

BASIC ACRYLIC MONOMER MANUFACTURERS, INC.

ACRYLIC ACID:

BACKGROUND INFORMATION

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NOTICE

BAMMM is a nonprofit, tax-exempt incorporated association, which has developed these materials to provide general background information on acrylic acid and the basic acrylate monomers. Use of this information is voluntary and should only be undertaken after an independent review of the applicable facts and circumstances of particular situations. Users should also consult the appropriate Material Safety Data Sheet (MSDS) for up-to-date information and precautions for safe handling and use of these chemical products. **Although BAMMM has made all reasonable efforts to present accurate information and guidance, no guarantees or warranties, including any express or implied warranties of merchantability or fitness, are made with respect to this material by BAMMM, its officers, directors, members or agents.** In addition, no liability, loss or damage is assumed, and all liability for any government fines or penalties, or any other claim, demand, or loss for negligence or misconduct of any kind, is expressly disclaimed, whether direct, indirect, or consequential.

ABOUT BAMM

The Basic Acrylic Monomer Manufacturers, Inc. (BAMM) is a trade association of manufacturers and importers of acrylic acid and its basic esters, including butyl acrylate, ethyl acrylate, methyl acrylate and 2-ethylhexyl acrylate. BAMM current membership includes: Arkema Inc.; BASF Corporation; The Dow Chemical Company; and Rohm and Haas Company.

ABOUT THIS BROCHURE

Basic Acrylic Monomers – acrylic acid and its esters – are versatile chemicals that have widespread use. The manufacturers, and other researchers, have conducted scientific studies on the health and environmental effects of these products. This summary provides reviews of technical, exposure, and regulatory information for use by government officials, health professionals, and others who would like a brief introduction to the data. This brochure includes data of which BAMM is aware as of the date of publication. While BAMM has been careful to accurately summarize the data and conclusions; newer data may be or become available.

Users should also consult their suppliers' Material Safety Data Sheet (MSDS) for up-to-date information and precautions for safe handling and use of these chemical products.

INTRODUCTION

Acrylic acid has been used for more than 30 years as an essential building block in the production of some of our most commonly used industrial and consumer products.

Approximately two-thirds of the acrylic acid manufactured in the United States is used to produce acrylic esters – methyl acrylate, butyl acrylate, ethyl acrylate, and 2-ethylhexyl acrylate – which, when polymerized (see below), are key ingredients in paints, coatings, textiles, adhesives, plastics, and many other applications.

The remaining one-third of the acrylic acid is used to produce polyacrylic acid, or crosslinked polyacrylic acid compounds, which have been successfully used in the manufacture of superabsorbents used in personal hygiene products, detergents, and waste water treatment chemicals.

Polymerization

Acrylic monomers are highly reactive chemicals and, therefore, are useful, nearly exclusively as intermediates in the production of other materials. For example individual molecules of acrylic acid or esters, called “monomers,” readily combine with themselves or other monomers to form long chains of repeating units, or “polymers.” Unlike their chemically-reactive (monomer) building blocks, the polymers have completely different physical and chemical properties and are considered biologically inert.

These polymers are used in the production of goods that for decades have provided added benefits and convenience to consumers and manufacturers worldwide.

PHYSICAL PROPERTIES

Acrylic acid is a clear, colorless, corrosive liquid.

Molecular Weight	72
Molecular Formula	C ₃ H ₄ O ₂
CAS Number	79-10-7
Boiling Point (°C)	141
Freezing Point (°C)	13
Density (20/20 °C)	1.049
Flash Point (Tag Closed Cup °C)	50

EXPOSURE TO ACRYLIC ACID

Acrylic acid vapor has a very strong acrid odor that allows for early detection of any potential releases. Current standards, or levels to which Authorities consider that most workers can be exposed during an 8-hour workday without harmful effects, are shown below. Based on its low odor detection limit (threshold), acrylic acid odor usually will be detected by smell before exposures reach the levels of the current acceptable standards. While unpleasant, smelling acrylic acid vapor is not necessarily indicative that these established occupational exposure limits have been exceeded.

ACGIH Threshold Limit Value® (TLV, 8-hr)	2 ppm, skin
OSHA Exposure Limit	10 ppm
Odor Threshold	0.1 ppm

Because consumer products contain only trace levels of acrylic acid as a result of the polymerization process, consumers are not generally exposed to these compounds in finished consumer products. Although potential for exposure does exist during the manufacture, transportation, and use of acrylic acid and its esters, enclosed systems limit the exposure to worker populations and nearby communities. Employees and contractors involved in acrylic acid manufacturing should wear appropriate personal protective equipment, use good industrial hygiene practices, and undergo appropriate training.

