

Methyl Methacrylate Market Expansion: Exploring New Applications

Overview

Methyl methacrylate (MMA) is an organic compound with the formula $C_5H_8O_2$. It is a colorless, volatile liquid that is slightly soluble in water but very soluble in most organic solvents. MMA's main uses are in the production of poly(methyl methacrylate) (PMMA), which is better known by trade names like Plexiglas or Acrylic glass, and as a chemical intermediate in the production of other substances and industrial chemicals.

Production and synthesis

Commercially, MMA is produced via the hydrolysis of methacrylic anhydride which itself is produced from acetone cyanohydrin or via the acid-catalyzed esterification of methacrylic acid with methanol. In laboratory settings, it can also be prepared by the condensation of acetone with malonic acid followed by decarboxylation. Globally, over 3 million tons of MMA are produced annually. It is one of the 150 most commonly produced chemicals and a valuable petrochemical product. The key manufacturers are located in Asia, North America and Western Europe.

Uses and applications of PMMA

Polymerization of MMA yields poly(methyl methacrylate) or PMMA, which is a transparent thermoplastic often used as a lightweight or shatter-resistant alternative to glass in applications such as aircraft canopies or windows and aquariums. It is easily worked, molded or thermoformed due to its low melting point. Some common uses of PMMA include:

- Signage and displays: Thin PMMA sheets are often used as an alternative to acrylic glass in illuminated signage due to its light weight and shatter resistance. It is also used as the glazing material on bus/taxi stop shelters.
- Construction: PMMA finds use in architectural applications like skylight domes, greenhouse glazing and translucent wall panels. It can also be used to produce bathtubs or sanitary fittings needing high durability and an aesthetically pleasing finish.
- Medical and dental: Clear and impact-resistant PMMA sheets are commonly used as the material for orthodontic appliances and in medical devices like inhalers or eyeglass frames. It is also employed as an insulator in bone cements used for joint replacements.
- Electronics: Various consumer electronic devices, especially mobile phones and PDAs, employ PMMA for touchscreens and display lenses owing to its durability and optical clarity.

Intermediate in chemical syntheses

Beyond PMMA, MMA also serves as a key chemical intermediate in production of a variety of other industrially significant chemicals and materials. Some examples include:

- MMA-based copolymers: MMA can copolymerize with other monomers like styrene, butyl acrylate or ethylene to produce impact-resistant alloys with PMMA or acrylic-based specialty polymers.
- Dispersants and plasticizers: Reaction of MMA with amines gives long-chain methacrylate esters acting as dispersants for pigments and plasticizers for PVC or other polymers.
- Adhesives: MMA combined with other reactive monomers forms the basis for many cyanoacrylate-

