



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

1. Identification of the substance/mixture and of the company/undertaking


1.1 Product identifier:

Product Name Graphene suspension
 Product Code S-EG60

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses of the Additive for enhancing physical properties.
 product

1.3 Details of the supplier of the safety data sheet

Manufacturer/ Supplier Enerage Inc. 
 Address No.5, Ligong 3rd Rd., Wujie Township, Yilan County 26841, Taiwan, R.O.C.
 Phone number 886-3-990-2100
 Fax 886-3-990-2500

1.4 Emergency phone number 886-3-990-2100

2. Hazards identification

GHS classification and label elements of the product

2.1 Classification of the substance or mixture

Health hazards	Acute toxicity (Oral)	Category 4
	Toxic to reproduction	Category 2
	Specific target organ toxicity-single exposure, respiratory system	Category 1
	Serious eye damage/ Eye irritation	Category 2A
Target Organs	Central nervous system, kidney	
Unknown toxicity	Acute toxicity, inhalation, vapor	100%

2.2 Label elements



Signal word Warning

Hazard statements H302 Harmful if swallowed.
 H373 May cause damage to organs (Kidney) through prolonged or repeated exposure if
 swallowed.

Precautionary statements

Prevention P102 Keep out of reach of children
 P201 Obtain special instructions before use
 P202 Do not handle until all safety precautions have been read and understood



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking

P211 Do not spray on an open flame or other ignition source.

P233 Keep container tightly closed.

P243 Take precautionary measures against static discharge.

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P270 Do not eat, drink or smoke when using this product

P271 Use only outdoors or in a well-ventilated area.

P272 Contaminated work clothing should not be allowed out of the workplace.

P280 Wear protective gloves/protective clothing/eye protection/face protection

P281 Use personal protective equipment as required.

P284 Wear respiratory protection

P285 In case of inadequate ventilation wear respiratory protection

Response

P301 IF SWALLOWED

P330 Rinse mouth.

P331 Do NOT induce vomiting.

P313 Get medical advice/attention

P303 IF ON SKIN (or hair)

P351 Rinse cautiously with water for several minutes.

P352 Wash with plenty of soap and water.

P353 Rinse skin with water/shower.

P304 IF INHALED

P314 Call a POISON CENTER/doctor if you feel unwell.

P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P305 IF IN EYES

P338 Remove contact lenses, if present and easy to do. Continue rinsing.

P351 Rinse cautiously with water for several minutes.

P337 If eye irritation persists

P313 Get medical advice/attention.

P370 In case of fire

P374 Fight fire with normal precautions from a reasonable distance.

P376 Stop leak if safe to do so.

P378 Use water, carbon dioxide, dry chemical powder or alcohol resistant foam to extinguish.

Storage

P402 Store in a dry place.

P403 Store in a well-ventilated place.

P404 Store in a closed container.

P405 Store locked up.

Disposal

P501 Dispose of contents/ container to an approved waste disposal plant.

3. Composition/information on ingredients



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

<u>Chemical name</u>	<u>CAS No.</u>	<u>EC No.</u>	<u>Index No.</u>	<u>Content (wt%)</u>
1,2-ethanediol (ethylene glycol)	107-21-1	203-473-3	603-027-00-1	80~95
Graphene	1034343-98-0	801-282-5		5~20

4. First-aid measures

4.1 Descriptions of first-aid measures

General measures	In the case of prolonged irritation or other adverse effects, contact a doctor. Show this safety data sheet to the doctor in attendance.
IF ON SKIN (or hair)	Wash with soap and water. If skin irritation occurs, get medical advice/ attention. Contaminated clothing should be removed and washed thoroughly before re-use.
IF INHALED	Remove from exposure to fresh air and call a poison center/ doctor to get medical advice/ attention. If breathing is difficult, administer oxygen. If breathing has stopped, begin artificial respiration immediately, and seek medical attention.
IF IN EYES	Flush eyes with water for at least 15 minutes. If easy to do, remove contact lens. Get medical attention
IF SWALLOWED	Rinse mouth with water and consult a physician. Call a POISON CENTER/doctor if you feel unwell. Never give anything to an unconscious person.

4.2 Most important symptoms/ effects, acute and delayed

Symptoms	May cause irritation to skin, eyes and respiratory tract.
Hazards	No information about adverse effects due to exposure

4.3 Indication of immediate medical attention and special treatment needed.

Treatment	Symptoms may be delayed. Treat symptomatically.
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5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media	Water, carbon dioxide, dry chemical powder or alcohol resistant foam.
Unsuitable extinguishing media	No data available

5.2 Specific hazards arising from the substance or mixture In the event of combustion or thermal decomposition, this material may release carbon monoxide (CO) or carbon dioxide (CO₂).

