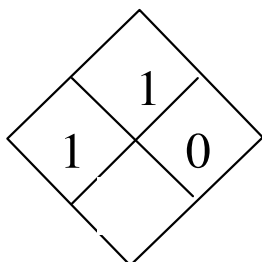


RISK DIAMMOND**Fire 1 – risk in case of strong heating****Health 1 – minimum risk****Reaction risk 0 – no risk under normal conditions**

Revision: item 9 – Chemical and Physical Properties (autoignition point, vapour pressure, explosion limits, solubility).

1. PRODUCT AND COMPANY IDENTIFICATION

- Product name (label): Fumaric Acid.
- Name in English: Fumaric Acid.
- Supplier name, address and telephone number:
Elekeiroz S.A. (Várzea Paulista-SP Unit) - Rua Dr. Edgardo de Azevedo Soares, 392
CEP 13224-030
Telephone: **(0xx11) 4596-8800 (24 h)**. Fax: (0xx11) 4596-8881
Elekeiroz S.A. (Camaçari-BA Unit) - Rua João Úrsulo, 1261, Pólo Petroquímico do Nordeste
CEP 42810-000
Phone: **(0xx71) 3632-7711 (24 h)**
Fax: (0xx71) 3632-2110
E-mail (customer service):
elisabete.moskalenko@elekeiroz.com.br
carlos.villani@elekeiroz.com.br

2. COMPOSITION AND INFORMATION ABOUT INGREDIENTS

- Common chemical name of the substance:
Fumaric Acid
- Synonyms:
Trans-butenodioic Acid, Trans 1,2 Ethylene Dicarboxylic Acid, Alomaleic Acid, Transbudenodioic Acid, cydo trans-butenodioic, trans 1,2 ethylene dicarboxylic acid, alomaleic acid.
- Register in *Chemical Abstract Service* (nº C.A.S): [110-17-8]
- Ingredients that contribute to hazard:
Fumaric Acid (99,0%).

3. HAZARDS IDENTIFICATION

- Most important hazards and effects:

Irritant to eyes, skin, respiratory tract and gastrointestinal tract. See also item 11.

4. FIRST AID MEASURES

- **Inhalation:**
Remove the victim to fresh air. If needed, apply artificial respiration.
- **Contact with the skin:**
Remove contaminated clothes and shoes. Wash immediately the affected area with plenty of soap and water.
- **Contact with eyes:**
Wash immediately the eyes with plenty of water during, at least, 15 minutes. Raise occasionally, lower and upper eyelids.
- **Ingestion:**
DO NOT INDUCE TO VOMIT. If the victim is conscious and alert, give him/her 2 to 4 glasses of milk or water to rinse the mouth.
- **Observation:** in all cases/instances, the victim should be sent to emergency medical assistance.
- **Notes to physician:**
Contact with skin and eyes: see above.
Inhalation: oxygen therapy. Induced respiration if necessary. Symptomatic treatment.
Ingestion: aspiration with nasogastric probe taking care to not induce to vomit.
Symptomatic treatment.

5. FIREFIGHTING MEASURES

- **Proper extinguishing media:**
Light fire: dry powder and CO₂.
Intense fire: water fog or foam.
- **Specific hazards:**
The product is considered combustible, but does not easily ignite. The dust can form explosive mixtures with air.
- **Special methods / firemen protection:**
Evacuate personnel from the affected área; do not approach the área without self-contained breathing apparatus and adequate protection clothes; remove all containers from fire area, if this can be done without any risk; cool with water the side of containers which are exposed to flames, until the fire is completely extinguished.

For emergency response involving fires wear self-contained breathing apparatus and full protection cloth. For large spills, wear adequate cloth (see item 8 – PPE's).

6. CONTROL MEASURES FOR SPILLS OR LEAKAGES

- **Personal precautions:**
Evacuate personnel from the affected área; cut/eliminate ignition sources, avoid sparks, open flames or smoking in the risk área; stop the leakage, if this can be done without risks; prevent inhalation of dusts, gases and contact with skin, mucous membranes and eyes; isolate the área; approach the incident área for contention/containment and/or cleaning with the adequate PPE's (see item 8). Avoid dust formation.
- **Environmental precautions:**
Avoid dust formation; avoid flowing to water streams and to the soil.
- **Cleaning methods:**
Little spills: collect with a clean shovel, put in clean and dry containers, and close. Remove the containers from the spillage area.

