
ACRYLIC ACID

Characteristics

Acrylic acid (CAS No. 79-10-7) is a colourless liquid with an irritating acid odour. Acrylic acid is used primarily as a starting material in the production of acrylic esters, as a monomer for polyacrylic acid and salts and as a co-monomer with acrylamide for polymers used as flocculants, with ethylene for ion-exchange resin polymers, and with methyl ester for polymers. The major industrial sectors contributing to acrylic acid emissions in Canada are the chemical and chemical products sector and the plastic products industries. The National Pollutant Release Inventory reports that there are no major emissions of acrylic acid from industrial facilities in Alberta. The potential for expansion or diversification of the synthetic organic chemical manufacturing and plastics industry poses a potential for major emitters to exist in Alberta.

When acrylic acid is released into the atmosphere, it undergoes both chemical and photochemical reactions. Chemical reactions include rapid polymerization in the presence of oxygen. Acrylic acid will react photochemically with hydroxyl radicals and ozone. Reaction of acrylic acid with ozone produces glyoxylic acid and formic acid as intermediates and hydrogen peroxide and citric acid as end products. The atmospheric lifetime of acrylic acid is less than one month. The detection limit for measurement in ambient air is 0.5 ppb by the US EPA Compendium Method TO-15A.

Effects

No published literature could be found on the direct effects of acrylic acid exposure through the atmosphere to terrestrial plants (WBK & Associates Inc., 2002). The primary route of acrylic acid exposure for the general public and animals would be through inhalation.

Short-term (5-hour) inhalation exposure to 17,700 mg m³ (6,000 ppm) acrylic acid has caused irritation of the eyes and nose, lung hemorrhage, and some systemic damage to the liver and kidneys in rats. Similar systemic effects have not been reported in humans, and are considered unlikely due to acrylic acid's strong irritant properties. No effects of acute toxicity in humans from inhalation are reported. Rats and mice exposed to acrylic acid by inhalation under longer conditions (5 to 13 weeks) have demonstrated eye, nose and skin irritation, degeneration of the nasal epithelium, reduced food consumption, and reduced weight gain at concentrations ranging from 15 to 700 mg m³ (5 to 238 ppm). No similar effects of chronic toxicity in humans are identified. Limited

studies examining the potential carcinogenicity of acrylic acid are inadequate to determine human carcinogenicity. However, the current practice requires strong evidence to conclude that a chemical is not carcinogenic in humans, usually including adequate chronic bioassays in at least two species. Based on the lack of this type of data, it cannot be definitively concluded that acrylic acid causes cancer in humans, although substantial relevant data suggest that it does not.

Objectives in Other Jurisdictions

Air quality objectives set by the agencies reviewed in the assessment report ranged from: 59 to 6,000 $\mu\text{g m}^{-3}$ (20 to 2,040 ppb) for a 1-hour averaging time; 140 $\mu\text{g m}^{-3}$ (48 ppb) for 8-hour; 1 to 141 $\mu\text{g m}^{-3}$ (0.34 to 48 ppb) for a 24-hour average, and 1 to 54 $\mu\text{g m}^{-3}$ (0.34 to 18 ppb) for annual. For acute exposure conditions the Texas Natural Resources Conservation Commission uses a 1-hour objective of 60 $\mu\text{g m}^{-3}$ (20 ppb). This objective is derived from taking the American Conference of Governmental Industrial Hygienists Permissible Exposure Limit of 5,900 $\mu\text{g m}^{-3}$ (2,000 ppb) and dividing it by a safety or adjustment factor of 100 and rounding. Another four agencies adopted 24-hour objectives ranging from 1 to 141 $\mu\text{g m}^{-3}$ (0.34 to 48 ppb). The approaches used by these four agencies in developing their objectives involve using non-carcinogenic risk assessment procedures or taking the American Conference of Governmental Industrial Hygienists Permissible Exposure Limit and dividing it by safety or adjustment factors.

For chronic, long-term exposure conditions the California Environmental Protection Agency, the New Hampshire Department of Environment Service, the New Jersey Department of Environmental Protection and the Wisconsin Department of Natural Resource all are based upon the U.S. Environmental Protection Agency's reference concentration for a non-cancer endpoint of 1 $\mu\text{g m}^{-3}$ (0.34 ppb).

Alberta Ambient Air Quality Objectives

Based upon the available information Alberta hereby adopts:

- *from Texas - an acute, short-term Alberta Ambient Air Quality Objective of 60 $\mu\text{g m}^{-3}$ (20 ppb) for acrylic acid as a 1-hour average concentration, and*
- *from California - a chronic, long-term Alberta Ambient Air Quality Objective of 1 $\mu\text{g m}^{-3}$ (0.34 ppb) for acrylic acid as an annual average concentration.*

Reference

WBK & Associates Inc., 2002: *Assessment Report on Acrylic Acid for Developing an Ambient Air Quality Guideline*. Prepared for Alberta Environment. Edmonton, Alberta, Canada. 56 p.