

Adipic acid

sc-239201



The Power is Question

Material Safety Data Sheet

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

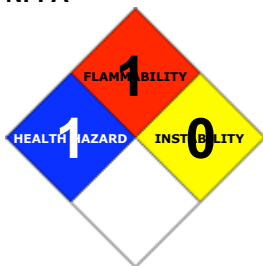
PRODUCT NAME

Adipic acid

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Santa Cruz Biotechnology, Inc.
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Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY

ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS

C6-H10-O4, HOOC-(CH2)4-COOH, acifloctin, acinettin, adilactetten, "adipinic acid", "1, 4-butanedicarboxylic acid", "hexanedioic acid", "1, 6-hexanedioic acid", "molten adipic acid"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability:	1	
Toxicity:	2	
Body Contact:	2	
Reactivity:	1	
Chronic:	2	

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Irritating to eyes, respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Accidental ingestion of the material may be damaging to the health of the individual.
- Ingestion of low-molecular organic acid solutions may produce spontaneous hemorrhaging, production of blood clots, gastrointestinal damage and narrowing of the esophagus and stomach entry.

EYE

■ This material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.

- Solutions of low-molecular weight organic acids cause pain and injury to the eyes.

SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- Skin contact is not thought to have harmful health effects, however the material may still produce health damage following entry through wounds, lesions or abrasions.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

- The material can cause respiratory irritation in some persons.

The body's response to such irritation can cause further lung damage.

- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

CHRONIC HEALTH EFFECTS

- Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

Administration of adipic acid to experimental animals has produced patchy livers, irritation of directly exposed organs, haemorrhagic lungs and symptoms of acidosis. Subchronic exposures in rats produced symptoms of toxicity including depression, dyspnea, ataxia and convulsions.

No evidence of toxicity was found on oral administration of 100 mg/kg adipic acid per day to human subjects.

[Center for Chemical Hazard Assessment, Report SRC TR 81-519, 1981]

Products of metabolism include urea, glutamic acid, lactic acid, beta-ketoadipic acid and citric acid. The presence of beta-ketoadipic acid provides evidence for beta-oxidation mechanisms.

[Rusoff et al, Toxicology Applied Pharmacology, 2, pp 316-330, 1960].

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
adipic acid	124-04-9	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

· If swallowed do NOT induce vomiting. · If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

EYE

■ If this product comes in contact with the eyes: · Wash out immediately with fresh running water. · Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.

SKIN

■ If skin contact occurs: · Immediately remove all contaminated clothing, including footwear · Flush skin and hair with running water (and soap if available).

INHALED

· If fumes or combustion products are inhaled remove from contaminated area. · Lay patient down. Keep warm and rested.

NOTES TO PHYSICIAN

- Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	72.756 x 10 ⁻³ , 18.5 C
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	1.36
Lower Explosive Limit (%):	0.035 (dust)

EXTINGUISHING MEDIA

- Water spray or fog.
- Foam.

FIRE FIGHTING

- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

May emit corrosive fumes.

FIRE INCOMPATIBILITY

- Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION

Glasses:

Safety Glasses.

Chemical goggles.

Gloves:

Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS

- Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers.
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

- Glass container.
- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

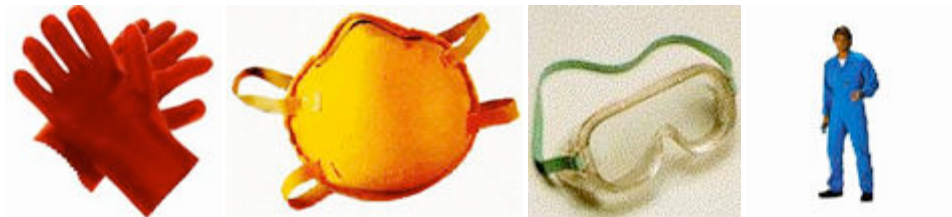
EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
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Canada - Alberta Occupational Exposure Limits	adipic acid (Adipic acid)	5		
US ACGIH Threshold Limit Values (TLV)	adipic acid (Adipic acid)	5		TLV Basis: URT irritation; ANS impairment
US - California Permissible Exposure Limits for Chemical Contaminants	adipic acid (Adipic acid)	5		
Canada - British Columbia Occupational Exposure Limits	adipic acid (Adipic acid)	5		
Canada - Nova Scotia Occupational Exposure Limits	adipic acid (Adipic acid)	5		TLV Basis: URT irritation; ANS impairment
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	adipic acid (Adipic acid)	5	10	
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	adipic acid (Adipic acid)	5		
Canada - Prince Edward Island Occupational Exposure Limits	adipic acid (Adipic acid)	5		TLV Basis: URT irritation; ANS impairment

