CITRIC ACID

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

<table>
<thead>
<tr>
<th>Product name</th>
<th>CITRIC ACID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Name</td>
<td>citric acid</td>
</tr>
<tr>
<td>Chemical English Name</td>
<td>citric acid</td>
</tr>
<tr>
<td>Synonyms</td>
<td>2-hydroxy-1,2,3-propanetricarboxylic acid, APS AR00000161 USP00005262 AR00000160 UL00000162 BP00005263, Acletten Food additive food acid 330 Citretten Citro ROA 10, Ardex Powder 420, C6-H8-O7, Citric acid anhydrous, USP/FCC, Deltrex Acide citrique Roche Ro-017548001, Dura 5936, HOC(CH2COOH)2COOH, HOC-(CH2-CO2-H)2-CO2-H, LPKF Cleaner, beta-hydroxycarboxylic acid, beta-hydroxytricarballylic acid, citric acid anhydrous, citric acid anhydrous BP, USP/FDC, citric acid anhydrous fine gr.</td>
</tr>
<tr>
<td>Proper shipping name</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Chemical formula</td>
<td>C6H8O7</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>Not Available</td>
</tr>
<tr>
<td>CAS number</td>
<td>77-92-9</td>
</tr>
</tbody>
</table>

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

Component acidulant in beverages, confectionery, effervescent salts, in pharmaceutical syrups, medicines, in effervescent powders and tablets. Used to adjust the pH of foods and as synergistic antioxidant. Used in beverages, jellies, jams, preserves and candy to provide tartness. Manufacture of citrate salts. In processing of cheese. In electroplating. As sequestering agent to remove trace metals. As mordant to brighten colours. In analytical chemistry as reagent for albumin, mucin, glucose. Food Additive 330. Citric acid is a natural ingredient of many fruits. Citric acid occurs naturally in the body as a metabolite in the tricarboxylic acid cycle.

Details of the manufacturer/importer

| Registered company name | ANPEL Laboratory Technologies (Shanghai) Inc. |
| Address                | No.260 Pu Ting Road, Song Jiang District, Shanghai China |
| Telephone              | 021-54890099 |
| Fax                    | 021-54248311 |
| Website                | www.anpel.com.cn |
| Email                  | shanpel@anpel.com.cn |

Emergency telephone number

| Association / Organisation | Not Available |
| Emergency telephone numbers | 021-57818692 |
| Other emergency telephone numbers | 021-57818692 |

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

| SUMMARY OF HAZARD IN AN EMERGENCY SITUATION |
| Solid |
| Mixes with water. Combustible. |
| Irritating to respiratory system and skin. |
| Risk of serious damage to eyes. |
| GHS Classification | Skin Corrosion/Irritation Category 2, Serious Eye Damage Category 1, STOT - SE (Resp. Irr.) Category 3 |
GHS label elements

<table>
<thead>
<tr>
<th>SIGNAL WORD</th>
<th>DANGER</th>
</tr>
</thead>
</table>

Hazard statement(s)

- **H315**: Causes skin irritation
- **H318**: Causes serious eye damage
- **H335**: May cause respiratory irritation

Precautionary statement(s) Prevention

- **P271**: Use only outdoors or in a well-ventilated area.
- **P280**: Wear protective gloves/protective clothing/eye protection/face protection.
- **P261**: Avoid breathing dust/fume/gas/mist/vapours/spray.

Precautionary statement(s) Response

- **P305+P351+P338**: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- **P310**: Immediately call a POISON CENTER/doctor/physician/first aider
- **P302+P340**: IF ON SKIN: Wash with plenty of water and soap
- **P304+P340**: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
- **P332+P313**: If skin irritation occurs: Get medical advice/attention.
- **P362+P364**: Take off contaminated clothing and wash it before reuse.

Precautionary statement(s) Storage

- **P405**: Store locked up.
- **P403+P233**: Store in a well-ventilated place. Keep container tightly closed.

Precautionary statement(s) Disposal

- **P501**: Dispose of contents/container to authorised chemical landfill or if organic to high temperature incineration

Physical and Chemical Hazard

- Solid.
- Mixes with water.
- Combustible.
- Toxic smoke/fumes in a fire.

Health Hazards

**Inhaled**
Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system, in a substantial number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.

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.

If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures.

**Ingestion**
Accidental ingestion of the material may be damaging to the health of the individual.

Ingestion of low-molecular organic acid solutions may produce spontaneous haemorrhaging, intravascular coagulation, gastrointestinal damage and oesophageal and pyloric stricture.