5.3 Advice for firefighters

Special protective equipment and	Firefighters must use standard protective equipment including flame retardant coat,
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SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

precautions for fire-fighters helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

Specific fire-fighting measures Cool containers exposed to flames with water until well after the fire is out.

In case of fire and/or explosion do not breathe fumes.

Keep away from any heat source or electronic circuits.

6. Accidental release measures

6.1 Personnel precautions, protective Evacuate personnel to safe areas.

equipment and emergency Remove all sources of ignition if safe to do.

procedures

Should wear suitable protective equipment to prevent inhalation or skin contact.

Should beware of the risk of slippage due to the material's low coefficient of friction.

Keep upwind.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so.

Do not contaminate water sources or sewer.

Avoid discharge into drains, water courses or onto the ground

6.3 Methods and materials for containment and cleaning up

Collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations.

Do not discharge into storm or sanitary sewers or groundwater.

7. Handling and storage

7.1 Precautions for safe handling

Preventive measures

(Exposure Control for handling personnel)

Do not breathe dust/fume/gas/mist/vapors/spray.

Avoid breathing dust/fume/gas/mist/vapors/spray.

(Protective measures against fire and explosion)

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

Safety Measures/Incompatibility

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

Use only outdoors or in a well-ventilated area.

Wear protective gloves and face protection.

Use personal protective equipment as required.

Remove contaminated clothing and wash the skin thoroughly with soap and water after work.

7.2 Conditions for safe storage, including any incompatibilities

Recommendation for storage

Store in a well-ventilated place and keep cool.

Keep container tightly closed

Store locked up.



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

Graphene is electrically conductive. Avoid accumulations of graphene in places where these accumulations could cause shorting of electrical switches, circuits or components since any dust can form a potentially explosive mixture in air.

8. Exposure controls/personal protection

8.1 Engineering controls Provide adequate workplace ventilation. If vapor/dusts are generated through handling, local exhaust ventilation should be employed.
 Eye wash facilities and emergency shower must be available when handling this product.
 Respiratory protection may be needed for non-routine or emergency situations.

8.2 Exposure controls

Components	Type	Exposure limit(s)	Source
Ethylene glycol, aerosol, inhalation	STEL	10 mg/m ³	US. ACGIH Threshold Limit Values (03 2017)
Ethylene glycol - Vapor fraction	TWA	25 ppm	US. ACGIH Threshold Limit Values (03 2017)
Ethylene glycol	STEL	50 ppm	US. ACGIH Threshold Limit Values (03 2017)
	Ceiling	50 ppm 125 mg/m ³	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	Ceiling	50 ppm 125 mg/m ³	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
	ST ESL	Health 450 µg/m ³	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (11 2016)
	AN ESL	Health 1.8 ppb	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (11 2016)
Ethylene glycol	AN ESL	Health 4.5 µg/m ³	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (11 2016)
	ST ESL	Health 180 ppb	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (11 2016)
	Ceiling	40 ppm 100 mg/m ³	US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (08 2010)

8.3 Personal protective Equipment

General Good general ventilation (typically 10 air changes per hour) should be used.
 Ventilation rates should be matched to conditions.
 If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits.
 If exposure limits have not been established, maintain airborne levels to an acceptable level.
 An eye wash and safety shower must be available in the immediate work area.



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

Respiratory protection	To minimize risk of over exposure to dust, vapor or fumes, it is recommended that a local exhaust system is placed above the equipment, and that the working area is properly ventilated. If ventilation is inadequate, use certified respirator that will protect against dust/mist.
Eye/face protection	Wear suitable safety eyeglasses or chemical protective goggles or other face protection.
Skin and body protection	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Hand protection	Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.
Hygiene	Do not eat, drink or smoke when using the product. Wash hands after handling. Observe good industrial hygiene practices.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance	Liquid
Color	Gray to black
Odor	Odorless
Odor threshold	No data available
pH	No data available
Melting point	Ethylene glycol: -13°C ; Graphene: $>3600^{\circ}\text{C}$
Initial boiling point	Ethylene glycol: 197.4°C @ 1,013hPa
Flash point	Ethylene glycol: 115°C (open cup)
Auto-ignition temperature	Ethylene glycol: 412°C ; Graphene: dispersed dust cloud: $>600^{\circ}\text{C}$
Flammability (solid, gas)	Ethylene glycol: No data available
Flammable limit	3.2~15.3 % (V)
Evaporation rate	No data available
Vapor density	2.14
Vapor pressure	0.067 hPa @ 20°C ; 0.123 hPa @ 25°C
Decomposition temperature	No data available
Density	1.113 g/cm ³ @ 20°C
Solubility in water	Ethylene glycol: 1,000 g/l; Graphene: Insoluble
Solubility (other)	Glycerol: Miscible



