Product Safety Summary
Acrylic Acid

This Product Safety Summary is intended to provide a general overview of the chemical substance. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the Material Safety Data Sheet (MSDS) for the chemical substance.

Chemical Identity

Abbreviation :	none used
CAS Number :	79-10-7
Formula:	CH_2=CHCOOH
Common Names :	2-propenoic Acid Acroleic Acid Propenoic Acid Ethylenecarboxylic Acid Vinyl Formic Acid Glacial Acrylic Acid

Product Overview

- Acrylic acid is a highly reactive material and will readily polymerize if not properly controlled by inhibitors.
- Acrylic acid is an important chemical building block in a wide variety of acrylic esters or acrylate monomers. These acrylates are then polymerized and a used in polymers, coatings, paints, adhesives, plastics, textiles and many other applications.
- Acrylic acid is also used to produce polyacrylic acid or crosslinked polyacrylic acid compounds. These compounds are used in the manufacture of hygienic products, detergents and waste water treatment chemicals.
- Like any reactive chemicals, acrylic acid products can create hazards if handled carelessly. All persons associated with the transportation, storage or handling of acrylic acid must understand the hazards. This includes training in the recommended normal and emergency handling procedures.
- The primary hazards with acrylic acid are from contact of the skin or inhalation of its vapors. Airborne limits have been established for acrylic acid vapor concentrations in the work environment. The American Conference of Governmental Industrial Hygienists (ACGIH) has a threshold limit value (TLV) of 2 ppm for an eight hour time-weighted average basis with a skin notation. Occupational Health and Safety Administration (OSHA) has not established an exposure limit. In animal studies, the irritation caused by repeated exposure to acrylic acid vapor has resulted in nasal lesions. Acrylic acid has not been shown to cause skin sensitization or allergic reaction. Animal exposure studies have not indicated that acrylic acid poses a cancer hazard.
- For further safety and health information, the current Material Safety Data Sheet (MSDS) should be used for this substance.

Physical/Chemical Properties

- Acrylic acid is a clear, colorless and corrosive liquid that has a strong acrid odor.
- The specific gravity of acrylic acid is 1.05 and is denser than water. Acrylic acid solubility in water is infinite and is freely soluble in most organic solvents.
- The Boiling point of acrylic acid is 141°C and the Freezing point is 13°C. The Flash point of acrylic acid is 50°C, by Tag Closed Cup method.
- Acrylic acid will react with itself and a wide variety of chemicals. These reactions can generate heat and the reactions can become progressively more vigorous and can be violent. Acrylic acid can be completely stable when properly inhibited and stored.

Health Information

Acute Hazards

Acrylic acid is a potentially hazardous material. A thorough knowledge of potential dangers, with strict adherence to recommended safety practices, is essential before acrylic acid products are handled, stored or used. Workers must be properly instructed and supervised in the handling of acrylic acid. The primary hazards with acrylic acid are the inhalation of its vapors. Limits have been established for allowable vapor concentrations in the work environment. ACGIH has a threshold limit value (TLV) of 2 ppm for an eight hour time-weighted average basis with a skin notation, while OSHA has no limit established.

Effects on Respiratory System:
Exposure to mists or vapor at levels above the recommended exposure limits can produce eye, nose, or lung irritation and injury. Seriousness of injury depends on the degree of exposure. The symptoms can include respiratory irritation and watering of the eyes.

Effects on Eyes:
Exposure to acrylic acid vapors may cause mild irritation and watering. The symptoms of direct contact to acrylic acid liquid or high concentrations of vapors are severe watering, irritation and inflammation of the mucous membranes. Any situation in which acrylic acid contacts the eyes should be considered a medical emergency. Even dilute aqueous solutions of acrylic acid (1%) can produce serious eye injury.

Effects on Skin:
Acrylic acid is corrosive to skin contact and can result in and blistering or burns.

Effects on Ingestion:
The effects of ingestion include the irritation and burning of the mouth, esophagus and stomach. The harm that occurs will be a result of this irritation and not of any systemic toxicity. Drink 4 to 8 ounces of water and DONOT induce vomiting.

Chronic Hazards

Acrylic acid produces toxic effects mainly at the site of contact: nasal lesions if inhaled, skin lesions upon dermal contact, and gastrointestinal effects if acrylic acid solutions are swallowed. Overall, long-term studies and the studies for genetic and reproductive effects, indicate that acrylic acid does not pose a genotoxic or carcinogenic threat, or cause reproductive or developmental effects. The current ACGIH TLV of 2 ppm protects against potential adverse health effects.

Environmental Information

Because of its reactivity, acrylic acid is generally not persistent in the environment. It disperses via a combination of mechanisms, including biodegradation, oxidation, and volatilization.

In biochemical oxygen demand (BOD) studies, acrylic acid has been shown to degrade 81% in 22 days in water inoculated with sewage seed. Acrylic acid is also amenable to anaerobic treatment, degrading to about 75% of theoretical methane in acclimated cultures.