**Skin Contact**
The material produces mild skin irritation; evidence exists, or practical experience predicts, that the material either
- produces mild inflammation of the skin in a substantial number of individuals following direct contact, and/or
- produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.

Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.

Skin contact is not thought to have harmful health effects (as classified under EC Directives); 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 bloodstream through, for example, cuts, abrasions, puncture wounds 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.

**Eye**
When applied to the eye(s) of animals, the material produces severe ocular lesions which are present twenty-four hours or more after instillation.

Dilute solutions of low-molecular organic acids cause conjunctival hyperaemia, prompt pain and corneal injury.
Chronic
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. 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. A prime symptom is breathlessness. Lung shadows show on X-ray.

Environmental Hazards
See Section 12

Other hazards
Cumulative effects may result following exposure.*
Ingestion may produce health damage*.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Substances</th>
<th>CAS No</th>
<th>%[weight]</th>
<th>Name</th>
<th>GHS Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>77-92-9</td>
<td>&gt;98</td>
<td>citric acid</td>
<td>Skin Corrosion/Irritation Category 2, Serious Eye Damage Category 1, STOT - SE (Resp. Irr.) Category 3; H315, H318, H335</td>
</tr>
</tbody>
</table>


SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact
- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with 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.
  - Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact
- If skin contact occurs:
  - Immediately remove all contaminated clothing, including footwear.
  - Flush skin and hair with running water (and soap if available).
  - Seek medical attention in event of irritation.

Inhalation
- If fumes or combustion products are inhaled remove from contaminated area.
  - Lay patient down. Keep warm and rested.
  - Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
  - Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained.
  - Perform CPR if necessary.
  - Transport to hospital, or doctor, without delay.

Ingestion
- 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.
  - Observe the patient carefully.
  - Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
  - Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
  - Seek medical advice.

Advise for rescue team (PPE requirement for rescue personnel)
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact with the substance, by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

Indication of any immediate medical attention and special treatment needed
- Treat symptomatically.
- Simple antacid powders should be useful in the case of ingestion.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media
- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
Special hazards arising from the substrate or mixture

Fire Incompatibility

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

Advice for firefighters

**Fire Fighting**

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

- Combustible solid which burns but propagates flame with difficulty; it is estimated that most organic dusts are combustible (circa 70%) according to the circumstances under which the combustion process occurs, such materials may cause fires and / or dust explosions.
- Organic powders when finely divided over a range of concentrations regardless of particulate size or shape and suspended in air or some other oxidizing medium may form explosive dust-air mixtures and result in a fire or dust explosion (including secondary explosions).
- 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 (420 micron or less) may burn rapidly and fiercely if ignited - particles exceeding this limit will generally not form flammable dust clouds; once initiated, however, larger particles up to 1400 microns diameter contribute to the propagation of an explosion.
- In the same way as gases and vapours, dusts in the form of a cloud are only ignitable over a range of concentrations; in principle, the concepts of lower explosive limit (LEL) and upper explosive limit (UEL) are applicable to dust clouds but only the LEL is of practical use; this is because of the inherent difficulty of achieving homogeneous dust clouds at high temperatures (for dusts the LEL is often called the "Minimum Explosive Concentration", MEC).
- When processed with flammable liquids/vapors/mists ignitable (hybrid) mixtures may be formed with combustible dusts. Ignitable mixtures will increase the rate of explosion pressure rise and the Minimum Ignition Energy (the minimum amount of energy required to ignite dust clouds - MIE) will be lower than the pure dust in air mixture. The Lower Explosive Limit (LEL) of the vapour/dust mixture will be lower than the individual LELs for the vapors/mists or dusts.
- A dust explosion may release of large quantities of gaseous products; this in turn causes a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.
- Usually the initial or primary explosion takes place in a confined space such as plant or machinery, and can be of sufficient force to damage or rupture the plant. If the shock wave from the primary explosion enters the surrounding area, it will disturb any settled dust layers, forming a second dust cloud, and often initiate a much larger secondary explosion. All large scale explosions have resulted from chain reactions of this type.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.
- All movable parts coming in contact with this material should have a speed of less than 1-meter/sec.
- A sudden release of statically charged materials from storage or process equipment, particularly at elevated temperatures and/or pressure, may result in ignition especially in the absence of an apparent ignition source.
- One important effect of the particulate nature of powders is that the surface area and surface structure (and often moisture content) can vary widely from sample to sample, depending of how the powder was manufactured and handled; this means that it is virtually impossible to use flammability data published in the literature for dusts (in contrast to that published for gases and vapours).
- Autoignition temperatures are often quoted for dust clouds (minimum ignition temperature (MIT)) and dust layers (layer ignition temperature (LIT)); LIT generally falls as the thickness of the layer increases.
- 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/Explosion Hazard**

- May emit corrosive fumes.

