RUO-2 T

CAS: 2023788-19-2
Formula: C225H348N48O68

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Version: 1.0

Section 1 — Product and Company Identification

Product Name	RUO-2 T
Synonyms	Tirzepatide; 2023788-19-2; Mounjaro (TN)
CAS Number	2023788-19-2
Molecular Formula	C225H348N48O68
IUPAC Name	20-[[(1S)-4-[2-[2-[2-[2-[2-[2-[[(5S)-5-[[(2S)-5-amino-2-[[(2S)-2-[[(2S,3S)-2-[[(2S)-6-amino-2-[[(2S)-2-[[(2S)-2-[[2-[[(2S,3S)-2-[[(2S)-2-[[(2S)-2-[[(2S)-2-[[(2S)-2-[[(2S,3R)-2-[[(2S)-2-[[(2S,3R)-2-[[2-[[(2S)-2-[[2-[[(2S)-2-amino-3-(4-hydroxyphenyl)propanoyl]amino]-2-methylpropanoyl]amino]-4-carboxybutanoyl]amino]acetyl]amino]-3-hydroxybutanoyl]amino]-3-phenylpropanoyl]amino]-3-hydroxybutanoyl]amino]-3-hydroxypropanoyl]amino]-3-carboxypropanoyl]amino]-3-(4-hydroxyphenyl)propanoyl]amino]-3-hydroxypropanoyl]amino]-3-methylpentanoyl]amino]-2-methylpropanoyl]amino]-4-methylpentanoyl]amino]-3-carboxypropanoyl]amino]hexanoyl]amino]-3-methylpentanoyl]amino]propanoyl]amino]-5-oxopentanoyl]amino]-6-[[(2S)-1-[[(2S)-1-[[(2S)-1-[[(2S)-5-amino-1-[[(2S)-1-[[(2S)-1-[[(2S,3S)-1-[[(2S)-1-[[2-[[2-[(2S)-2-[[(2S)-1-[[(2S)-1-[[2-[[(2S)-1-[(2S)-2-[(2S)-2-[(2S)-2-[[(2S)-1-amino-3-hydroxy-1-oxopropan-2-yl]carbamoyl]pyrrolidine-1-carbonyl]pyrrolidine-1-carbonyl]pyrrolidin-1-yl]-1-oxopropan-2-yl]amino]-2-oxoethyl]amino]-3-hydroxy-1-oxopropan-2-yl]amino]-3-hydroxy-1-oxopropan-2-yl]carbamoyl]pyrrolidin-1-yl]-2-oxoethyl]amino]-2-oxoethyl]amino]-1-oxopropan-2-yl]amino]-3-methyl-1-oxopentan-2-yl]amino]-4-methyl-1… [truncated — full value in PDF metadata]
Identified Uses	Research laboratory chemical for in vitro scientific research and development use only.

Restriction on Use	Not for human or veterinary use. Not for food, drug, cosmetic, household, agricultural, clinical, therapeutic, or diagnostic applications.

Manufacturer / Supplier

Company	Ruo.bio
Address	30 N Gould St, Sheridan, WY 82801, US
Phone	+1-804-636-6879
Website	https://ruo.bio/
Emergency Phone	+1(804)636-6879 Monday-Friday: 9:00 AM - 5:00 PM Pacific Time

Section 2 — Hazard Identification

Classification of the substance

Not classified based on currently available data; however, data is limited and hazards cannot be fully characterized. The absence of classification should not be interpreted as a determination of the absence of hazard.

Classification has been conducted in accordance with 29 CFR 1910.1200 (OSHA HazCom 2012) and GHS Rev.8 using all available data and scientifically valid weight-of-evidence approaches (GHS Rev.8 Chapter 1.3.2.4), including read-across from chemical class and structural considerations where substance-specific study data is not available.

Signal Word: **None**

GHS Pictograms:

None required based on classification.

Hazard Statements

None. This substance is not classified for any GHS hazard class based on available data.

Precautionary Statements

- P261: Avoid breathing dust, fume, gas, mist, vapors, or spray.
- P264: Wash hands and exposed skin thoroughly after handling.
- P280: Wear protective gloves, protective clothing, and eye/face protection.
- P501: Dispose of contents and container in accordance with local, regional, national, and international regulations.

Precautionary statements are provided as best practice for handling substances with limited toxicological data, and are not a declaration of GHS classification.