Acrylic acid is moderately toxic to aquatic life, but not persistent in aquatic environments, due to rapid oxidation. Large releases can deplete dissolved oxygen.

Acrylic acid is essentially nonvolatile, although some vaporization from surface and dry soils may occur. Acrylic acid released to the atmosphere will react with ozone and photochemically produce hydroxyl radicals, resulting in a half-life of six to fourteen hours. Since acrylic acid is miscible with water, it would not be expected to absorb significantly on soil or sediment.

A variety of federal, state and local regulations govern the release of any material to the land, air or surface waters. Any release or discharge of acrylic acid must be evaluated in reference to these regulations to determine appropriate response actions and reporting requirements. Acrylic acid is one of the chemicals for which releases to all environmental media must be annually reported.

A regulation called Resource Conservation and Recovery Act (RCRA) must be followed if a volume of acrylic acid or material contaminated with acrylic acid is to be disposed of or discarded. Based on RCRA criteria, acrylic acid or materials contaminated with acrylic acid will likely be considered a “Hazardous Waste” upon disposal and will need to follow certain storage, handling and disposal restrictions as outlined in RCRA. Strict adherence to these restrictions as well as proper characterization and labeling of the material is the responsibility of the generator and handler of the waste material.

Emphasis should be placed on the prevention of releases through careful design of equipment and sound operating procedures. If acrylic acid is lost from containment through a leak or spill, care should be taken to use the proper personal protective equipment, decontamination procedures and other safety considerations. It is important to remember that spills of acrylic acid and materials contaminated by acrylic acid must be handled as RCRA hazardous wastes.

Any release of acrylic acid greater than the “reportable quantity” designated by the EPA in CERCLA or SARA should be reported immediately on discovery to the National Response Center and State Emergency Response Agency (see current MSDS for reportable quantity and pertinent phone numbers).

In the event of accidental spillage of acrylic acid to surface waters or to a municipal water system, contact the local and state pollution control agencies immediately.

Additional Hazard Information

Acrylic acid is stable when stored and handled under recommended conditions. Commercially available acrylic acid is stabilized (inhibited) with hydroquinone monomethyl ether (MEHQ), which prolongs the shelf life. However, this shelf life is reduced exponentially with increasing temperature, so exposure to high temperatures must be avoided.

The polymerization of acrylic acid can be very violent, evolving considerable heat and pressure and ejecting hot vapor and polymer, which may auto ignite. An explosion hazard exists due to extremely rapid pressure build up. Several case histories are known in which vessels of acrylic acid exploded due to violent (“runaway”) polymerization when proper procedures were not followed.

The presence of dissolved oxygen is necessary for MEHQ to function effectively. Thus, acrylic acid should never be handled or stored under an oxygen-free atmosphere. A gas mixture containing 5 to 21 vol. % of oxygen at one atmosphere should always be maintained above the monomer to ensure inhibitor effectiveness. In a closed system, this atmosphere must be periodically replenished since dissolved oxygen is gradually consumed in the inhibition process.

The freezing of acrylic acid should be avoided (its freezing point is 13˚C [55˚F]) because thawing it can be extremely hazardous. The use of insulated containers and carriers and/or tempered water tracing is recommended to prevent freezing. The temperature of the acid should be maintained at 15 to 25˚C (59 to 77˚F).

If acrylic acid freezing occurs, the first crystals are formed along the inner wall of the container. This crystallized acrylic acid contains very little inhibitor; the inhibitor is concentrated in the remaining liquid. The temperature of the medium used to thaw acrylic acid should never be greater than 45˚C (113˚F).

In the event that freezing does occur, the following procedures are suggested:

- Use only tempered water, 45˚C (113˚F) maximum temperature, to thaw containers. UNDER NO CIRCUMSTANCES SHOULD STEAM BE USED TO HEAT OR THAW ACRYLIC ACID
- The temperature of both the circulating water and the thawed portion of the monomer should be closely monitored and controlled.
- The monomer should be well mixed to redistribute the inhibitor and resupply dissolved oxygen.
- Drums of frozen acrylic acid should be thawed in a heated room at temperatures between 20 and 33˚C (68 and 91˚F). The drums must be agitated periodically to redistribute the inhibitor and dissolved oxygen during thawing (i.e. drum roller, tote agitator, pallet shaker). As soon as the acrylic acid is thawed, its temperature should be maintained at 15 to 25˚C (59 to 77˚F).

NEVER REMOVE LIQUID FROM A PARTIALLY-THAWED VESSEL OF ACRYLIC ACID; THE REMAINING MATERIAL COULD BE SERIOUSLY UNDER-INHIBITED.

Exposure Potential

Consumer products potentially could contain trace levels of acrylic acid as a result of the polymerization process, however consumers are not generally exposed to these compounds in finished products. Although potential for exposure does exist during acrylic acid manufacture, transportation and use, enclosed systems limit the exposure to worker populations and nearby communities. Exposure to the general public may occur in accidental situations. Acrylic acid is not intended for the general use by the general public.