**SECTION 6 ACCIDENTAL RELEASE MEASURES**

**Personal precautions, protective equipment and emergency procedures**

**Minor Spills**

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

**Moderate hazard.**

- CAUTION: Advise personnel in area.
- Alert Emergency Services and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise Emergency Services.

**Major Spills**

- Personal Protective Equipment advice is contained in Section 8 of the MSDS.
Measures for Preventing Secondary Contamination
Refer to section above

Environmental precautions
See section above

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- **DO NOT** enter confined spaces until atmosphere has been checked.
- **DO NOT** allow material to contact humans, exposed food or food utensils.
- Avoid contact with incompatible materials.
- When handling, **DO NOT** eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.
- Use good occupational work practice.
-Observe manufacturer's storage and handling recommendations contained within this MSDS.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
- Organic powders when finely divided over a range of concentrations regardless of particulate size or shape and suspended in air or some other oxidizing medium may form explosive dust-air mixtures and result in a fire or dust explosion (including secondary explosions).
- Minimise airborne dust and eliminate all ignition sources. Keep away from heat, hot surfaces, sparks, and flame.
- Establish good housekeeping practices.
- Remove dust accumulations on a regular basis by vacuuming or gentle sweeping to avoid creating dust clouds.
- Use continuous suction at points of dust generation to capture and minimise the accumulation of dusts. Particular attention should be given to overhead and hidden horizontal surfaces to minimise the probability of a "secondary" explosion. According to NFPA Standard 654, dust layers 1/32 in. (0.8 mm) thick can be sufficient to warrant immediate cleaning of the area.
- **Do not use air hoses for cleaning.**
- Minimise dry sweeping to avoid generation of dust clouds. Vacuum dust-accumulating surfaces and remove to a chemical disposal area. Vacuums with explosion-proof motors should be used.
- Control sources of static electricity. Dusts or their packages may accumulate static charges, and static discharge can be a source of ignition.
- Solids handling systems must be designed in accordance with applicable standards (e.g. NFPA including 654 and 77) and other national guidance.
- Do not empty directly into flammable solvents or in the presence of flammable vapors.
- The operator, the packaging container and all equipment must be grounded with electrical bonding and grounding systems. Plastic bags and plastics cannot be grounded, and antistatic bags do not completely protect against development of static charges. 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.

Other information

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry area protected from environmental extremes.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storage and handling recommendations contained within this MSDS.

For major quantities:

- Consider storage in bunded areas - ensure storage areas are isolated from sources of community water (including stormwater, ground water, lakes and streams).
- Ensure that accidental discharge to air or water is the subject of a contingency disaster management plan; this may require consultation with local authorities.

Conditions for safe storage, including any incompatibilities

**Suitable container**

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

**Storage incompatibility**

- Avoid strong bases.
- Avoid reaction with oxidising agents
- Avoid potassium tartrate, alkali and alkaline earth carbonates and bicarbonates, acetates, sulfides, metal nitrates.

**PACKAGE MATERIAL INCOMPATIBILITIES**

Not Available

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

**Control parameters**

**OCCUPATIONAL EXPOSURE LIMITS (OEL)**

**INGREDIENT DATA**

Not Available

**EMERGENCY LIMITS**

Continued...
The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.

**TEEL-3**

Upper end of the range

- Disturbing room air currents
- Contaminants of high toxicity
- 590 mg/m³

**TEEL-1**

- High production, heavy use
- 4 mg/m³

**TEEL-0**

- Room air currents minimal or favourable to capture
- Low toxicity or of nuisance value only
- Intermittent, low production.
- 0.37 mg/m³

### Exposure controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:

- Process controls which involve changing the way a job activity or process is done to reduce the risk.
- Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
- Employers may need to use multiple types of controls to prevent employee overexposure.