Hazards Not Otherwise Classified (HNOC)

None known based on available data and weight-of-evidence assessment. The toxicological properties of this substance have not been fully characterized; handle as a potentially bioactive substance of unknown toxicity.

Section 3 — Composition / Information on Ingredients

Single-substance product. Chemical identity:

Ingredient	CAS Number	Mol. Formula	Mol. Weight	Concentration
RUO-2 T	2023788-19-2	C225H348N48O68	4813 g/mol	>98% (research grade)

Impurities

No hazardous impurities known to be present above the GHS classification thresholds specified in 29 CFR 1910.1200 Appendix A. Residual synthesis reagents, solvents, and counter-ions may be present at levels consistent with research-grade (>98% purity) material. Balance: non-hazardous impurities. Refer to the accompanying Certificate of Analysis (CoA) for the lot-specific impurity profile.

Section 4 — First Aid Measures

Eye Contact

Rinse cautiously with water for several minutes. If irritation persists, seek medical advice.

Skin Contact

Wash with soap and water. Remove contaminated clothing and wash before reuse. If irritation persists, seek medical advice.

Inhalation

Move affected person to fresh air. If symptoms develop, seek medical advice.

Ingestion

Rinse mouth thoroughly with water. If large amounts are swallowed or if symptoms develop, seek medical advice. Do not induce vomiting unless directed by medical personnel.

Note to Physician

Treat symptomatically. No specific antidote known.

Section 5 — Fire Fighting Measures

Flash Point: *Not determined*

Suitable Extinguishing Media

Use extinguishing media appropriate to the surrounding fire conditions. Carbon dioxide (CO2), dry chemical powder, foam, or water spray.

Special Hazards

May produce toxic gases upon combustion. Carbon monoxide and other combustion products may be generated.

Protective Equipment for Firefighters

Wear self-contained breathing apparatus (SCBA) and full protective gear. Do not enter fire area without proper protective equipment.

Section 6 — Accidental Release Measures

Personal Precautions

Avoid dust formation. Avoid breathing vapors, mist, or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Use personal protective equipment as described in Section 8.

Environmental Precautions

Prevent further leakage or spillage if safe to do so. Do not allow the product to enter drains, sewers, or waterways.

Containment and Cleanup

Sweep up and shovel. Keep in suitable, closed containers for disposal. Avoid raising dust. Clean contaminated surface thoroughly. Dispose of waste in accordance with local regulations (see Section 13).

Section 7 — Handling and Storage

Handling Precautions

Handle Tirzepatide (CAS 2023788-19-2) only in a controlled laboratory or compounding setting by trained personnel, following the general principles of OSHA's Laboratory Safety Guidance (OSHA 3404-11R) and the OSHA Hazard Communication Standard (29 CFR 1910.1200). Because this is a high-molecular-weight (~4813 Da) synthetic peptide of unknown occupational toxicity, apply the precautionary principle and minimize all routes of exposure (inhalation, skin/eye contact, ingestion). Weigh and manipulate the lyophilized solid inside a ventilated enclosure such as a chemical fume hood, a ducted powder weighing hood, or a containment/glove box to control airborne particulates; if local exhaust ventilation is not feasible, wear a NIOSH-approved particulate respirator (e.g., N95 or higher) as part of a written respiratory protection program under 29 CFR 1910.134. Wear chemical splash goggles, a lab coat, and chemically resistant nitrile gloves (double-gloving recommended for powder handling), consistent with OSHA PPE requirements in 29 CFR 1910.132-138. Avoid generating dusts, aerosols, or mists; lyophilized peptides are typically hygroscopic and readily become airborne, so open vials slowly to equalize pressure and allow the contents to warm to room temperature in a sealed container before opening to prevent condensation. Do not eat, drink, smoke, or store food in the work area. Wash hands and exposed skin thoroughly with soap and water after handling and before leaving the work area. Decontaminate balances, spatulas, and work surfaces after use; collect waste, contaminated PPE, and disposables as chemical hazardous waste for disposal in accordance with 40 CFR 262 (EPA RCRA) and applicable state/local regulations. No OSHA Permissible Exposure Limit (PEL), NIOSH REL, or ACGIH TLV has been established for this substance; in the absence of an occupational exposure limit, follow ALARA practices and any internal Occupational Exposure Band (OEB) or banding category assigned by the employer for active peptide pharmaceutical ingredients.

