# BASIC ACRYLIC MONOMER MANUFACTURERS, INC.

## SUBSTANCE REVIEW: ETHYL ACRYLATE

**(Last Updated: 5/7/12)**

**Disclaimer**

| Substance | Acronym | CAS Number |
|---|---|---|
| **Ethyl acrylate** | EA | 140-88-5 |

### Physicochemical Properties

| Property | Results |
|---|---|
| Physical state at 20°C and 1013 hPa | liquid<br>Color: colorless<br>Odor: pungent |
| Melting / freezing point | -71.2 °C |
| Boiling point | 99.8 °C at 1013 hPa |
| Relative density | 0.92 g/cm$^3$ at 20 °C |
| Vapor pressure | 40 hPa at 20.9 °C |
| Surface tension | based on chemical structure, no surface activity is predicted. |
| Water solubility | 20 g/l at 20 °C |
| Partition coefficient n-octanol/water (log value) | log POW= 1.18 at 25 °C |
| Flash point | 9 °C (cc) |
| Flammability | Highly flammable<br>The substance has no pyrophoric properties and does not liberate flammable gases on contact with water. |
| Explosive properties | Non explosive |
| Self-ignition temperature | 372 °C |
| Oxidizing properties | Oxidizing: no |
| Granulometry | N/A |
| Stability in organic solvents and identity of relevant degradation products | N/A |
| Dissociation constant | substance does not contain any ionic structure |
| Viscosity | 0.5351 mPa.s at 25 °C |

## Environmental Fate

In contact with water, EA will hydrolyze slowly. Photodegradation in air will proceed slowly, too. In water, sewage treatment plants and soil rapid degradation is expected, since EA was readily biodegradable in a OECD 310 -Screening test. Based on an experimental log Pow and subsequently calculated BCF, a potential for bioaccumulation is not expected. Adsorption of EA to the solid soil phase is not expected. Fugacity models (Mackay Level I and III) revealed the atmosphere as the main target compartment for distribution which is also indicated by the substance's physicochemical properties.

## Ecotoxicity

When evaluated as a group, the acrylate esters have similar ecotoxicity data. LC50 values in freshwater fish ranged from 1.81 and 5.2 mg/L, EC50 values in freshwater invertebrates (Daphnia magna) were between 1.3 and 8.74 mg/L, and EC50 values in freshwater algae were between 1.71 and 14.6 mg/L, respectively. Thus, effect values were all in the same range of concentrations with Daphnia magna as the most sensitive freshwater species by a narrow margin. A 21-day chronic life-cycle study with Daphnia magna is available with EA with a respective NOEC of 0.19 mg/L, and another with n-butyl acrylate with a NOEC of 0.136 mg/L. In addition, several NOEC values from studies in algal species are available ranging from 0.45 to 3.85 mg/L.

## HUMAN HEALTH EFFECTS

Acute Toxicity
Ethyl acrylate is of moderate toxicity after a single ingestion and of moderate toxicity after a short-term inhalation. EA is of low toxicity after a short-term skin contact.

- Oral: LD50 = 1120 mg/kg bw (rat)
- Dermal: LD50 = 3049 mg/kg bw (rat)
- Inhalation: LC50 = 9 mg/L (rat); LC50 = 12.9 mg/L (rat)

Irritation/Sensitization
Ethyl acrylate is irritating to eyes, respiratory system and skin. After repeated skin contact with EA sensitization is possible.

Repeated Dose Toxicity
After subchronic exposure by vapor inhalation over 3 months the NOAEC for systemic and toxic effects was 100 mg/m³, while the respective LOAEC was 310 mg/m³ based on retardation of body weight gain and lesions of the nasal mucosa.

In a chronic repeated dose study by the inhalation route a NOAEC of 20 mg/m³ was determined in rats for local effects (nasal irritation). The respective NOAEC for systemic effects was 100 mg/m³ based on body weight decrease.

After subchronic exposure by gavage over a test period of 90 days, a NOAEL of 55 mg/kg bw/day was determined in rats based on grosspathological changes of the stomach.

Genetic Toxicity

Ethyl acrylate was negative in bacterial mutation tests. EA seems to have some potential for genotoxicity in mammalian cells, presumably by a clastogenic mechanism. Since this effect is limited to doses with moderate to strong cytotoxicity, it is highly unlikely that this potential will be expressed in vivo. EA was negative in several in vivo mouse micronucleus assays and chromosome aberration tests. Thus, taking the negative test results in vivo for EA into consideration, it can be assumed that EA will not cause any DNA damage, i.e. genotoxicity in vivo.