**Appropriate 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.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:
  - (a): particle dust respirators, if necessary, combined with an absorption cartridge;
  - (b): filter respirators with absorption cartridge or canister of the right type;
  - (c): fresh-air hoods or masks
- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

### Type of Contaminant: Air Speed:

<table>
<thead>
<tr>
<th>Contaminant Description</th>
<th>Air Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct spray, spray painting in shallow booths, drum filling, conveyor loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)</td>
<td>1-2.5 m/s (200-500 f/min.)</td>
</tr>
<tr>
<td>Grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).</td>
<td>2.5-10 m/s (500-2000 f/min.)</td>
</tr>
</tbody>
</table>

**Within each range the appropriate value depends on:**

- **Lower end of the range**
  - 1: Room air currents minimal or favourable to capture
  - 2: Contaminants of low toxicity or of nuisance value only
  - 3: Intermittent, low production.
  - 4: Large hood or large air mass in motion
- **Upper end of the range**
  - 1: Disturbing room air currents
  - 2: Contaminants of high toxicity
  - 3: High production, heavy use
  - 4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 metres distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

### Personal protection

- Safety glasses with side shields.
- Chemical goggles.

### Eye and face protection

- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing
the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lenses as soon as practicable. Lenses should be removed at the first signs of eye redness or irritation - lenses should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

** Skin protection **

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and durability

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).

- 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, AS/NZS 2161.10.1 or national equivalent) 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, AS/NZS 2161.10.1 or national equivalent) is recommended.
- Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use.
- 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.

- polyethylene (PE)
- nitrile rubber
- butyl rubber
- fluorocautchouc.
- polyvinyl chloride.

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

** Hands/feet protection **

** Body protection **

** Other protection **

** Thermal hazards **

Not Available

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### Recommended material(s)

** GLOVE SELECTION INDEX **

Glove selection is based on a modified presentation of the:  
"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the computer-generated selection:

CITRIC ACID Not Available

<table>
<thead>
<tr>
<th>Material</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>* CPI - Chemwatch Performance Index</td>
<td></td>
</tr>
<tr>
<td>A: Best Selection</td>
<td></td>
</tr>
<tr>
<td>B: Satisfactory; may degrade after 4 hours continuous immersion</td>
<td></td>
</tr>
<tr>
<td>NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation.</td>
<td></td>
</tr>
<tr>
<td>* Where the glove is to be used on a short term, casual or infrequent basis, factors such as &quot;feel&quot; or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.</td>
<td></td>
</tr>
</tbody>
</table>

---

** Respiratory protection **

Particulate. (AS/NZS 1716 & 1715, EN 143:000 & 149:001, ANSI Z88 or national equivalent)

<table>
<thead>
<tr>
<th>Required Minimum Protection Factor</th>
<th>Half-Face Respirator</th>
<th>Full-Face Respirator</th>
<th>Powered Air Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 10 x ES</td>
<td>P1 Air-line*</td>
<td>-</td>
<td>PAPR-P1</td>
</tr>
<tr>
<td>up to 50 x ES</td>
<td>Air-line**</td>
<td>P2</td>
<td>PAPR-P2</td>
</tr>
<tr>
<td>up to 100 x ES</td>
<td>-</td>
<td>P3</td>
<td>-</td>
</tr>
<tr>
<td>100+ x ES</td>
<td>-</td>
<td>Air-line*</td>
<td>PAPR-P3</td>
</tr>
</tbody>
</table>

* - Negative pressure demand  
** - Continuous flow

A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

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** SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES **

** Information on basic physical and chemical properties **

| Appearance | White odourless crystals, granules or powder; mixes with water, alcohol and methanol; practically insoluble in chloroform. Solubility in water @ 20 deg.C: 59.2 g/100 ml. Weakly acidic; pHa1 = 3.14, pH2a = 4.77 and pH3a = 6.39. Monohydrate loses water of crystallisation in dry air or when heated to 40-50 deg.C. Slightly deliquescent (absorbs moisture) in moist air. Softens at 75 deg. C and melts at 100 deg. C. At 175 deg.C begins to convert to various organic compounds (aconitic acid, aconitocarboxylic acid, acetone). |
| Physical state | Divided Solid | Relative density (Water = 1) | 1.67 @ 20 deg.C |