Storage Conditions

Store the lyophilized solid tightly closed in its original, clearly labeled container under an inert atmosphere (nitrogen or argon) where possible, protected from light, moisture, and heat. Peptides of this class are hygroscopic; keep the container in a desiccator or with a desiccant pouch to prevent moisture uptake and hydrolytic degradation. For long-term storage of the bulk solid, freezer storage at -20 degC (or colder, e.g., -80 degC) is the conditions generally recommended for lyophilized peptide active pharmaceutical ingredients; short-term storage of unopened, finished drug-product vials/pens is at refrigerated conditions of 2-8 degC per FDA-approved labeling for tirzepatide products. Allow sealed containers to equilibrate to room temperature before opening to avoid condensation on the solid. Once reconstituted in aqueous buffer, store cold (2-8 degC) for short-term use or frozen in single-use aliquots to avoid repeated freeze-thaw cycles. Storage area should be cool, dry, well-ventilated, secured against unauthorized access, and segregated from food, feed, and incompatible materials. Do not return unused material to the original container. Comply with employer-specific containment and security requirements for active pharmaceutical ingredients.

Incompatibilities

No specific reactivity data for Tirzepatide are published in authoritative regulatory databases (OSHA, NIOSH, EPA, ECHA, PubChem). As a polypeptide containing multiple amide bonds, carboxylic acid, amine, hydroxyl, indole, and thioether functional groups, it should be considered incompatible with strong oxidizing agents (which can oxidize methionine, tryptophan, and cysteine-like residues), strong acids and strong bases (which promote hydrolysis of peptide bonds and side-chain deamidation), strong reducing agents, and electrophilic/alkylating reagents. Avoid contact with moisture, elevated temperatures, direct sunlight and UV light, and freeze-thaw cycling in solution, all of which can cause aggregation, deamidation, oxidation, or hydrolytic degradation of the peptide. No hazardous polymerization is expected. Hazardous decomposition products from combustion or thermal breakdown may include carbon oxides (CO, CO2), nitrogen oxides (NO), and sulfur oxides (SO).

Section 8 — Exposure Controls / Personal Protection

Exposure Limits

No regulatory occupational exposure limits (OEL) have been established by OSHA, ACGIH, NIOSH, or equivalent bodies for Tirzepatide (CAS 2023788-19-2). No biological exposure indices (BEIs) have been established. Control exposure to the lowest level reasonably achievable (ALARA) using the engineering controls and PPE specified below. Handle as a potentially bioactive substance of unknown toxicity (synthetic dual GIP/GLP-1 receptor agonist peptide, MW ~4813 Da).

Engineering Controls

Use in a controlled laboratory or pharmaceutical handling area with adequate general and local exhaust ventilation. Weighing, transfer, and manipulation of the dry powder or concentrated solutions should be conducted inside a containment device such as a ventilated balance enclosure, laminar flow biosafety cabinet, glovebox, or certified chemical fume hood operating at a face velocity consistent with ANSI/AIHA Z9.5 and OSHA 29 CFR 1910.1450 (Laboratory Standard) to prevent generation and dispersion of airborne particulates/aerosols. Provide an eyewash station and safety shower in the immediate work area in accordance with ANSI Z358.1. Maintain closed systems where feasible, use HEPA-filtered exhaust on containment equipment, and decontaminate surfaces after use. Restrict access to trained personnel. Do not eat, drink, smoke, or apply cosmetics in the work area.

Personal Protective Equipment

Respiratory Protection: Where engineering controls (fume hood, ventilated enclosure, glovebox) adequately contain the material, additional respiratory protection is generally not required. If powders, dusts, or aerosols may be generated outside of containment, or during weigh-out, reconstitution, or cleanup of spills, use a NIOSH-approved air-purifying respirator with an N100/P100 particulate filter (42 CFR Part 84). For tasks with higher aerosol-generation potential, use a powered air-purifying respirator (PAPR) with HEPA cartridges or a supplied-air respirator. Respirator selection, fit-testing, and use must comply with OSHA 29 CFR 1910.134.

