Date of Issue:
03 November 2017

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

RM Number: 8281
RM Name: Single-Wall Carbon Nanotubes
(Dispersed, Three Length-Resolved Populations)
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Reference Material (RM) is intended to provide a common set of single-wall carbon nanotube (SWCNT) dispersions of varying aspect ratios and purity for measurement comparisons. A unit of RM 8281 consists of four ampoules, three of the ampoules contain a single dispersion of average length SWCNTs and are labeled Long, Medium, and Short according to the population present in surfactant solution and the fourth ampoule labeled Blank which contains only surfactant solution. The surfactant is sodium deoxycholate and is present at a concentration of approximately 10 g/L in each of the four ampoules. Each ampoule contains approximately 2.5 mL of solution. The surfactant solution is subjected to the same processing as the nanotube dispersions and is included as a blank; no reference values are provided for this sample.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
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1-800-424-9300 (North America)
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2. HAZARDS IDENTIFICATION

Note: The concentration of SWCNT in this suspension is below the cut-off value/concentration limit for SDS information as required by OSHA 29 CFR 1910.1200. This material should be handled as recommended by the National Institute for Occupational Safety and Health (NIOSH). According to NIOSH, occupational health risks associated with manufacturing and using nanomaterials are not fully understood. Minimal information is currently available on dominant exposure routes, potential exposure levels, and material toxicity of nanomaterials.

Classification

Physical Hazard: Not classified.
Health Hazard: Not classified.

Label Elements
Symbol
No Symbol

Signal Word
No Signal Word

Hazard Statement(s): Not applicable.

Precautionary Statement(s): Not applicable.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: SWCNT/Sodium deoxycholate/Water solution

Other Designations: Sodium deoxycholate (Deoxycholic acid, sodium salt)
SWCNT (Carbon nanotubes; nanotubes; SWCNT; CNT; synthetic graphite)

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the Report of Investigation.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Sodium deoxycholate	302-95-4	206-132-7	1
Carbon nanotubes	308068-56-6	not applicable	<0.1
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>98

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Thoroughly clean and dry contaminated clothing before reuse.

Eye Contact: Flush eyes with water for at least 15 minutes. If necessary, seek medical attention.

Ingestion: If ingested, seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Irritation.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:
Suitable: Regular dry chemical, carbon dioxide, water, and regular foam.
Unsuitable: None listed.

Specific Hazards Arising from the Chemical: None listed.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 1 Fire = 0 Reactivity = 0

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact safety personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (oxidizing materials).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: This material contains SWCNT and inhalation/respiratory protection should be used to minimize exposure. Carbon nanotubes and carbon nanofibers may cause adverse pulmonary effects such as inflammation, granulomas, and pulmonary fibrosis. No OSHA occupational exposure limits have been established for carbon nanotubes. The recommended exposure limit below is from NIOSH.

Recommended NIOSH (REL): 1 $\mu g/m^3$ (TWA, respirable elemental carbon)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties:

Appearance (physical state, color, etc.):	opaque black liquid
Molecular Formula:	not available
Molar Mass (g/mol):	not available
Odor:	not available
Odor threshold:	not available
pH:	not available
Evaporation rate:	not applicable
Melting point/freezing point (°C):	not available
Relative Density (g/L):	not available
Vapor Pressure (mmHg):	not applicable
Vapor Density (air = 1):	not applicable
Viscosity (cP):	not applicable
Solubility(ies):	soluble in water
Partition coefficient (n-octanol/water):	not available
Particle Size (if relevant)	not available

Thermal Stability Properties:

Autoignition Temperature (°C):	not available
Thermal Decomposition (°C):	not available
Initial boiling point and boiling range (°C):	not available
Explosive Limits, LEL (Volume %):	not available
Explosive Limits, UEL (Volume %):	not available
Flash Point (°C)	not available
Flammability (solid, gas):	not available

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable _____ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Avoid contact with incompatible materials.

Incompatible Materials: Oxidizing materials.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Carbon oxides, sodium oxides, and oxides of metallic impurities.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: No data available; exposure to sodium deoxycholate may cause irritation.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Exposure to sodium deoxycholate can cause irritation.

Skin Contact: Exposure to sodium deoxycholate can cause skin irritation and itching.

Eye Contact: Exposure to sodium deoxycholate can cause eye irritation.

Ingestion: May be harmful if ingested.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.
Sodium deoxycholate, Rat Oral LD50: 1370 mg/kg

Skin Corrosion/Irritation: Not classified; no data available.

Serious Eye damage/ Eye irritation: Not classified; no data available.

Respiratory Sensitization: Not classified; no data available.

Skin Sensitization: Not classified; no data available.

Germ Cell Mutagenicity: Not classified; no data available.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen _____ Yes X No
Sodium deoxycholate and carbon nanotubes are not listed in NTP, IARC or OSHA as a carcinogen.
Note: Sodium deoxycholate has been found to be a promoter of colon carcinogenesis in rats.

Reproductive Toxicity: Not classified; no data available.
Sodium deoxycholate, Rat Intraperitoneal TDLo: 1400 mg/kg (28 d)

Specific Target Organ Toxicity, Single Exposure: Not classified; no data available.

Specific Target Organ Toxicity, Repeated Exposure: Not classified; no data available.

Aspiration Hazard: Not classified; no data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: No data available.

Persistence and Degradability: No data available.

Bioaccumulative Potential: No data available.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Not regulated by DOT or IATA.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated for this material.

SARA Title III Section 302 (40 CFR 355.30): Not regulated for this material.

SARA Title III Section 304 (40 CFR 355.40): Not regulated for this material.

SARA Title III Section 313 (40 CFR 372.65): Not regulated for this material.

OSHA Process Safety (29 CFR 1910.119): Not regulated for this material.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	No.
CHRONIC HEALTH:	No.
FIRE:	No.
REACTIVE:	No.
PRESSURE:	No.

State Regulations:

California Proposition 65: Not listed.

U.S. TSCA Inventory: Sodium deoxycholate and synthetic graphite are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 03 November 2017

Sources: Fisher Scientific, Vendor MSDS *Deoxycholic acid, sodium salt*, 20 July 2009.

South-West NanoTechnologies, Vendor MSDS *Single-Wall Carbon Nanotubes Freeze-Dried Powder*, 20 December 2011.

ChemADVISOR, Inc., MSDS *Graphite, Synthetic*, 03 December 2012.

ChemADVISOR, Inc., MSDS *Sodium Desoxycholate*, 09 December 2015.

NIOSH; *Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials*, NIOSH Publication 2009-128, available http://www.cdc.gov/niosh/docs/2009-125/ (accessed Nov 2017); see also NIOSH Current Intelligence Bulletin 65: *Occupational Exposure to Carbon Nanotubes and Nanofibers*, DHHS (NIOSH) Publication No 2013-145 (April 2013); available at http://www.cdc.gov/niosh/docs/2013-145/pdfs/2013-145.pdf (accessed Nov 2017).

Khripin, C.Y.; Tu, X.; Howarter, J.; Fagan, J.; Zheng, M.; *Concentration Measurement of Length-Fractionated Colloidal Single-Wall Carbon Nanotubes*; Anal. Chem., Vol. 84 (20), pp. 8733–8739 (2012).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Level
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Level
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
NIOSH	National Institute for Occupational Safety and Health	UEL	Upper Explosive Limit
NIST	National Institute of Standards and Technology	WHMIS	Workplace Hazardous Materials Information System

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Report of Investigation.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.