

DUKE STANDARDS™ Microsphere Size Standards NIST Traceable Mean Diameter

1. DESCRIPTION. These particle size standards provide accurate and traceable size calibration for particle size analysis. They are part of a series of polymer microspheres with calibrated mean diameters traceable to the Standard Meter through the National Institute of Standards and Technology (NIST). Diameters from 20 nanometers (nm) to 160 micrometers (µm) are available as aqueous suspensions in dropper-tipped vials, calibrated by photon correlation spectroscopy (PCS), transmission electron microscopy (TEM) or optical microscopy. The aqueous medium has been prepared to promote dispersion and reduce clumping of the particles. The approximate particle concentration in percent solids is given to facilitate dilution for the calibration and validation of particle analyzers. Diameters from 200 µm to 1000 µm are available as dry spheres, calibrated by optical microscopy. The certified mean diameter is traceable to NIST. Other values are for information only and should not be used as calibration values.

2. PHYSICAL DATA

Certified Mean Diameter:	3.007 µm ± 0.032 µm, k=2
Standard Deviation:	0.030 µm
Coefficient of Variation:	1.0%
Microsphere Composition:	Polystyrene
Microsphere Density:	1.05 g/cm ³
Index of Refraction:	1.59 @ 589 nm
Approximate Concentration:	0.46% solids

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CERTIFICATE OF CALIBRATION AND TRACEABILITY

This certifies that the calibrated mean diameter dimension of this product was transferred by optical microscopy from a stage micrometer calibrated by the National Institute of Standards and Technology (SRM 2800 SN411). NIST Standard Reference Materials 1690, 1692, 1960, and 1961 were used to validate the accuracy and traceability of the calibration methods.

Catalog Number: 4203 and 4203A, Duke Standards™ Microsphere Size Standards	
Certification Date:	May 24, 2017
Certified Batch:	4203-006
Production Batch:	4203-032
Certified Mean Diameter:	3.007 µm
Expanded Uncertainty:	± 0.032 µm, k=2



Saba Hashemi 06-05-2017
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Packaging Lot # 185943

Expiration Date: JUN'20

3. MEASUREMENT METHODOLOGY The certified diameter of this product was transferred by optical microscopy from an stage micrometer, a glass slide with a scale with line spacing calibrated by NIST in micrometers. The uncertainty is calculated from the calibration transfer uncertainty and the random error of the measurements per NIST Technical Note 1297. The uncertainty listed is the expanded uncertainty, with a coverage factor of 2 ($k=2$). To validate the accuracy of our optical methods, NIST certified microsphere standards were measured by the same method. The size distribution (standard deviation) was obtained by optical microscopy, electron microscopy or electrical resistance analysis depending on the size of the particles. The coefficient of variation is the standard deviation as a percentage of the mean diameter.

4. CERTIFICATE Except for the purposes of record keeping, this certificate may not be reproduced. Rebottling or relabeling voids the warranty and invalidates the certification and traceability of these products. The Certified Batch is the master batch of material that is measured and certified with a NIST traceable mean diameter. The Production Batch represents the intermediate material from which the final product is made. Several Production Batches can be made from one Certified Batch.

5. OPERATING INSTRUCTIONS For ease of use, standards with mean diameters below 200 μm are packaged in an aqueous suspension. They must be thoroughly dispersed in the bottle to ensure statistically consistent samples. To disperse the particles, gently invert the bottle several times, then immerse in a low power ultrasonic bath (10 seconds). Do not shake the bottle, as the small bubbles formed may introduce statistical artifacts. Before using, clear the tip of residue by dispensing 2 - 3 drops into a waste container. Dispense immediately after dispersion using the dropper tip. Standards 200 μm and larger are dry and should not be shaken as this may produce static, making the particles hard to handle.

6. SAFETY AND HANDLING PRECAUTIONS Avoid aerosol production in the workplace while handling these products, or wear a suitable filter respirator when necessary. Avoid inhalation or ingestion of the particles. These products should only be used by trained scientific personnel. A Material Safety Data Sheet is included with each package.

7. STORAGE AND DISPOSAL Keep the bottle tightly sealed to avoid contamination. Store aqueous standards upright to prevent clogging the tip with particles. Refrigeration is not required for storage. Do not freeze the particles. In case of spills, wash or wipe the area thoroughly. Caution: surfaces covered with dry spheres may be very slippery. Wipe area with damp cloth. Dispose of as normal laboratory waste. There are no special disposal procedures. Each bottle has a limited shelf life and should not be used after its expiration date.

