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d-Limonene

Technical, Food, and Lemon-Lime Grades

Product Data Sheet

November 2004

DESCRIPTION

d-Limonene is a biodegradable solvent occurring in nature as the main component of orange peel oil. d-Limonene's positive environmental profile and pleasant orange aroma have earned the product acceptance in many diverse chemical applications. d-Limonene can be used in its pure form, blended with other solvents, or easily emulsified to make water soluble cleaning products.

APPEARANCE & ODOR

Clear water-white to slightly yellow liquid with a mild to strong orange aroma depending on grade.

USES & APPLICATIONS

d-Limonene can be used to replace toxic, hazardous, and dangerous petroleum-derived chemicals. Ideal for use as parts cleaner, engine degreaser (automotive, aircraft, and aerospace industries), electronics cleaner, tar cleaner, asphalt release agent, graffiti remover, grease trap maintainer, heat transfer fluid, lift station and sewage treatment solvent.

d-Limonene is excellent in household, institutional and industrial product formulations such as: hand cleaner, glass cleaner, hard surface cleaner, floor cleaner, printing press wash, carpet/stain cleaner, metal cleaner, petroleum tank cleaner, asbestos abatement cleaner, and oil drilling fluid. It is also commonly used as an aerosol ingredient, fragrance ingredient, fragrance additive or odor mask in formulated products.

New applications for d-Limonene are emerging daily. d-Limonene is also showing promise in medical and pharmaceutical fields.

REGULATORY STATUS

d-Limonene has been designated as GRAS (Generally Recognized As Safe) by the Food and Drug Administration. The EPA has granted d-Limonene an exemption from the requirement of a tolerance when it is an inert ingredient used as a solvent or fragrance in pesticide formulations. d-Limonene is not considered a carcinogen, a developmental toxicant or mutagenic. d-Limonene is not listed on California Proposition 65.

d-Limonene is a naturally occurring VOC. d-Limonene is reportable on average as 95% VOC (850 grams per litre, 6.8 lbs per gallon). Emulsions containing d-Limonene can be exempt from VOC regulations. Contact state VOC or regulatory authorities for ruling.

PACKAGING

d-Limonene is packaged in phenolic-lined containers as follows:

1-Gallon Pail	7 Pounds Net Weight	3.2 kg. Net Weight
5-Gallon Pail	35 Pounds Net Weight	16 kg. Net Weight
55-Gallon Pail	390 Pounds Net Weight	177 kg. Net Weight

Drums are typically orange or black DOT approved steel drums coated with a phenolic resin liner. All drums of our domestic d-Limonene are filled to a net weight of 390 lbs. Dimensions of 55-gallon drums are: length 23", width 23", and depth 35". Imported drums of Brazilian d-Limonene vary slightly in net weight – weight should be verified when ordering. Tank truck shipments average 6500 gallons (45,000 lbs). Overseas ISO tank shipments are either 20,000 liters (16,800 kg) or 24,000 liters (20,180 kg). Sample quantities (gallons & pints) are packaged in fluorinated plastic containers or glass (1 oz. samples).

STORAGE & HANDLING

Store in a warehouse with a fire prevention system. Avoid contact with incompatible chemicals listed in Section IV. Store in tightly sealed full containers in well-ventilated controlled warehouse conditions. Partially filled containers should be blanketed with nitrogen. Antioxidants such as BHT are commonly used in addition to proper storage and handling procedures.

Improper storage and handling can lead to oxidation.

d-Limonene samples and certificates of analysis are available upon request. *Caution: The user should conduct his/her own experiments and establish proper procedures and controls before attempting use on critical parts*

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MATERIAL SAFETY DATA SHEET

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Emergency Phone Numbers:

Florida Chemical: (863) 294-8483

CHEMTREC 24 Hour Number (800) 424-9300

Outside United States: Call CHEMTREC Collect

Section I - IDENTIFICATION

Trade Name: d-Limonene – Technical grade, Food grade, High Purity grades, Lemon-Lime grade, Orange Terpenes, Citrus Terpenes

Product Codes: 301000-Technical Grade 301000 – Citrus Terpenes 302000-Orange Terpenes 302000-Food Grade 302001 – High Purity grade 302002 – Ultra High Purity grade 303000-Lemon-Lime Grade