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

Ether: Slightly soluble
Benzene: Practically insoluble
Acetic acid: Miscible
Acetone: Miscible
Petroleum ether: Practically insoluble
Pyridine: Miscible
Partition coefficient (n-Octanol/water) -1.36, Bioaccumulation is not expected

10. Stability and Reactivity

10.1 Reactivity Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical

10.2 Chemical stability No decomposition if stored and applied as directed.

10.3 Possibility of hazardous reactions

Risk of explosion with Aluminum
Perchloric acid

Risk of ignition or formation of inflammable gases or vapours with Chromyl chloride
Strong oxidizing agents
Chlorates
Peroxides
Potassium permanganate

Exothermic reaction with Chlorosulfonic acid
Sodium hydroxide
Fuming sulfuric acid
Sulfuric acid

10.4 Conditions to avoid Strong heating.

10.5 Incompatible materials Strong oxidizing agents.

10.6 Hazardous decomposition products Mainly carbon oxides occur under high temperature/fire conditions.

11. TOXICOLOGICAL INFORMATION

11.1 Information on the likely routes of exposure

Inhalation No adverse effects are expected.

Ingestion Harmful if swallowed. No adverse effects due to ingestion are expected.

Skin contact No adverse effects are expected

Eye contact Causes serious eye irritation. None known or expected under normal use.



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Inhalation	No data available.
Ingestion	No data available.
Skin contact	No data available.
Eye contact	No data available.

11.3 Information on toxicological effects

Acute toxicity

Dermal	LD 50, Rabbit: 9,530 mg/kg
Oral	LD 50, Rat: 5.89 g/kg
Inhalation	LD 50, Rat, 6 h: >2.5 mg/l
Skin Corrosion/Irritation	No data available.
Serious Eye Damage/Eye Irritation	No data available..
Respiratory or skin sensitization	Not a skin sensitizer.
Germ cell mutagenicity	
in vitro	No mutagenic components identified.
in vivo	No mutagenic components identified.
Carcinogenicity	“No carcinogenic components identified” in IARC Monographs on the Evaluation of Carcinogenic Risks to Humans US. National Toxicology Program (NTP) Report on Carcinogens US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
Reproductive toxicity	Suspected of damaging fertility or the unborn child.

Specific target organ toxicity

Single exposure	No data available.
Repeated exposure	No data available.
Specific Target Organ Toxicity	Single Exposure: Central nervous system, Kidney

Aspiration hazard No data available.

Other effects When ingested early symptoms mimic alcohol inebriation and are followed by nausea, vomiting, abdominal pain, weakness, muscle tenderness, respiratory failure, convulsions, cardiovascular collapse, pulmonary edema, hypocalcemic tetany, and severe metabolic acidosis. Without treatment, death may occur in 8 to 24 hours. Victims who survive the initial toxicity period usually develop renal failure along with brain and liver damage. Exposure to and/or consumption of alcohol may increase toxic effects. To the best of our knowledge, the chemical, physical, and toxicological properties have



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

not been thoroughly investigated.

Central nervous system - Irregularities - Based on Human Evidence

12. Ecological Information

12.1 Ecotoxicity

Specific substance(s)	Ethylene glycol
Fish	(US-EPA) Static test LC 50, Fathead minnow (<i>Pimephales promelas</i>), 96 h: 72,860 mg/l
Aquatic invertebrates	(OECD Test Guideline 202) Static test LC 50, Water flea (<i>Daphnia magna</i>), 48 h: 100 mg/l
Algae	Static test IC 50, Green algae (<i>Scenedesmus quadricauda</i>), 7d: >10,000 mg/l, Lit.
Fish (Chronic toxicity)	Flow-through test, LC50, <i>Menidia peninsulae</i> (Tidewater silverside), 28d: > 1,500 mg/l

12.2 Persistence and degradability

Biodegradation	(OECD Test Guideline 301A), Aerobic, Exposure time 10d Result: 90~100 %, Readily biodegradable.
Biochemical Oxygen Demand (BOD)	780 mg/g
Chemical Oxygen Demand (COD)	Remarks: (IUCLID)
BOD/ThBOD	1,190 mg/g
	Remarks: (IUCLID)
	60 %

12.3 Bioaccumulative potential

Bioaccumulation	Does not bioaccumulate. Ethylene glycol: Other fish 61d- 50mg/l.
Bioconcentration factor (BCF)	0.60
Partition coefficient n-octanol/water	Log Kow: -1.36

12.4 Mobility in soil No data available.

12.5 Results of PBT and vPvB assessment This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

13. Disposal considerations

13.1 Waste Code Offer surplus and non-recyclable solutions to a licensed disposal company. Waste material must be disposed of in accordance with the Directive on waste 2008/98/EC as well as other national and local regulations.