Continued...
<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Not Available</td>
</tr>
<tr>
<td>Odour threshold</td>
<td>Not Available</td>
</tr>
<tr>
<td>pH (as supplied)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Melting point / freezing point (°C)</td>
<td>153</td>
</tr>
<tr>
<td>Initial boiling point and boiling range (°C)</td>
<td>Decomposes</td>
</tr>
<tr>
<td>Flash point (°C)</td>
<td>1000-1020</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Flammability</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>2.29 kg/m³</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>0.29 kg/m³</td>
</tr>
<tr>
<td>Vapour pressure (kPa)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Solubility in water (g/L)</td>
<td>Miscible</td>
</tr>
<tr>
<td>Vapour density (Air = 1)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Molecular weight (g/mol)</td>
<td>192.13</td>
</tr>
<tr>
<td>Auto-ignition temperature (°C)</td>
<td>1000-1020</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>&gt;153</td>
</tr>
<tr>
<td>Partition coefficient n-octanol / water</td>
<td>Not Available</td>
</tr>
<tr>
<td>Viscosity (cSt)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>pH (as supplied)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>&gt;153</td>
</tr>
</tbody>
</table>

**SECTION 10 STABILITY AND REACTIVITY**

| Reactivity | See section 7 |
| Chemical stability | • Unstable in the presence of incompatible materials.  
| | • Product is considered stable.  
| | • Hazardous polymerisation will not occur.  |
| Possibility of hazardous reactions | See section 7 |
| Conditions to avoid | See section 7 |
| Incompatible materials | See section 7 |
| Hazardous decomposition products | See section 5 |

**SECTION 11 TOXICOLOGICAL INFORMATION**

<table>
<thead>
<tr>
<th>citric acid</th>
<th>TOXICITY</th>
<th>IRRITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (rat) LD50: 3000 mg/kg</td>
<td>Eye (rabbit): 0.75 mg/24h-SEVERE</td>
<td></td>
</tr>
<tr>
<td>Not Available</td>
<td>Skin (rabbit): 500 mg/24h - mild</td>
<td></td>
</tr>
</tbody>
</table>

* Value obtained from manufacturer's msds  
unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances

Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic 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 presence 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 substances (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

For citric acid (and its inorganic citrate salts)  
Based on many experimental data in animals and on human experience, citric acid is of low acute toxicity. The NOAEL for repeated dose toxicity for rats is 1200 mg/kg/d. The major, reversible (sub)chronic toxic effects seem to be limited to changes in blood chemistry and metal absorption/excretion kinetics. Citric acid is not suspected of being a carcinogen nor a reprotoxic or teratogenic agent. The NOAEL for reproductive toxicity for rats is 2500 mg/kg/d. Further, it is not mutagenic in vitro and in vivo. Also, the sensitising potential is seen as low. In contrast, initiation, in particular of the eyes but also of the respiratory pathways and the skin, is the major toxicological hazard presented by citric acid.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.
SECTION 12 ECOLOGICAL INFORMATION

Toxicity

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Endpoint</th>
<th>Test Duration</th>
<th>Effect</th>
<th>Value</th>
<th>Species</th>
<th>BCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>citric acid</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

DO NOT discharge into sewer or waterways.

for citric acid (and its inorganic citrate salts)

Environmental fate:

Due to its physico -chemical characteristics citric acid is highly mobile in the environment and will partition to the aquatic compartment. Citric acid is rapidly degraded in both sewage works and surface waters and in soil. Citric acid is exceedingly soluble in water, has relatively low acid dissociation constants that ensure that the substance is at least partly deprotonated in aqueous solution at all environmentally relevant pH values. Additionally, it has a low n-octanol/water partition coefficient; no precise information was found on vapour pressure but the melting point is around 153 deg C. The result of a QSAR estimation is 7.3 x 10-7 Pa at 25 deg C. These properties of citric acid indicate that it is likely to partition mainly into the water phase, with very little distributing into the atmosphere. In addition, due to the high water solubility the substance is unlikely to adsorb onto soil or sediment. Using a level III generic fugacity model it is predicted that if citric acid is released to water, it is unlikely to partition into other environmental compartments. Release of citric acid to air is likely to lead to distribution into soil and water through deposition processes, while release or deposition onto soil is predicted to lead to redistribution into the aquatic compartment.

The prediction of extensive and rapid degradation, both in sewage treatment plants and in natural water bodies, is borne out by experimental data confirming double to three times the degradation of low concentrations of citric acid in lake water at pH 8 as compared to in distilled water.