CAS Number: 94266-47-4 - Technical grade, Citrus Terpenes, Lemon-Lime grade

CAS Number: 8028-48-6 – Food grade, Orange Terpenes, High Purity grades

EINECS Nos: 304-454-3 – Technical, Lemon-Lime, Citrus Terpenes

232-433-8 – Food grade, Orange Terpenes, High Purity grades

Synonyms: Citrus Stripper Oil, Terpene Hydrocarbons

Section II - HAZARDOUS COMPONENTS

Volatile Ingredients: d-Limonene (solvent) is the major component (technical grade >93%, food grade 95%, high purity grades >98%, lemon-lime 70%) with the balance consisting of other terpene hydrocarbons and oxygenated compounds - octanal, myrcene, alpha-pinene, linalool predominant. Product is a by-product of citrus, entirely of natural origin, and to the best of our knowledge contains no artificial flavors, sulfites, nitrites, or pesticide residue exceeding tolerances established by the FDA. d-Limonene does NOT contain lead, cadmium, mercury, or hexavalent chromium or come in contact with these chemicals since it is an citrus-derived essential oil produced by steam/vacuum distillation. Further, d-Limonene is packaged in food grade containers with inert liners that do NOT contain lead, cadmium, mercury, or hexavalent chromium. d-Limonene does NOT contain and is NOT manufactured with any of the Class I or II ozone-depleting substances listed under the United States Clean Air Act of 1990.

Hazardous Materials Identification System - HMIS:

- 1 Health Hazard - Mild skin irritant
- 2 Flammability - Flashpoint above 110° F (43° C)
- 0 Reactivity - Stable
- G Protection - Safety glasses, gloves

This substance contains no materials subject to the reporting requirements of SARA TITLE III SECTION 313.

Section III - PHYSICAL DATA

	Technical Grade	Food Grade & High Purity	Lemon-Lime Grade
Appearance	Yellow to water-white oil	Water-white oil	Water-white oil
Odor	Orange aroma	Orange aroma	Lemon-lime aroma
Specific Gravity (25°C)	0.838 - 0.843	0.838 – 0.843	0.841 – 0.848
Refractive Index (20°C)	1.4710 - 1.4740	1.4710 – 1.4740	1.470 – 1.4770
Optical Rotation (25°C)	+96° - +104°	+96° - + 104°	+70° - +75°
Flashpoint (CCCFP)	>110° F (43°C)	>110° F (43° C)	>110° F (43° C)
Boiling Point	349° F (176°C)	349° F (176°C)	349° F (176°C)
Evaporation Rate	0.2 (BuAc=1)	0.2 (BuAc=1)	0.2 (BuAc=1)
Water Solubility	Insoluble	Insoluble	Insoluble
Vapor Pressure (20°C)	<2mmHg	<2mmHg	<2mmHg
Melting Point Info	The published melting point of d-Limonene is approximately -140° F (-96° C). But, testing has shown that below -108° F (-78° C), it becomes a thick, white, gel-like substance that is impossible to pump.		

Material Safety Data Sheet (cont.)

d-Limonene – all grades

Section IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (CCCFP): >110°F (43°C)

Flammable Limits: LEL = 0.7% UEL = 6.1% (Identified for Technical Grade only)

Extinguishing Media: Carbon dioxide, foam or dry chemical

Special Fire Fighting Procedures: SCBA recommended. Smother to exclude air. **Do not use water.** Handle as an oil fire.

Unusual Fire and Explosive Hazards: Combustible liquid. Keep away from heat, sparks, and open flame. Guard against spontaneous combustion of improperly discarded oily rags.

Incompatibility (Materials to avoid): Strong oxidizing agents and acidic agents including acidic clays, peroxides, halogens, vinyl chloride, and iodine pentafluoride.

Hazardous Decomposition Materials: Smoke may be acrid and the fumes may be irritating. Burning generates CO, CO₂, and smoke.

Hazardous Polymerization: None described

Conditions to Avoid for Polymerization: Polymerization catalysts such as aluminum chloride and acidic clays.

Stability Considerations: Stable

Conditions to Avoid for Stability: Avoid temperatures over 110° F (43°C)

Section V - HEALTH HAZARD DATA

Health Hazards (Acute and Chronic): Product is harmful if swallowed. Ingestion may cause vomiting, headache, and other medical problems. May be irritating to skin and eyes. Skin contact may cause slight redness. Eye contact can cause moderate to high irritation. Inhalation can cause nose, throat, and respiratory tract irritation, coughing and headache. Prolonged or repeated exposure can cause drying, defatting, and dermatitis of skin.

Signs and Symptoms of Exposure: Product may be irritating to the skin, eyes, nose and throat.

Medical Conditions Generally Aggravated by Exposure: Persons with allergies or pre-existing skin conditions should avoid contact with this product.

Emergency & First Aid Procedures :

Eyes: Remove contact lenses at once. Flush with water for at least 15 minutes. If irritation persists, seek medical attention.

Skin: Wash affected area with copious amounts of soap and water. If irritation develops, seek medical attention.

Ingestion: Seek medical attention immediately. Do not induce vomiting. Rinse mouth with water, then drink one glass of water. Do not leave victim unattended. Never give anything by mouth if victim is unconscious, is rapidly losing consciousness, or is convulsing.