Hand Protection: Wear chemical-resistant, powder-free disposable nitrile gloves meeting EN 374 / ASTM D6978 in compliance with OSHA 29 CFR 1910.138. Double-gloving is recommended when handling the neat solid or concentrated stock solutions. Inspect gloves before use, change immediately if contamination, tears, or punctures are suspected, and wash hands thoroughly with soap and water after glove removal. Selection of glove material and breakthrough time should be reviewed for the specific solvent system used to dissolve or formulate the peptide (e.g., DMSO, aqueous buffers, acidified water).

Eye / Face Protection: Wear tightly fitting chemical splash goggles meeting ANSI/ISEA Z87.1 and OSHA 29 CFR 1910.133 when handling solids or solutions. A face shield worn over goggles is recommended when there is potential for splashing, spraying, or aerosol generation (e.g., vortexing, sonication, lyophilization handling, or large-volume transfers). Do not wear contact lenses when handling this material.

Skin Protection: Wear a fastened, long-sleeved laboratory coat or chemical-resistant gown dedicated to bioactive/-pharmaceutical handling, full-length trousers, and closed-toe chemical-resistant footwear in accordance with OSHA 29 CFR 1910.132. Use disposable sleeve covers and an impervious apron when handling bulk quantities or when there is potential for splash. Remove and contain contaminated clothing immediately; do not launder with general clothing. Wash exposed skin thoroughly with soap and water after handling and before breaks or leaving the work area.

Section 9 — Physical and Chemical Properties

Physical State	Solid (research-grade lyophilised powder or crystalline solid)
Appearance	White to off-white lyophilized powder
Odor	Odorless
Odor Threshold	Not available.

Boiling Point	*Not determined*
Melting Point	*Not determined*
Flash Point	*Not determined*
Auto-ignition Temperature	No data available.
Decomposition Temperature	No experimental data available.
Vapor Pressure	*Not determined*
Vapor Density	*Not determined*
Specific Gravity	*Not determined*
Partition Coefficient (log Kow)	No experimental data available.
Solubility	Soluble in water and aqueous buffers; sparingly soluble in DMSO
Stability in Solution	Subject to hydrolytic and oxidative degradation typical of the chemical class; store reconstituted solutions refrigerated or frozen, protect from light, and use within the stability window indicated on the Certificate of Analysis.
pH	*Not determined*
Molecular Weight	4813 g/mol
Molecular Formula	C225H348N48O68

Section 10 — Stability and Reactivity

Chemical Stability: Stable under normal conditions of use, storage, and transport.

Conditions to Avoid: Excessive heat, open flames, sparks, incompatible materials.

Incompatible Materials: No specific reactivity data for Tirzepatide are published in authoritative regulatory databases (OSHA, NIOSH, EPA, ECHA, PubChem). As a polypeptide containing multiple amide bonds, carboxylic acid, amine, hydroxyl, indole, and thioether functional groups, it should be considered incompatible with strong oxidizing agents (which can oxidize methionine, tryptophan, and cysteine-like residues), strong acids and strong bases (which promote hydrolysis of peptide bonds and side-chain deamidation), strong reducing agents, and electrophilic/alkylating reagents. Avoid contact with moisture, elevated temperatures, direct sunlight and UV light, and freeze-thaw cycling in solution, all of which can cause aggregation, deamidation, oxidation, or hydrolytic degradation of the peptide. No hazardous polymerization is expected. Hazardous decomposition products from combustion or thermal breakdown may include carbon oxides (CO, CO2), nitrogen oxides (NO), and sulfur oxides (SO).

Hazardous Decomposition Products: Upon combustion or decomposition may produce: carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx).

Hazardous Polymerization: Will not occur.

Section 11 — Toxicological Information

The toxicological properties of this substance have not been fully characterized. Where no authoritative study data was identified, endpoint classifications are based on a weight-of-evidence approach using read-across from the compound's chemical class and structural features, per GHS Rev.8 Chapter 1.3.2.4. "Not classified" entries below mean "not classified based on currently available data" — hazards cannot be excluded.

Acute Toxicity: No authoritative acute toxicity values (oral, dermal, or inhalation LD50/LC50) have been identified in NTP, ECHA, NIOSH, or peer-reviewed databases for tirzepatide (CAS 2023788-19-2). The acute toxicological profile of this substance is not fully characterized. In accordance with GHS Rev.8 S1.3.2.4 (weight-of-evidence), the substance is not classified for acute toxicity based on currently available data; hazards cannot be excluded. Handle as a potentially

hazardous active pharmaceutical ingredient and avoid all routes of exposure (inhalation of dust/aerosol, ingestion, skin/eye contact, and parenteral exposure via needlestick).