Acrylic acid vapor has a very strong acrid odor that allows for early detection of any potential release. Acrylic acid odor usually will be detected before it reaches the level of the current standard. While smelling acrylic acid may be unpleasant, the presence of acrylic acid in not necessarily indicative that levels are above the current standard. Acrylic acid should only be handled by knowledgeable, well-trained personnel who thoroughly understand the hazards associated with the transportation, storage and use of the chemical.

Workplace exposure should be limited by the use of engineering controls. Acrylic acid vapors must be monitored and controlled below applicable regulatory limits. Acrylic acid should be

processed within a closed system. Worker exposure can potentially happen from leaks in piping system, during repair or replacement of the piping system or during removal of a sample for quality control purposes.

Regulations involving hazardous chemicals are continually evolving and thus exposure guidelines are reviewed regularly and modified whenever new information dictates a change. It is important that all companies handling acrylic acid are aware of the current legislative requirements.

The guidelines established by OSHA, ACGIH, NIOSH and others, represent current thinking and are believed to be conservative and protective of occupational workers. There is not guarantee of absolute safety.

Risk Management

The potential hazards associated with acrylic acid can be avoided if workers are adequately instructed in supervised on the proper procedures of handling acrylic acid.

Personal protective equipment (PPE) should be selected based on the potential for exposure to particular chemical(s), and the unique properties of that chemical. In general, PPE is not an adequate substitute for appropriate workplace controls (such as ventilation), or other safe work practices. There may be situations when the only practical means of preventing employee exposure is through the effective use of PPE. When PPE is provided to employees, they must be trained in how, where, when, and why the equipment should be used. The facility must also have provisions for decontaminating and replacing such equipment as necessary.

Eye protection in the form of chemical splash goggles should be worn to prevent acrylic acid from accidentally splashing in an employee's eye. Goggles should be non-vented, and designed specifically to protect against chemical splash. If an employee wears corrective lenses, chemical goggles should be worn over the lenses. Contact lenses are not recommended for use in areas where there is a potential for exposure to acrylic acid. Corrosive vapors can collect behind contact lenses and may cause severe damage to the eye and/or cause the contact lenses to adhere to the eyes.

Skin protection may be found in many forms. Hand protection such as chemical resistant gloves, protective arm sleeves, aprons, full body coveralls, boots, and head coverings are among the types available. Skin protection must be made of a material impervious to acrylic acid. Butyl rubber of 0.4 to 0.6 mm thickness is a good example. Neoprene is less resistant to acrylic acid but is acceptable. Personal protective equipment should be selected on the basis of potential exposure, e.g., gloves may be required for sample collection while full body clothing including gloves, boot covers, head covering may be necessary for spill clean-up. Skin protection for the purpose of preventing chemical exposure may be worn in conjunction with other types of PPE. For example, steel toe safety shoes may be required to prevent a person's foot from being crushed, but an additional boot cover may be required to prevent acrylic acid permeation into the safety shoe. Skin protection PPE is available in a variety of sizes, and should be available in a size that fits the employee wearing it. Improperly sized PPE may compromise its effectiveness and create additional safety hazards. When skin protection PPE is used, there must be a means of cleaning or disposal/replacement of the PPE.

Respiratory protection is available in two basic varieties, air purifying, and air supplied. In general, air purifying respirators provide less protection than air supplied respirators. Both types, however, have their particular advantages and limitations. The appropriate type of respirator must be selected to provide the appropriate level of protection for the anticipated

degree of exposure to airborne acrylic acid (vapor or mist). Detailed guidance for the selection of respiratory protection can be found in The American National Standards Institute Document Z88.2. Respiratory protective equipment should be approved by NIOSH. It must be carefully maintained, inspected, and cleaned. All employees required to wear respiratory protection must be medically cleared to do so (this ensures their physical capability to wear a respirator) and trained to use and care for the equipment. OSHA requirements for respiratory protection can be found in 29 CFR 1910.134.

Properly designed emergency showers and eyewash fountains should be placed in convenient locations wherever acrylic acid is used. All employees should know the location and operation of this equipment. All equipment must be frequently inspected to make sure they are in proper working condition.

Federal/Science Findings

U.S. Environmental Protection Agency – Integrated Risk Information System (IRIS)
http://www.epa.gov/ncea/iris/subst/0002.htm

U.S. Environmental Protection Agency
http://www.epa.gov/ttn/atw/hlthef/acrylica.html

U.S Department of Labor – Occupational Safety and Health Administration (OSHA)
http://www.osha.gov/dts/chemicalsampling/data/CH_217240.html

American Conference of Governmental Industrial Hygienists (ACGIH)
http://www.acgih.org

Contact Information
http://www.basf.com

MSDS
http://worldaccount.basf.com/wa/PublicMSDS~en_US/Search

References

"Acrylic Acid", A Summary of Safety and Handling, ICSHAM, 3rd Edition.
"Acrylic Acid: Background Information", Basic Acrylic Monomer Manufacturers, Inc.(BAMM)website, April 2006.