ENDOELTABLE

PERSONAL PROTECTION



RESPIRATOR

Particulate

Consult your EHS staff for recommendations

EYE

- Safety glasses with side shields.
- Chemical goggles.

HANDS/FEET

- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
 - frequency and duration of contact,
 - chemical resistance of glove material,
 - glove thickness and
 - dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed

moisturiser is recommended.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocautchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

OTHER

- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.

ENGINEERING CONTROLS

- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.

Mixes with water.

State	Divided solid	Molecular Weight	146.1
Melting Range (°F)	305.6	Viscosity	Not Applicable
Boiling Range (°F)	638.6 (decomp)	Solubility in water (g/L)	Miscible
Flash Point (°F)	384.8 (TCC)	pH (1% solution)	2.8
Decomposition Temp (°F)	446	pH (as supplied)	Not applicable
Autoignition Temp (°F)	789.8	Vapor Pressure (mmHg)	72.756 x 10 ⁻³ , 18.5 C
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	1.36
Lower Explosive Limit (%)	0.035 (dust)	Relative Vapor Density (air=1)	5.04
Volatile Component (%vol)	Negligible	Evaporation Rate	Not available

APPEARANCE

White, crystalline powder (monoclinic crystals). Little or no odour. Freely soluble in hot water, methanol, ethanol, acetone. Partially soluble in cold water. Practically insoluble in benzene, petroleum ether. Reacts with diamines to form polyamides or with glycols to form polyesters (thermoplastics). pKa 4.34; 5.44

log Kow 0.08

Material	Value
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Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.

STORAGE INCOMPATIBILITY

- Adipic acid
- may ignite or explode in contact with strong oxidisers
- is incompatible with sulfuric acid, caustics, ammonia, aliphatic amines, alkanolamines, isocyanates, alkylene oxides, epichlorohydrin
- may generate electrostatic charges due to low conductivity.
- Reacts with metals producing flammable / explosive hydrogen gas.
- Avoid strong bases.

Avoid reaction with oxidizing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

ADIPIC ACID

TOXICITY AND IRRITATION

ADIPIC ACID:

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 3600 mg/kg	Eye (rabbit): 20 mg/24h-Moderate
Oral (Mouse) LD50: 1900 mg/kg *	
Dermal (Rabbit) LD50: >7940 mg/kg *	
Inhalation (Rat) LC50: >31 mg/l *	

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

Adipic acid:

Acute toxicity: In limited studies in animals and humans it was shown that adipic acid is absorbed after oral administration, partially metabolized to various metabolites and CO₂ which are excreted via urine and breath, respiration. None of the studies was conducted according to GLP.

Adipic acid is of very low acute toxicity. Clinical signs at lethal doses included acute dilatation of the heart and acute congestive hyperaemia, ulceration of glandular stomach (bleeding-corrosive gastritis), intestinal atony, pale liver and reddening of intestinal mucosa.

In an inhalation test similar to OECD TG 403 in rats neither mortality nor symptoms were observed during and after 4 hour exposure to 7700 mg/m³ of adipic acid.

Reduced appetite and activity were the only effects reported following occlusive dermal administration of 7940 mg/kg bw of adipic acid to 2 rabbits for 24 hours.

In rabbits, 50 % adipic acid suspensions were slightly irritating to the intact skin and moderately irritating to scarified skin. The neat material was a severe eye irritant in rabbits, with symptoms being reversible within 16 days.

Respiratory irritation in animals is not sufficiently examined.

Workers exposed over an extensive period (average: 9.2 years) complained of respiratory irritation at adipic acid concentrations of 0.47-0.79 mg/m³. Due to the acidic character of the substance, a local irritation potential is plausible.