Spills of fumaric acid aqueous solutions: cover the spill with sodium bicarbonate and add water until a slurry is formed; put this slurry in proper containers, neutralize with plenty of barrilha and water solution.

The waste can be disposed in effluent treatment system, removed to a landfill proper to chemicals or incinerated in furnace with post-burner.

7. HANDLING AND STORAGE

- **Handling (technical measures):**
Use safety equipment, according to item 8. Avoid the dust accumulation and formation. Do not smoke or se alimentar in the workplace. At the slightest sign of contact with the product, proceed according to item 4, first aid measures.
- **Storage (technical measures):**
Keep the product in well closed containers, in dry and ventilated place at temperature below to 25°C. Do not reuse empty packages.

General recommendations:

Protect the area against physical damages and isolated from incompatible substances (see item 10). Empty packages of the product can be dangerous since they retain residues (dusts/particles). Protect the area and tanks against static discharges. Empty the packages, only under inert atmosphere, due to the risk of fire or explosion caused by static discharges.

Adequate package: polyethylene bags

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Control Parameters:
Decree 3214/78, Regulatory Standard NR-15: not available.
-ACGIH-TLV/TWA= particulate not Classified by Other Way (PNOS) = 3.0 mg/m³ (dust).
- Environmental evaluation:
-Particulate not classified by other way (PNOS): monitor with com PVC membrane 5.0 micra, with nylon cyclone. Analytical technique: gravimetry.
- Personal Protective Equipment:
-Latex or PVC gloves, full vision safety glasses, semifacial mask with organic vapours cartridge or with supplied air. If respiratory protection panoramic type is used, safety glasses are not required. In case of fire, wear self-contained breathing apparatus and full protection clothes.

9. PHYSICO-CHEMICAL PROPERTIES

- Physical state: crystalline solid.
- Color: white.
- Odour: odourless.
- pH: not available.
- Specific temperatures at which occur physical state changes:
 - Boiling point (760 mmhg): 290°C.
 - Melting point: 287°C.
- Flash point: combustible
- Autoignition point: 740°C.
- Vapour pressure (kPa): 1.3 at 0°C.
- Explosion limits: Lower: 30 g/m³.
Upper: not available.
- Sublimation Temperature: 200 °C.
- Specific gravity (20/4°C): 1.635.
- Solubility:
Water (25°C): 0.63% weight.

Water (100°C): 9.8% weight.

Ethanol 95% (30°C): 5.8% weight.

Diethyl Ether (25°C) 0.72% weight

Ketone (30°C): 1.7% weight

Insoluble: benzene, xylene, chloroformium and carbon tetrachloride.

- Molecular weight: 116.
- Chemical formula: C₄H₄O₄

10. STABILITY AND REACTIVITY

- Specific conditions:
It is considered stable under normal handling and storage conditions, but, it can decompose if heated. It does not occur hazardous polymerization.
- Incompatible materials or substances:
Amines, alkalys, oxidizer, reducer agents.
- Hazardous decomposition products:
Thermal decomposition or burning can produce irritant fumes of maleic anhydrite, carbon monoxide and dioxide.

11. TOXICOLOGICAL INFORMATION

- Acute toxicity and local effects:
Fumaric acid is considered non toxic, being inclusive used for human consumption as food additive. However, it can eventually act as irritant for respiratory tract, skin, eys and by accidental ingestion.
- Acute effects
Inhalation: the product is uncomfortable to upper respiratory tract. Inhalation of the product can cause cough, sneezing and difficult breathing.

Eyes: the product is moderately unpleasant to eyes and is capable of causing moderate temporary redness in conjunctive, temporary impediment/impedimento of vision and other transitory damages/ulcers/ulcerações. Diluted solutions of low molecular weight organic compounds cause conjunctiva hyperemia, immediate pain and damages to cornea. The product can produce moderate eye/ocular irritation evolving to inflammation. Prolonged or repeated exposure to irritant products can produce conjunctivitis.

Skin: the material is moderately uncomfortable to the skin. Prolonged exposure can cause chemical burns. Product solution over wet skin or under transpiration can aggravate irritant effects.