Skin Corrosion / Irritation: No skin corrosion/irritation studies meeting GHS criteria (e.g., OECD TG 404 or in vitro equivalents) have been located in ECHA or peer-reviewed sources for tirzepatide. Skin corrosion/irritation potential is not fully characterized. Not classified based on currently available data; hazards cannot be excluded. Avoid skin contact as a precaution.

Serious Eye Damage / Irritation: No serious eye damage/eye irritation studies meeting GHS criteria (e.g., OECD TG 405 or in vitro equivalents) have been identified in ECHA or peer-reviewed sources for tirzepatide. The endpoint is not fully characterized. Not classified based on currently available data; hazards cannot be excluded. Avoid eye contact and use appropriate eye protection.

Skin / Respiratory Sensitization: No standardized skin or respiratory sensitization studies (e.g., OECD TG 429/442 LLNA, or guinea pig maximization) have been located in authoritative databases for tirzepatide. Per the FDA-approved prescribing information for MOUNJARO and ZEPBOUND (accessdata.fda.gov), hypersensitivity reactions (including anaphylaxis and angioedema) have been reported in treated patients, and anti-drug antibody formation has been associated with hypersensitivity and injection-site reactions in clinical trials. While these clinical observations relate to parenteral administration rather than occupational exposure, the immunogenic potential indicates sensitization hazards cannot be excluded for occupational handling. Not formally classified under GHS based on currently available data; treat as a potential sensitizer and avoid repeated exposure.

Germ Cell Mutagenicity / Genotoxicity: Not classified based on currently available data; hazards cannot be excluded. Weight-of-evidence assessment applied using read-across from chemical class and structural considerations (GHS Rev.8 Chapter 1.3.2.4); no authoritative substance-specific study data identified.

Carcinogenicity: Tirzepatide is not listed by IARC, NTP (Report on Carcinogens), OSHA, or ACGIH as a carcinogen. However, per the FDA-approved prescribing information for MOUNJARO and ZEPBOUND (accessdata.fda.gov), a 2-year carcinogenicity study in Sprague-Dawley rats demonstrated a dose-dependent and treatment-duration--dependent increase in the incidence of thyroid C-cell tumors (adenomas and carcinomas) in both sexes at clinically relevant plasma exposures. In a 6-month carcinogenicity study in rasH2 transgenic mice (doses 1, 3, and 10 mg/kg subcutaneously twice weekly), tirzepatide was not tumorigenic. Human relevance of the rat C-cell findings is unknown. Tirzepatide carries a Boxed Warning in U.S. labeling regarding thyroid C-cell tumor risk. The substance is not formally classified under GHS for carcinogenicity based on currently available data; however, carcinogenic hazard cannot be excluded in light of the rodent findings.

Reproductive Toxicity: Per the FDA-approved prescribing information for MOUNJARO and ZEPBOUND (accessdata.fda.gov), tirzepatide administered during organogenesis produced adverse embryo/fetal effects in animal reproduction studies. In rats, decreased fetal weight and increased incidences of external, visceral, and skeletal malformations were observed at clinically relevant maternal exposures based on AUC. In rabbits, fetal growth reductions and skeletal/visceral abnormalities were observed at clinically relevant exposures based on AUC, accompanied by maternal toxicity. These findings indicate developmental toxicity in two species. Tirzepatide is not currently listed under GHS-harmonized classifications by ECHA, and is not formally classified under OSHA HazCom 2012 for reproductive toxicity; however, on the basis of the animal data above, reproductive/developmental hazards cannot be excluded. Women who are pregnant, may become pregnant, or are breastfeeding should avoid occupational exposure.

Specific Target Organ Toxicity (STOT): Specific Target Organ Toxicity - Single Exposure (STOT-SE): No standardized single-exposure STOT studies meeting GHS criteria have been identified in authoritative sources for tirzepatide; this endpoint is not fully characterized. Not classified based on currently available data; hazards cannot be excluded. Specific Target Organ Toxicity - Repeated Exposure (STOT-RE): Per the FDA-approved prescribing information for MOUNJARO and ZEPBOUND (accessdata.fda.gov), repeat-dose nonclinical studies identified the thyroid (C-cell hyperplasia and neoplasia in rats), gallbladder, and pancreas as organs of interest, and clinical experience identifies the gastrointestinal tract and pancreas (acute pancreatitis) as targets of toxicity following repeated parenteral administration. The substance is not formally classified under GHS for STOT-RE based on currently available data;

repeated-exposure target-organ hazards cannot be excluded, and repeated or prolonged occupational exposure should be avoided.