In spite of a manufacturer's efforts to fully contain acrylic acid during its manufacture or use, vapors can potentially escape from leaks in the piping system (including tanks and reactors), during repair or replacement of the piping system, or during removal of samples for quality control purposes. Worker exposure can be monitored in facilities using either specialized air sampling analysis or specific monitoring systems.

While exposure could occur during loading, unloading, and transportation of tank trucks, railroad tankers, barges, and drums, dedicated systems designed to handle acrylic acid are used routinely. Procedures and equipment should be in place to reduce the potential for spills or leaks during transportation.

TOXICOLOGY PROFILE

The likely primary routes of potential human exposure to acrylic acid are skin contact and inhalation; toxicity is due to tissue damage at the site of contact. Undiluted acrylic acid is a corrosive liquid that can cause permanent tissue damage upon direct contact. Contact with dilute solutions of acrylic acid or acrylic acid vapor can be irritating to the skin, eyes and respiratory tract. In animal studies, the irritation caused by repeated exposure to inhaled acrylic acid vapor has resulted in damage to the nasal tissue.

Freshly distilled acrylic acid did not cause skin sensitization (allergic reaction) in animal studies, however an impurity present in AA from one manufacturing process (DAPA) has been shown to be a strong skin sensitizer in studies using laboratory animals. This impurity is rarely found in commercial AA and the formation of DAPA at ambient temperatures in stored AA requires the presence of a catalyst.

Once absorbed, acrylic acid is rapidly broken down and eliminated, primarily in expired air as carbon dioxide. Toxicity associated with repeated exposures of experimental animals to acrylic acid include: changes in body weight, organ weights, and in clinical chemistry. Except for dermal and nasal lesions which have been observed at the site of contact, microscopic examination of organ tissues has been generally unremarkable indicating no significant difference to non-exposed animals.

Animal exposure studies have shown that acrylic acid poses no cancer hazard.

Acrylic acid was shown to be highly toxic to algae. Acrylic acid does not accumulate in the environment. If released to surface water, acrylic acid should rapidly biodegrade; with a minor fraction volatilizing to the air.

REGULATORY AND RELATED STATUS

The manufacture, transportation, and use of acrylic acid are regulated or addressed by a number of government agencies and other expert groups to control exposure to workers and the environment. The following table records major U.S. federal regulatory and similar information as of June 1999. Such regulations frequently change, and many states and localities adopt their own regulations. Therefore, you should consult applicable laws and regulations, as well as the manufacturer's MSDS, for current requirements.

REGULATORY STANDARDS

OSHA PEL	10 ppm
ACGIH TLV®	2 ppm, skin, A4
NIOSH RELs (TWA)	2 ppm, skin
DFG MAKs (TWA)	none
IARC	3 ¹
NTP ROC	no
DOT Hazard Class	corrosive, flammable
SARA/CERCLA RQ	5000 lbs
SARA 313	yes
RCRA	yes
CAA	yes
CWA	no
FDA	yes ²
NFPA Rating: ³	
• Health	3
• Flammability	2
• Reactivity	2

¹ Category 3 - Not Classifiable as to Carcinogenicity to Humans

² Acrylic acid used as a monomer to make specific polymers is listed for certain specific indirect food additive uses.

³ NFPA Rating Definitions: 3/Health=Materials extremely hazardous to health, but areas may be entered with extreme care; 2/Flammability =Materials that must be moderately heated before ignition will occur; 2/Reactivity=Materials that (in themselves) are normally unstable and readily undergo violent chemical change but do not detonate.

ACRONYMS

ACGIH TLV®	American Conference of Governmental Industrial Hygienists, Threshold Limit Value®
CAA	Clean Air Act, §112(b)
CWA	Clean Water Act, §§116.4, 112 App. D, 131.36, 401.15, 423 App. A.
DOT Hazard Class	Dept. Of Transportation: Hazard Class 49 C.F.R. §172.101
FDA	Food & Drug Administration: 21 C.F.R. Parts 174 to 178
IARC	International Agency for Research on Cancer
NFPA	National Fire Protection Association
OSHA PEL	Occupational Safety and Health Administration, Permissible Exposure Limit, 29 C.F.R., Table Z, §1910.1200
RCRA	RCRA - Resource Conservation and Recovery Act, 40 C.F.R. §261.33
SARA/CERCLA RQ	Superfund Amendments and Reauthorization Act (1986), 40 C.F.R. §375/Comprehensive Environmental Response, Compensation, & Liability Act (1980), 40 C.F.R. §302.4 Reportable Quantity
SARA 313	Section 313 of Title III of SARA - Toxic Release Inventory Reporting & Community Right-To-Know, 40 C.F.R. §72.65

FOR MORE INFORMATION

For more information, please contact your supplier, one of the BAMM member companies (see <http://www.bamm.net/companies.htm>) or BAMM at e.hunt@comcast.net.