Developmental/Reproductive Toxicity

The results of subchronic and chronic animal studies gave no indication of a fertility impairing effect caused by EA. In addition, there are data from the structural analogue methyl acrylate. In a two-generation study in which groups of rats were whole-body exposed to methyl acrylate vapors, no effects on reproductive function (i.e. fertility) were observed. The NOAEC for reproductive function was 75 ppm (= ca. 0.268 mg/L). In this study, the no-observed-effect concentration (NOEC) for parental systemic toxicity was based on microscopic changes in the nasal tissues seen at higher concentrations. Secondary to this, parental toxicity pup body weights where decreased, but no further developmental effects were observed.

Overall no indications of a developmental toxic / teratogenic effect were seen in animal studies with EA.

Carcinogenicity

Ethyl acrylate showed no evidence of carcinogenicity in rats or mice following chronic inhalation to atmospheres of 75 and 225 ppm (corresponding to approx. 0.31 and 0.92 mg/L), respectively. Lifetime dermal exposure to mice did not result in a positive tumor response. A chronic drinking water study with rats also did not result in evidence of carcinogenicity. Long-term exposure to EA at high concentrations by gavage administration which induced marked local irritation and cellular proliferation led to forestomach tumors in rats and mice.

Toxicokinetics

Frederick et al. (1992) developed a physiologically based pharmacokinetic (PBPK) and pharmacodynamic model to describe the absorption, distribution and metabolism of orally dosed EA. The model describes the metabolism of EA in 14 tissues based on in vitro metabolic studies including carboxylesterase-catalyzed ester hydrolysis, conjugation with glutathione, and binding to protein and includes as a key component the steady-state rate of glutathione synthesis in each organ because of the role of glutathione depletion in EA kinetics. In vivo validation of the model was conducted by comparing the model predictions to the results of several gavage dosing experiments with EA, including (1) the time course of glutathione depletion in a variety of tissues up to 98 hr following dosing at three dose levels, (2) the rate and extent of radio-labeled carbon dioxide excretion, and (3) protein binding in the forestomach. The very rapid metabolism predicted by the model was consistent with the observation that EA was metabolized too rapidly in vivo to be detected. The validation data indicated that the model provides a reasonable description of the pharmacokinetics and the pharmacodynamic response of specific rat tissues following gavage dosing of EA. A dose surrogate, or measure of delivered dose, for EA was calculated and correlated with the incidence and severity of contact site toxicity (edema, inflammation, ulceration, and hyperplasia). Thus, the model provides a quantitative approach for evaluating potential contact-site toxicity as well as lack of effects in tissues remote from the dosing site as observed experimentally.

Ethyl acrylate is absorbed and metabolized rapidly following oral and inhalation exposure. Metabolism occurs by two primary routes, hydrolysis of the ester linkage to acrylic acid and ethyl alcohol, and conjugation with glutathione (GSH). Both pathways serve to detoxify EA. In rats, hydrolysis, mediated by the carboxylesterases, results in the formation of $CO_2$ as ethanol enters the normal catabolic process and acrylic acid is rapidly incorporated into the normal cellular metabolism via the propionate degradation pathway. Conjugation of EA with GSH can occur spontaneously by a Michael addition or can be mediated by GSH transferase. The conjugated form is rapidly excreted by the kidney (De Bethizy et al., 1987). In addition, oral doses of EA were shown to deplete nonprotein sulfhydryl (NPSH) in the forestomach and glandular stomach in a dose-related manner that was concluded to represent significant detoxification of EA at the site of administration.

## Disclaimer

This document is not intended to be comprehensive. It is provided solely as background information and should not substitute for an up-to-date Safety Data Sheet or research should specific regulatory or other legal questions arise. It is not intended to be a statement of legal requirements when using or handling acrylates. Although the information is believed to be accurate as of the last update, new information may become available and regulations frequently change, and no warranty, expressed or implied, is made concerning the contents. In addition, many states and localities adopt their own regulations, which are not covered by this summary or on the BAMM website. In all events, the user should consult applicable laws and regulations, as well as their supplier's Safety Data Sheet, for current information and requirements. **NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN.**