8. LIMITED WARRANTY These products are intended for laboratory use by trained scientific personnel. Determination of their suitability for a specific end-use is the responsibility of the user, who assumes all liability for loss or damage arising out of the use of the product. Rebottling or relabeling voids the warranty and certification. Microgenics Corporation's warranty is limited to replacement of defective products if returned with our authorization within 60 days of purchase date.

THE FOREGOING WARRANTY SHALL BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MICROGENICS BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

SECTION 10 - STABILITY AND REACTIVITY

STABILITY: Stable at room temperature in closed containers under normal storage and handling conditions
INCOMPATIBILITY: None known
HAZARDOUS DECOMPOSITION PRODUCTS: Not known
HAZARDOUS POLYMERIZATION: Will not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

REPRODUCTIVE AND DEVELOPMENTAL TOXICITY: Material is not considered to be a reproductive or developmental toxicant
CARCINOGENICITY: Material is not listed by NTP, ACGIH, IARC or OSHA as a carcinogen. For more information refer to Section 2. Hazards identification.

SECTION 12 - ECOLOGICAL INFORMATION

ECOTOXICITY: Not regarded as dangerous for the environment LC/EC/IC50 > 100 mg/L
PERSISTENCE/DEGRADATION: No information found
BIOACCUMULATION/ACCUMULATION: No information found
MOBILITY IN ENVIRONMENTAL MEDIA: Microspheres are insoluble in water
ENVIRONMENTAL: Not classified as harmful to the environment
OTHER ADVERSE EFFECTS: No information found

SECTION 13 - DISPOSAL CONSIDERATIONS

Dispose of any waste residues according to prescribed federal, state, and local guidelines (e.g., to an appropriately permitted chemical waste incinerator)
None of the components are on RCRA P& RCRA U Series Wastes list. EWC waste code 18 01 05 discard as chemicals and medicines
Other Information: According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used

SECTION 14 - TRANSPORTATION INFORMATION

HAZARD CLASS: Not classified per US DOT, TDG, UNECE, ADR, ADN, IATA, ICAO, RID, IMDG/IMO, OTIF, Mexico

SECTION 15 - REGULATORY INFORMATION

CAS# 9003-53-6, CAS#9003-70-7

TSCA 8(b)	SARA 302	SARA 313	CERCLA	RCRA 261.33	TSCA 8(d)	TSCA 12(b)	FIFRA	CWC	SARA 311/312	EPICRA	CAA- SNAP	FDA
yes (XU)	no	no	no	no	no	no	yes	no	no	no	no	yes

CAS#7732-18-5

TSCA 8(b)	SARA 302	SARA 313	CERCLA	RCRA 261.33	TSCA 8(d)	TSCA 12(b)	FIFRA	CWC	SARA 311/312	EPICRA	CAA- SNAP	FDA
yes	no	no	no	no	no	no	yes	no	no	no	yes	no

Not subject to ITAR and EAR regulations

US State - CAS# 9003-53-6 - Texas

California - Prop 65, Title 8 CCR, Title 22 CCR, ATHS, Occupational Exposure Limits, Ozone Depleting Compounds, Precursor Chemicals, SCAQMD, California No Significant Risk Level - **No information found**

None of the chemicals are on Prop 65 lists

CAS#9003-70-7 - DSL

WHMIS:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

SECTION 16 - OTHER INFORMATION

Revision: 07

Date prepared: October 1, 2008

ABBREVIATIONS

EU: European Union

DOT: Department of Transportation

NIOSH: National Institute for Occupational Safety and Health

ACGIH: American Conference of Governmental Industrial Hygienists

IATA: International Air Transport Association

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

IARC: International Agency for Research on Cancer

This MSDS is intended for review and guidance in the receipt, storage, handling, use and disposal of product purchased from Thermo Fisher Scientific, and for no other purpose. Use this product only as directed and in accordance with applicable instructions and warnings provided with the product. Please consult your institution's policies regarding use of this product. If you have obtained this MSDS other than in connection with the supply of this product from Thermo Fisher Scientific, this MSDS should be consulted for general information only, and should not be relied upon for any purpose. As with the use of all hazardous materials, you should in all instances follow the guidance of the MSDS provided or available with the specific product purchased.