Despite the wide dispersive use of adipic acid, only very few cases of skin or respiratory tract sensitisation reactions are reported in humans. A sensitisation study in animals according to validated guidelines is not available. Overall, sensitisation is not expected for adipic acid.

Repeat dose toxicity: There is no repeated inhalation toxicity study with histopathological examination of the nose available. Systemic effects after repeated inhalation have not been investigated in fully valid studies. There are no studies on repeated dermal application available. In a limited 2-year oral study adipic acid was of low repeated dose toxicity, however it was not tested according to modern standards. The NOAEL was 1 % for male rats (approx. 750 mg/kg bw/day) and higher doses (3 and 5 %) caused body weight retardation with no indication of specific target organ toxicity. The NOAEL for female rats was 1 % (approx. 750 mg/kg bw/day), the highest dose tested in females. In one volunteer no overt toxic symptoms were seen after oral administration of 7 g adipic acid per day for 10 days.

Genotoxicity: A variety of mutagenicity tests in vitro and in vivo have failed to demonstrate that adipic acid possesses genotoxic potential. A number of good quality Ames tests in Salmonella typhimurium similar to OECD TG 471 and an examination of chromosome damage in human lung cells in culture produced negative results. In gavage studies in male rats it did not induce chromosome damage in the bone marrow or dominant lethal mutations in a dose-response or time-trend pattern.

Carcinogenicity: Adipic acid was not carcinogenic in a limited two-years feeding study where male rats were fed with up to 5 % (3750 mg/kg bw/day) adipic acid and female rats with 1 % (750 mg/kg bw/day).

Reproductive toxicity: No specific studies on fertility have been conducted. In a two-year feeding study in rats histopathological examination of testes, ovaries, and uterus revealed no evidence of an adverse effect on the reproductive organs up to the highest doses tested (males approx. 3750 mg/kg bw/day, females approx. 750 mg/kg bw/day). Based on the available data there is no reason to expect specific reproductive toxicity of adipic acid.

Developmental toxicity: Adipic acid was not embryo- or foetotoxic and not teratogenic up to the highest tested doses of 288, 263, and 250 mg/kg bw/day via oral administration to rats, mice, and rabbits, respectively. In none of these studies signs of maternal toxicity have been observed and the highest dose was well below the limit dose of 1000 mg/kg bw which would be a precondition for a fully valid negative study. In view of the low systemic toxicity of the compound, however, this endpoint seems to be adequately covered despite the limitations of the studies.

The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Non-mutagenic*

Draize Eye Irritation Test: Rabbit, Score 18.2/110 - moderately irritating.

Skin irritation (rabbit): 4 hr (FSHA); 0.0 on an scale of 8.0 - non-irritating.*

Non-sensitising to rabbit skin *

* Supreme Resources MSDS

Section 12 - ECOLOGICAL INFORMATION

No data

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
adipic acid	LOW		LOW	HIGH

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

! Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

Section 15 - REGULATORY INFORMATION

adipic acid (CAS: 124-04-9) is found on the following regulatory lists;

"Canada - Alberta Occupational Exposure Limits","Canada - British Columbia Occupational Exposure Limits","Canada - Nova Scotia Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)","Canada - Saskatchewan Industrial Hazardous Substances","Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits","Canada Domestic Substances List (DSL)","Canada Ingredient Disclosure List (SOR/88-64)","Canada National Pollutant Release Inventory (NPRI)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)","International Council of Chemical Associations (ICCA) - High Production Volume List","OECD Representative List of High Production Volume (HPV) Chemicals","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - California Permissible Exposure Limits for Chemical Contaminants","US - Massachusetts Oil & Hazardous Material List","US - Minnesota Hazardous Substance List","US - New Jersey Right to Know Hazardous Substances","US - Pennsylvania - Hazardous Substance List","US - Rhode Island Hazardous Substance List","US ACGIH Threshold Limit Values (TLV)","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","US DOE Temporary Emergency Exposure Limits (TEELs)","US EPA High Production Volume Program Chemical List","US Food Additive Database","US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act","US NFPA 499 Combustible Dusts","US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION

Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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Issue Date: May-15-2009

Print Date: Jan-19-2011