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Acrylic Acid

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Abstract

Acrylic acid is a major building block in the production of many industrial and consumer products. The global market for acrylic acid was approximately 5 million metric tons in 2013, worth $8 billion, with growth forecast at 4.2% annually during 2013–18. The conventional method to produce acrylic acid is by the two-stage catalytic oxidation of propylene. Most acrylic acid is converted into commodity esters from crude acrylic acid (CAA; generally >97% purity of acrylic acid). The most commonly used processes are based on Nippon Shokubai, BASF, BP (Sohio), and Mitsubishi catalysts or technologies.

Our prior PEP Report on acrylic acid production by the two-stage catalytic oxidation of propylene was published in 2003, and covered BASF's and Nippon Shokubai's conventional acrylic acid and ester production processes. In recent years, there has been significant research on reducing the cost of acrylic acid production. Mitsubishi Chemical has recently announced development of a new waved-plate reactor for performing oxidation reactions such as propylene oxidation to acrylic acid. The company claimed significantly reduced investment and variable costs. Nippon Shokubai has continued to improve its conventional acrylic acid process by developing a single oxidation reactor capable of replacing the tandem oxidation reactors and improving the acrylic acid recovery process. In 2004, Lurgi started licensing an acrylic acid process using Nippon Kayaku's catalysts. In 2004, LG Chem announced it had developed a new advanced acrylic acid process.

The focus of the report is conventional acrylic acid production processes using propylene as a feedstock. Propylene-based acrylic acid production processes by BASF, Nippon Shokubai, LG Chem, Mitsubishi Chemical, and Lurgi/Nippon Kayaku will be presented. In addition, acrylic acid from other feedstocks including propane, formaldehyde with acetic acid, ethylene oxide with carbon monoxide, and renewable raw materials will be discussed. Production economics of three propylene-based processes—Nippon Shokubai, Mitsubishi Chemical, and Lurgi/Nippon Kayaku—will be presented.

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