanization, or drying and later silanization. Acid-washed or derivatized (silanized) spheres should be stored dry with a desiccant. See the References section for additional protocols.

Adsorption is a common strategy for the assembly of lipid bilayers and for the isolation of nucleic acids. Silica microspheres may be coated with proteins via adsorption; however, as desorption of protein from the hydrophilic bead surface may occur over time, covalent coupling may be a better coating strategy for applications that require long-term stability.

References

1. **Cras, J.J., C.A. Rowe-Taitt, D.A. Nivens, F.S. Ligler.** 1999. Comparison of cleaning methods of glass in preparation for silanization. *Biosens Bioelectron,* 14: 683-688.
2. **Falipou, S., J-M. Chovelon, C. Martelet, J. Margonari, D. Cathignol.** 1999. New use of cyanocilane coupling agent for direct binding of antibodies to silica supports. Physicochemical characterization of molecularly bioengineered layers. *Bioconjugate Chem,* 10: 346-53.
3. **Iler, R.K.** 1979. *The chemistry of silica: solubility, polymerization, colloid and surface properties, and biochemistry.* New York: John Wiley & Sons.
4. **Kumar, A., O. Larsson, D. Parodi, Z. Liang.** 2000. Silanized nucleic acids: a general platform for DNA immobilization. *Nucleic Acids Res,* 28(14): e71.
5. **Steinberg, G., K. Stromsborg, L. Thomas, D. Barker, C. Zhao.** 2004. Strategies for covalent attachment of DNA to beads. *Biopolymers,* 73: 597-605.
6. **Walsh, M.K., X. Wang, B.C. Weimer.** 2001. Optimizing the immobilization of single-stranded DNA onto glass beds. *J Biochem Biophys Methods,* 47: 221-31.
7. **Weetall, H.H.** 1993. Preparation of immobilized proteins covalently coupled through silane coupling agents to inorganic supports. *Appl Biochem Biotechnol,* 41(3): 157-88.

Storage and Stability

Store dry and functionalized (COOH and NH_2) silica particles at room temperature. Functionalized silica microspheres should be stored dry to deter loss of surface groups.

Store suspended (plain and coated) silica particles at 4°C. Freezing may result in irreversible aggregation and loss of binding activity. Coated silica microspheres should be stored in a buffer that is suitable for both the biomolecule and the silica matrix. Stability of coated microspheres should be determined empirically.

This product is for research use only and is not intended for use in humans or for *in vitro* diagnostic use.

Ordering Information

Cat. #	Description	Size
24298	Silica Microspheres. 0.01µm (broad distribution)	10ml
24040	Silica Microspheres, 0.05µm	10ml
24041	Silica Microspheres, 0.10µm	10ml
24320	Silica Microspheres, 0.15µm	15ml
24321	Silica Microspheres, 0.30µm	15ml
24322	Silica Microspheres, 0.40µm	15ml
24042	Silica Microspheres, 0.45µm	10ml
24323	Silica Microspheres, 0.50µm	15ml
24324	Silica Microspheres, 0.70µm	15ml
24325	Silica Microspheres, 0.90µm	15ml

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Cat. #	Description	Size
24326	Silica Microspheres, 1.0µm	15ml
24327	Silica Microspheres, 1.5µm	15ml
24328	Silica Microspheres, 2.0µm	15ml
24329	Silica Microspheres, 2.5µm	15ml
24330	Silica Microspheres, 3.0µm	15ml
24331	Silica Microspheres, 4.0µm	15ml
24332	Silica Microspheres, 5.0µm	15ml
24756	Silica Amine, 0.5µm	1g
24757	Silica Amine, 1.0µm	1g
24758	Silica Amine, 5.0µm	1g
24753	Silica Carboxyl, 0.5µm	1g
24754	Silica Carboxyl, 1.0µm	1g
24755	Silica Carboxyl, 5.0µm	1g
24759	Silica Streptavidin, 0.5µm	2ml
24760	Silica Streptavidin, 1.0µm	2ml
24761	Silica Streptavidin, 5.0µm	2ml

To Order

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