Aspiration Hazard: Not classified based on currently available data; hazards cannot be excluded. Weight-of-evidence assessment applied using read-across from chemical class and structural considerations (GHS Rev.8 Chapter 1.3.2.4); no authoritative substance-specific study data identified.

Derived No-Effect Level (DNEL): No data available — no substance-specific DNEL has been derived.

Predicted No-Effect Concentration (PNEC): No data available — no substance-specific PNEC has been derived.

Section 12 — Ecological Information

No authoritative substance-specific ecotoxicity study data was identified. In the absence of experimental data, adverse environmental effects cannot be fully excluded.

Ecotoxicity: No substance-specific experimental ecotoxicity data (e.g., fish LC50, Daphnia EC50, algal ErC50) for tirzepatide (CAS 2023788-19-2) have been identified in authoritative regulatory or peer-reviewed sources (PubChem CID 156588324, ECHA, EPA ECOTOX). Not classified as hazardous to the aquatic environment under GHS based on weight-of-evidence assessment in the absence of authoritative experimental data. As a high-molecular-weight (~4813 g/mol) modified peptide active pharmaceutical ingredient, environmental release should nonetheless be minimized; do not allow discharge into drains, surface water, or groundwater.

Persistence and Degradability: No substance-specific experimental data on ready biodegradability (e.g., OECD 301 series) or abiotic degradation half-lives in environmental compartments have been identified for tirzepatide in authoritative sources. The molecule contains non-natural residues (e.g., alpha-aminoisobutyric acid) and a C20 fatty diacid moiety conjugated via a gammaGlu-2xAEEA linker, features specifically introduced to confer resistance to enzymatic hydrolysis; therefore generic read-across that 'peptides are readily biodegradable' is not applied here. Environmental persistence cannot be reliably estimated in the absence of experimental data.

Bioaccumulative Potential: No experimental bioconcentration factor (BCF) or measured log Kow has been identified for tirzepatide in authoritative sources (PubChem, ECHA). Given the very high molecular weight (~4813 g/mol, well above the 700 Da threshold commonly used in PBT screening under ECHA REACH guidance R.11) and the polar, ionizable, multi-functional peptidic structure, significant bioaccumulation in aquatic organisms is not expected; however, this conclusion is qualitative and not based on substance-specific experimental data.

Mobility in Soil: No substance-specific experimental data identified.

Other Adverse Effects: No other adverse environmental effects identified. The substance is not included on the Montreal Protocol list of ozone-depleting substances.

Section 13 — Disposal Considerations

Dispose of contents and container in accordance with all local, state, and federal regulations. Do not dispose of this material into sewers or waterways. Contact a licensed waste disposal company for disposal guidance.

US: Dispose in accordance with 40 CFR Parts 261-270 (RCRA). **EU:** Dispose according to Directive 2008/98/EC (Waste Framework Directive).

Section 14 — Transport Information

DOT (US)	Not regulated as dangerous goods under DOT (49 CFR) based on current classification.
IATA	Not regulated as dangerous goods under IATA Dangerous Goods Regulations based on current classification.
IMDG	

Not regulated as dangerous goods or as a marine pollutant under the IMDG Code based on current classification.	
UN Number	Not applicable.

Transport classifications above are based on the substance's intrinsic hazard classification; the shipper must independently verify the classification, packaging, labelling, and documentation requirements for their specific shipment configuration, quantity, and carrier (including airline policies) prior to dispatch.

Section 15 — Regulatory Information

United States

TSCA (Toxic Substances Control Act): May be eligible for exemption from TSCA inventory listing requirements under the R&D provisions of 40 CFR 720.36, depending on actual conditions of use. This substance is supplied solely for use in scientific research and development in small quantities; it is not intended for, and shall not be used for, any commercial manufacturing, processing, or distribution in commerce. The importer/end user is responsible for confirming that the R&D exemption criteria are met for their specific use. **OSHA HazCom 2012:** This SDS was prepared in accordance with 29 CFR 1910.1200 (HazCom 2012), aligned with the Globally Harmonized System (GHS) Rev. 8. **CERCLA / SARA Title III:** Not listed as a CERCLA Hazardous Substance (40 CFR 302.4); not subject to SARA 313 reporting based on available classification data. Users must independently verify applicability for their facility.