Inhalation: If symptoms of overexposure are experienced, evacuate to fresh air. If symptoms persist, seek medical attention.

Section VI - TOXICOLOGICAL DATA/ACUTE TOXICOLOGY

d-Limonene is not acutely toxic.

Oral: LD50 >5 g/kg, rabbit

Dermal: LD50 >5 g/kg, rabbit

Skin: The skin irritancy of limonene in guinea pigs and rabbits is considered moderate and low, respectively.

Sensitization: d-Limonene is **not** a sensitizer. Improper storage and handling can lead to oxidation. The oxidized forms of d-Limonene have been shown to be a skin sensitizer.

Inhalation: RD50 >1000 ppm

Chronic Toxicity: **Not listed as a carcinogen (OSHA, NTP, IARC, or ACGIH)**

Ecotoxicological Information: Product may be toxic to aquatic organisms.

Section VII - SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled: Use protective gloves to avoid skin contact. Small spills can be wiped up. Large spills should be absorbed by dirt, sand, or other suitable absorbents for disposal. Do not hose spills down drains, sewers, or waterways. d-Limonene may be toxic to aquatic organisms. Move leaking containers to well ventilated area. No smoking. Eliminate any source of ignition. Minimize inhalation. Use NIOSH approved respiratory protection device in areas of high vapor concentration. CAUTION: slippery on floor.

Waste Disposal Method: Incinerate or Dispose in Accordance with Local, State, and Federal Regulations. Taking regulations into consideration, waste may be incinerated or handled through EPA spill control plan via landfill or dilution.

Material Safety Data Sheet (cont.)

d-Limonene – all grades

Section VIII - SPECIAL PROTECTION INFORMATION

Respiratory Protection: Not normally required. If vapor concentration becomes high, use NIOSH approved respirators.

Ventilation: Local exhaust should be adequate. Mechanical ventilation recommended as necessary.

Eye Protection: Safety goggles or glasses suggested.

Skin Protection: Oil resistant gloves.

Other Protective Equipment: Oil resistant apron, emergency eye wash and shower stations.

Appropriate Hygienic Practices: Wash thoroughly after handling. Launder contaminated clothing before re-use.

Section IX – SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing: Usual precautions for combustible liquids.

Handling and Storage Precautions: Store in a warehouse with proper sprinkler/fire deterrent system. Avoid contact with incompatible chemicals listed in Section IV. Store in tightly sealed, full containers in well-ventilated controlled warehouse conditions. Partially filled containers should be blanketed with nitrogen.

Other Precautions: Product may expand slightly in storage causing pressure to build in container. Open container carefully if product appears to be under pressure. Drum lining may occasionally chip and fall to bottom of container after long storage or excessive handling. As a precaution, pour liquid through filter/strainer to catch small pieces of liner before blending or repackaging. Commercially clean empty containers before re-use. **CAUTION:** Do not weld or cut empty containers (Vapors May Ignite).

Section X - REGULATORY INFORMATION

Inventory	Status
United States (TSCA)	Listed on the inventory.
Canada (DSL)	Listed on the inventory.
European Union (EINECS)	Listed on the inventory.
Australia (AICS)	Listed on the inventory.
Japan (MITI)	Listed on the inventory.
South Korea (KECL)	Listed on the inventory.
Philippines (PICCS)	Listed on the inventory.

Section XI - TRANSPORTATION INFORMATION

TDG Status: Hazardous
IMO Status: Hazardous
IATA Status: Hazardous

DOT Label/Placard [exemption § 173.150(f) applies:
Highway/Rail: per requirements for Combustible Liquids

Air/Ship: per requirements for Flammable Liquids

SHIPPING CLASSIFICATION:

Proper Shipping Name: TERPENE HYDROCARBONS, N.O.S.

Hazard Class: 3

Identification No.: UN2319

Packing Group: III

The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

Section XII - ADDITIONAL INFORMATION

National Fire Protection Association Hazard Ratings - NFPA(R):

- 1 Health Hazard - Slight
- 2 Flammability - Moderate
- 0 Reactivity - Minimal

Key Legend Information:

ACGIH American Conference of Governmental Industrial Hygienists

OSHA Occupational Safety and Health Administration

NTP National Toxicology Program

IARC International Agency for Research on Cancer

The information contained herein is based on current knowledge and experience; no responsibility is accepted that the information is sufficient or correct in all cases. Users should consider these data only as a supplement to other information obtained by the user. No warranty is expressed or implied regarding the accuracy of this data, the results to be obtained from the use thereof, or that any such use will not infringe any patent. Users should make independent determinations of suitability and completeness of information from all sources to assure proper use and disposal of these materials, the safety and health of employees and customers, and the protection of the environment. This information is furnished upon the condition the person receiving it shall determine the suitability for the particular purpose. This MSDS is to be used as a guideline for safe work practices and emergency response.