End of MSDS

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product Name: Polymer Microsphere Suspension
 Contents: Polymer microspheres suspended in water. Polymers include polystyrene, polystyrene divinylbenzene (PSDVB), or other styrene copolymers

Company Identification: Microgenics Corporation	Company Phone Number: (510) 979-5000
Office Address: 46360 Fremont Blvd.	Emergency Phone Number: (510) 979-5000
City, State, Zip Code: Fremont, CA 94538	CHEMTREC Phone Number, US: (800) 424-9300
Country: USA	CHEMTREC Phone Number, Europe: (202) 483-7616

SECTION 2 - HAZARD IDENTIFICATION

CAUTION! May cause lung irritation if inhaled. By normal use the product is not regarded as hazardous to health. The product is not classified as flammable or harmful to the environment; may cause eye, skin, digestive track, and respiratory track irritation. The toxicological properties of this material have not been fully investigated. This product is not classified as dangerous in accordance with Directive 1999/45/EC or 67/548/EEC

SECTION 3 - COMPOSITION/INFORMATION ON INGREDIENTS

Component: Name	CAS Number:	Percentage:	EINECS/ELINCS
polystyrene or	9003-53-6	<0.1-10	N/A
polystyrene divinylbenzene	9003-70-7		N/A
water	7732-18-5	90-99.9+	231-791-2
dispersant/surfactant	Proprietary	<0.5 (if any)	N/A
preservative	Proprietary	<0.1 (if any)	N/A

Component comments have no OSHA, Canadian, or EU hazardous ingredients above applicable threshold

SECTION 4 - FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water for at least 15 minutes. If an irritation develops, seek medical advice
 SKIN CONTACT: In case of contact promptly remove clothes, wash area with soap and flush with plenty of water. If an irritation develops, seek medical advice.
 INHALATION: Remove to fresh air and seek medical advice
 INGESTION: Give one to two glasses of water and seek medical advice

SECTION 5 - FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: Not considered flammable or explosive. NFPA/HMIS Rating (estimated): Health: 1; Flammability: 0; Instability: 0
 PROTECTION FOR FIREFIGHTERS: Use extinguishing media appropriate for surrounding fire (water, foam, vaporizing liquid or multipurpose dry chemical).

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Areas covered with spilled microspheres may be slippery. If material is spilled or released, cordon off the area. Collect material by wiping the spill area with a paper towel or disposable wipe, and place materials into an appropriate container. Avoid inhaling fine particle dust. Discard collected material in containers suitable for proper disposal

SECTION 7 - HANDLING AND STORAGE

Keep tightly sealed to prevent contamination; store between 4 °C to 30 °C unless otherwise specified on product label or literature. Avoid damaging or puncturing containers. When creating aerosols of fine particles use minimal and directional (away from the user) airflow

SECTION 8 - EXPOSURE CONTROL/PERSONAL PROTECTION

Occupational Exposure Limits

Chemical Name - polystyrene or polystyrene divinylbenzene, water

OSHA PEL					ACGIH TLV			AIHA		NIOSH REL			
Ceiling	TWA	STEL	Final	Vacated	Ceiling	TWA	STEL	WEEL	OEL	Ceiling	TWA	STEL	IDLH
Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed	Not listed

EXPOSURE GUIDELINES: This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies. Safety glasses with side shields are suggested
 ENGINEERING CONTROLS: Use minimal and directional (away from the user) airflow to minimize worker exposure
 SKIN PROTECTION: Wear appropriate protective gloves to prevent skin exposure. No skin irritation expected
 RESPIRATORY PROTECTION: Respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149
 GENERAL HYGIENE CONSIDERATIONS: Wear appropriate protective clothing to prevent skin exposure

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: 100 °C (as water)	SOLUBILITY IN WATER: microspheres are insoluble in water	FLASH POINT: N/A
MELTING POINT: 0 °C (as water)	EVAPORATION RATE: N/A	FLAMMABLE PROPERTIES: N/A
PHYSICAL STATE: suspension	VAPOR PRESSURE: N/A	AUTO IGNITION TEMP: N/A
VAPOR DENSITY: N/A	pH: 5-8 Kow: N/A	DECOMPOSITION: N/A
APPEARANCE, COLOR, ODOR: White or colorless liquid, odorless		POLYMER/ SUSPENSION DENSITY: 1.0 to 1.05 g/cm ³