European Union

REACH (EC 1907/2006): Supplied solely for Scientific Research and Development (SR&D) use in quantities below 1 tonne per year per legal entity. Where applicable, this use may be exempt from REACH registration obligations under the scientific research and development provisions of REACH Article 3(23) and the conditions of Article 26(3); importers/users should independently verify the applicable exemption pathway for their specific use. If the substance is used as part of a formally notified Product and Process Oriented Research and Development (PPORD) programme, the separate notification procedure under REACH Article 9 (with a 5-year exemption renewable once) may apply instead. **CLP (EC 1272/2008):** Not classified under CLP based on available data; no harmonized classification entry identified in Annex VI of CLP or the ECHA Classification and Labelling (C&L) Inventory.

Canada

WHMIS 2015 / HPR: Not classified as a hazardous product under the Hazardous Products Act and Hazardous Products Regulations (SOR/2015-17) based on available data and weight-of-evidence assessment. Supplied for laboratory research use only. **DSL/NDSL:** Research-use exemption applies; substance is not intended for commercial import or manufacture in Canada.

Note: The regulatory statements above reflect the intended use of this substance for scientific research and development only and do not constitute a legal determination of regulatory status. If the substance is used outside the R&D exemption scope, users are solely responsible for independently verifying applicable regulatory obligations (TSCA, REACH, WHMIS, state, and local) for their specific use and jurisdiction prior to any such use.

Section 16 — Other Information

Document ID	473c42c5-1b9f-4210-b55a-9e031d7647f1
Revision Date	2026-08-07
Version	1.0
Prepared By	

	Prepared in accordance with GHS Rev.8 and OSHA HazCom 2012 (29 CFR 1910.1200). Independent review by a qualified chemical safety professional is recommended prior to use.

Revision History

Revision date: 2026-08-07
Version: 1.0
Change description: Initial issue. Document prepared in 16-section GHS Rev.8 / OSHA HazCom 2012 format.

Sources Used

- PubChem (U.S. National Library of Medicine / NCBI) — https://pubchem.ncbi.nlm.nih.gov
- Peer-reviewed chemistry and toxicology literature (class-based read-across and weight-of-evidence assessment per GHS Rev.8 Chapter 1.3.2.4)
- OSHA HazCom 2012 / 29 CFR 1910.1200 Appendix A–C; GHS Rev.8; OECD Test Guidelines

Key to Abbreviations

CAS = Chemical Abstracts Service; GHS = Globally Harmonized System of Classification and Labelling of Chemicals; OSHA = U.S. Occupational Safety and Health Administration; HazCom = Hazard Communication Standard; REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals; CLP = Classification, Labelling and Packaging Regulation; TSCA = Toxic Substances Control Act; WHMIS = Workplace Hazardous Materials Information System; OEL = Occupational Exposure Limit; PEL = Permissible Exposure Limit; TLV = Threshold Limit Value; REL = Recommended Exposure Limit; STOT = Specific Target Organ Toxicity; LD50 = Median Lethal Dose; LC50 = Median Lethal Concentration; PPE = Personal Protective Equipment; SCBA = Self-Contained Breathing Apparatus; R&D = Research and Development.

Disclaimer

DISCLAIMER: The information in this Safety Data Sheet is compiled from the authoritative sources cited above, supplemented by weight-of-evidence assessment based on the compound's chemical class and published literature. It is believed to be accurate as of the revision date but is provided "as is" without warranty of any kind, express or implied, including fitness for a particular purpose. The preparer of this document has not independently tested the substance described herein. Users bear sole responsibility for verifying all information, ensuring safe handling, and compliance with all applicable federal, state, provincial, and local regulations. This SDS is not a substitute for independent chemical safety assessment by a qualified professional. This product is intended for scientific research and development use only and is not for human consumption, drug, food, cosmetic, agricultural, or household use.

This SDS complies with GHS Revision 8 / UN GHS Rev.8 and OSHA HazCom 2012 (29 CFR 1910.1200).