Estimation of the indirect photolysis using a photochemical hydroxyl radical reaction constant of 7.02 x 10-12 cm3/mol sec and assuming a hydroxyl radical concentration 0.5 x 106 OH/cm3 would result in an atmospheric half life of 2.3 days. It should be kept in mind that environmental citrate concentrations do not only derive from man-made citric acid but that citric acid is extremely widespread in nature respectively widely distributed in plants and animal tissues and fluids and that every single eukaryote organism produces citric acid and excretes part of it to the environment.

Environmental fate:

Citric acid is of low acute toxicity to freshwater fish, daphnia and algae and also to the few marine species tested; longer -term tests show comparable effect values. Similarly, citric acid has no obvious toxic potential against protozoans and many species or strains of bacteria including activated sludge micro-organisms. Many results refer to toxic limit concentrations or no effect concentrations, from which no dependable EC50 can be derived. In a “long-term” daphnia test in “soft water”, which may be assumed not to buffer the acid effect of the test substance, the EC50 was found to be 80 mg/l and the EC100 was 120 mg/l, resulting in a geometric mean EC50 of 98 mg/l. Similarly, the lowest reported EC0 in cyanobacteria was 80 mg/l. Different strains of bacteria showed positive growth respectively good to excellent degradation with citric acid as the sole carbon source and the same holds for sewage sludge micro-organisms that thrive on citric acid.

The few marine species for which data are available seem to be somewhat more sensitive to citric acid, although at 160 mg/l the only acute LC50 reported for a crab is over 100 mg/l, while for two algae and a protozoan the subacute toxic limit concentration is only given as a wide range between 1 and 300 mg/l. Still, at least for the few tested organisms citric acid does not seem to be highly or acutely toxic. The toxicity of citric acid to other environmentally relevant species has not been determined.

Based on the available data, citric acid is not judged to be a substance that presents a hazard to the environment.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>LOW</td>
<td>LOW</td>
</tr>
</tbody>
</table>

Bioaccumulative potential

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Bioaccumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>LOW (LogKOW = -1.64)</td>
</tr>
</tbody>
</table>

Mobility in soil

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>LOW (KOC = 10)</td>
</tr>
</tbody>
</table>

Other adverse effects

No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

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. In most instances the supplier of the material should be consulted.

- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

| Depending on location and conditions, neutralised material may be disposed to sewer if approved by regulatory authorities. |

SECTION 14 TRANSPORT INFORMATION

Labels Required

- Marine Pollutant: NO

Land transport (UN): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Inland waterways transport (ADNR / River Rhine): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

| UN number | Not Available |
| Packing group | Not Available |
| UN proper shipping name | Not Available |
| Environmental hazard | No relevant data |
| Transport hazard class(es) | Not Available / Not Applicable |

Special precautions for user

| Classification code | Not Available |
| Limited quantity | Not Available |
| Equipment required | Not Available |
| Fire cones number | Not Available |

Transport in bulk according to Annex II of MARPOL 73 / 78 and the IBC code

<table>
<thead>
<tr>
<th>Source</th>
<th>Ingredient</th>
<th>Pollution Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk</td>
<td>citric acid</td>
<td>Z</td>
</tr>
</tbody>
</table>

Precautions for Transport

Suitable Containers

See section 7

SECTION 15 REGULATORY INFORMATION

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

<table>
<thead>
<tr>
<th>citric acid(77-92-9) is found on the following regulatory lists</th>
</tr>
</thead>
</table>
| "China Inventory of Existing Chemical Substances"

SECTION 16 OTHER INFORMATION

Other information

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.

Definitions and abbreviations

- **PC – TWA**: Permissible Concentration-Time Weighted Average
- **PC – STEL**: Permissible Concentration-Short Term Exposure Limit
- **IARC**: International Agency for Research on Cancer
- **ACGIH**: American Conference of Governmental Industrial Hygienists
- **STEL**: Short Term Exposure Limit
- **TEEL**: Temporary Emergency Exposure Limit
- **IDIH**: Immediately Dangerous to Life or Health Concentrations
- **OSF**: Odour Safety Factor
- **NOAEL**: No Observed Adverse Effect Level
- **LOAEL**: Lowest Observed Adverse Effect Level
- **TLV**: Threshold Limit Value
- **LOD**: Limit Of Detection
- **OTV**: Odour Threshold Value
- **BCF**: BioConcentration Factors
- **BEI**: Biological Exposure Index

Disclaimer

The information in the SDS applies only for the specified product and does not include mixtures of this product with other substances and mixtures. The SDS provides product safety information for personnel trained to use this product only.

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