Material can cause skin irritation after repeated or prolonged exposure and can produce contact dermatitis (not allergic). This kind of dermatitis is characterized by redness (erythema) and edema which can evolve to vesiculation, scaling or epidermis thickening. Histologically it can occur intracellular edema of the spongy layer and intracellular edema of the epidermis.

Ingestion: the dust can be unpleasant to the gastrointestinal tract if ingested in large amounts. Fumaric acid and its sodium salts can produce acute renal failure, gastrointestinal effects, infiltration and endanger of liver functions. Ingestion of low molecular weight organic compounds can produce spontaneous hemorrhage, intravascular coagulation, gastrointestinal damages and esophagus and pyloric narrow. The material is allowed as food additive. Considered as an improbable entry route in industrial and commercial environments. a poeira pode ser desconfortável para o trato gastrointestinal se ingerido em grande quantidade.

- **Carcinogenicity:**
NTP – non listed; IARC – non listed; OSHA – non listed; NIOSH – non listed; ACGIH – non listed; EPA – non listed; MAK – non listed.

NTP – National Toxicology Program.

IARC – International Agency for Research on Cancer.

OSHA – Occupational Safety and Health Administration.

NIOSH – National Institute of Occupational Safety and Health.

ACGIH – American Conference of Governmental Industrial Hygienists.

EPA – Environmental Protection Act.

- **Acute effects:**
There are no data about human exposure. For this reason, the effects over health are based in experiences with materials chemically related.
- **Known toxicological data:**

Toxicity:

LD50: 10700 mg/kg (rat, oral)

LD50: 20000 mg/kg (rabbit, skin)

LD50: 9300 mg/kg (rat, oral)

Irritation:

Skin (rabbit): 500 mg/24h – medium

Eyes (rabbit) – 100 mg/24h – moderate.

See *RETCS* LS 9625000, for additional data.

12. ECOLOGICAL INFORMATION

- **Environmental effects, behaviors and impacts of the product:**
If released to soil or water, it's expected biodegradation in most part of the process. Studies indicate that the product half life is of 1 to 15 days with proportional degradation to water streams pollution. If released to the atmosphere, there will occur first in the particulate phase, which can be physically

removed through wet or dry deposition. Vapour phase is readily degraded through hydroxilic radicals with half life of 7.3hr.

Henry law constant: estimated to 8.5×10^{-14}

Ecotoxicity: not found data.

Bioaccumulation factor: estimated at 4.2.

DBO (Oxygen Biochemical Demand): 61%, 5 days.

Partition coefficient Octanol/Water: $\log K_{ow}$: calculated at 0.07 to 0.56.

Partition coefficient soil/sorption: K_{oc} : estimated at 3.5.

13. CONSIDERATIONS ABOUT TREATMENT AND DISPOSAL

- Treatment and disposal methods for product, wastes and used packages:
Any wastes treatment should be in accordance with local and national regulations.

14. TRANSPORTATION INFORMATION

Product not comprised by the Decree/Portaria em vigor about hazardous products transportation, Resolution ANTT 420/04; Transportation Ministry, Decree N° 96.044/88; and their updatings.

15. REGULATIONS

Transportation: follow item 14.

Consult pertinente national and international regulation.

Consult Brazilian Standards related to the product.

EPA Regulation:

-RCRA 40 CFR: non listed

-CERCLA 40 CFR 302.4: listed by CWA Section 311 (b) (4) 5000 lb (2268 kg)

-SARA 40 CFR 372.65: Non Listed.

-SARA EHS 40 CFR 355: non listed.

-TSCA: listed.

EPA – Environmental Protection Agency

SARA - Superfund Amendments and Reauthorization Act

RCRA - Resource Conservation and Recovery Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

TSCA - Toxic Substances Control Act

16. OTHER INFORMATION

References:

- Elekeiroz specification, code EKFA-PR.01 issue: 04/15/2004, revision 1.
- MSDS - GENIUM PUBLISHING CORP. (record n.º FUM5000, revision June/2006);

- IATA/DGR – International Air Transport Association – Edition 2007.
- IMO/IMDG – International Maritime Dangerous Goods – Edition 2006.
- Manual ACGIH, Portuguese version, 2006 (translation: ABHO).
- Commented Regulatory Standards – Health and Safety Regulation Volume I – Press GVC 2005.

Observation:

The information contained in this MSDS are offered in good faith and as guide tool, without incurring expressed or implicit liability. If clearings or additional information are needed, consult the manufacturer.