13.2 Disposal methods Dispose of only in accordance with local, state, and federal regulations. Do not



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

contaminate any lakes, streams, ponds, groundwater or soil.

No mixing with other waste.

Leave chemicals in original containers.

13.3 Empty containers

Empty containers retain product residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Empty drums should be completely drained, triple-rinsed, properly bunged and promptly returned to a drum reconditioner, or properly disposed.

14. Transport Information

DOT (U.S. Department of Transportation)

UN number	Not regulated.
UN proper shipping name	Not regulated.
Transport hazard class(es)	
Class	Not regulated.
Label(s)	Not regulated.
Packing group	Not regulated.
Material pollutant	Not regulated.
Special precaution for user	No data available.

IATA (International Air Transport Association)

UN number	Not regulated.
UN proper shipping name	Not regulated.
Transport hazard class(es)	
Class	Not regulated.
Label(s)	Not regulated.
Packing group	Not regulated.
Material pollutant	Not regulated.
Special precaution for user	No data available.

IMDG (International Maritime Dangerous Goods)

UN number	Not regulated.
UN proper shipping name	Not regulated.
Transport hazard class(es)	
Class	Not regulated.
Label(s)	Not regulated.
EmS No.	Not regulated.

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3



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

Packing group Not regulated.
Material pollutant Not regulated.
Special precaution for user No data available.

14.1 Environmental hazards

MARPOL Annex III - Prevention of pollution by harmful substances

Marine pollutants (yes/no) no

14.2 Special precautions for user No data available.

14.3 Transport in bulk according to Annex II of MARPOL73/78 and IBC Code

Remarks No data available.

15. Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Regulations on Labelling and Hazard Communication of Hazardous Chemicals

Regulations on Occupational Safety and Health Facilities

Standards for the Storage, Cleanup, Handling and Disposal of Industrial Waste

Establishment Standards and Safety Control Regulations for Manufacturing, Storing, Processing

Public Hazardous Substances and Flammable Pressurized Gases Places

Occupational Safety and Health Act

Regulations on Occupational Safety and Health Facilities

Waste Disposal Act

Standards for the Storage, Cleanup, Handling and Disposal of Industrial Waste

Regulations on Labelling and Hazard Communication of Hazardous Chemicals

Exposure Assessment and Control Banding of Hazardous Chemicals

Standards of Permissible Exposure Limits in Workplace

Establishment Standards and Safety Control

Regulations for Manufacturing, Storing, Processing

Public Hazardous Substances and Flammable Pressurized Gases Places

Inventory status

Australia	Inventory of Chemical Substances (AICS)	On or in compliance with the inventory
Japan	Inventory of Chemical Substances (ISHL)	On or in compliance with the inventory
EU	European Inventory of Existing Commercial Chemical Substances (EINECS)	On or in compliance with the inventory
EU	European List of Notified Chemical Substances (ELINCS)	On or in compliance with the inventory
Canada	Domestic Substances List (DSL) Inventory	On or in compliance with the inventory
Philippines	Inventory of Chemicals/ Chemical Substances (PICCS)	On or in compliance with the inventory
Korea	Existing Chemicals Inventory (KECI)	On or in compliance with the inventory



SAFETY DATA SHEET

Trade name: Graphene Suspension

Revised 2023

China	Inventory of Existing Chemical Substances (IECSC)	On or in compliance with the inventory
Mexico	National Inventory of Chemical Substances of Mexico (INSQ)	On or in compliance with the inventory
New Zealand	Inventory of Chemical Substances	On or in compliance with the inventory
Taiwan	National Existing Chemical Inventory (NECI)	On or in compliance with the inventory

16. Other Information

Full Text of H-Statements referred to under sections 2 and 3

- H302 Harmful if swallowed.
- H373 May cause damage to organs through prolonged or repeated exposure if swallowed.

Hazard Ratings

	<u>Health</u>	<u>Flammability</u>	<u>Physical Hazard/ Instability</u>
NFPA	2	1	0

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible

Date of the latest revision 2023/03/08

DISCLAIMER:

This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained in this Safety Data Sheet is to the best of our knowledge and believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application etc. It is up to the user/distributor to ensure that the information contained in the material safety data sheet is relevant to the product manufactured or sold as the case may be. Enerage Inc. makes no warranties, expressed or implied, in respect of the adequacy of this document for any particular purpose.

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