COLIN A. HOUSTON & ASSOCIATES
20 Milltown Road, Suite 206
Brewster, NY 10509
Fax: 845-279-7751
E-mail: CAHA1@colinhouston.com

Contact:
Marilyn L Bradshaw
845-279-7891

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Consumption of alpha-olefins used as comonomers in the production of polyolefins will grow from around 830,000 tons in 1995 to nearly 2 million tons in 2005, according to Colin A. Houston & Associates, Inc. (CAHA), a consulting firm in Pound Ridge, New York. CAHA has just published a multiclient study entitled *Polyolefin Comonomers - World Markets, 1995 - 2005* which quantifies and forecasts the use of butene-1, hexene-1, octene-1 and other alpha-olefin comonomers in the production of polyethylene copolymers and polypropylene multipolymers.

The study found that polymers based on hexene-1 and octene-1 are growing more than twice as fast as butene-1 based HDPE and LLDPE. While consumption of butene-1 will grow 5.2 percent/year to 2005, hexene-1 will grow 10 to 11 percent/year, and octene-1 consumption could grow at an average rate of 13 to 14 percent/year. At these rates, hexene-1 will account for 35 percent of total comonomer use in 2005 and octene-1 almost 30 percent. Octene-1 consumption is currently constrained by inadequate supplies, and even with expected new production, the potential demand could exceed supply through 2005.

MORE MORE MORE MORE MORE

Dow is the largest user of octene-1 comonomers, and the tight market is due primarily to the success of its octene-based conventional and enhanced LLDPE, metallocene-catalyzed LLDPE and plastomers, and the elastomers marketed by Dupont-Dow Elastomers. Other octene-1 users include Huntsman and Nova in North America; Idemitsu, Mitsui and Asahi in Japan; and Hyundai and SK Corp in Korea.

There are over 250 plants producing HDPE, LLDPE, VLDPE, plastomers, or elastomers around the world, and except for a few that produces only HDPE homopolymers, all of them use alpha-olefin comonomers. The location, type, process, capacity and comonomer type used are detailed for each plant in CAHA's new study. "In order to understand the polyolefin production trends affecting comonomer use, we analyzed the comonomer market from the standpoint of the customers in each region. Their expansion plans, adoption of new process and catalyst technology, and the markets they serve are key factors in estimating comonomer consumption and growth," says Marilyn Bradshaw, project leader for the study.

Polyolefin elastomers, such as DuPont-Dow's Engage^{R} products, which incorporate high levels of octene-1 comonomers, are the fastest-growing end use for alpha-olefin comonomers. Comonomer consumption in polyolefin elastomers has been doubling annually, but CAHA expects growth to moderate to an average annual rate of 20 percent after 2000. By 2005, over 150,000 tons of comonomer will be used to produce an estimated 625,000 tons of elastomers.

"Metallocene technology is having a tremendous impact on the use of alpha-olefin comonomers," says Ms. Bradshaw. "In addition to the specialty products such as polyolefin elastomers and plastomers, the metallocene grades of LLDPE represent a significant growth area for comonomers." Metallocene LLDPE incorporates comonomers at a 10 percent level versus an 8 percent level for conventional LLDPE. "For every pound of metallocene LLDPE that replaces conventional LLDPE, alpha-olefin consumption increases by 25 percent," says Ms. Bradshaw.

The study reports that in 1995, metallocene polyolefins accounted for only about 2.2 percent of total comonomer consumption. By 2000, they will consume nearly 12 percent of the total comonomer volume, and by 2005 they will represent 22 percent.

Alpha-olefin producers are taking advantage of the strong comonomer growth by adding new alpha-olefin capacity. Chevron is building a 340,000 ton/year plant in Cedar Bayou, Texas that is due on stream in mid-2000. BP Amoco is building a 250,000 ton/year plant in Alberta, Canada due on stream in mid-2001. Shell is planning to build a 318,000 ton/year plant in Geismar, Louisiana by mid-2001. These three producers use ethylene oligomerization processes which produce a range of chain lengths. The primary markets for the C_{10} and higher fractions are synthetic lubricants, surfactant intermediates, plasticizer alcohols, petroleum additives and oilfield drilling fluids.

Sasol in South Africa is also planning new capacity based on its proprietary coal-derived synthesis gas technology. Sasol plans to increase maximum

hexene-1 capacity from 140,000 tons/year to 210,000 tons/year by mid-2000. Sasol uses one of its two current units to produce small amounts of pentene-1, which slightly reduces the capacity available for hexene-1 production.

Another new player entering the hexene-1 market is Phillips. A 50,000 ton/year plant will be built by Q-Chem, Phillips' joint venture in Qatar, using Phillips' proprietary hexene-1 technology. The onstream date of the Q-Chem complex, which also includes ethylene and swing polyethylene plants, has been pushed back to 2003. Phillips also intends to build a 100,000 ton/year hexene-1 plant in Texas sometime after 2002. CAHA's study concludes that all of the new hexene-1 capacity, including the Phillips and Sasol plants, will be needed to meet demand through 2005.

Fewer production options exist for octene-1. The six producers using oligomerization processes must produce more of the entire range of chain lengths in order to get more octene-1, and thus their octene-1 output is limited. The only other octene-1 production technology in commercial use is that of Sasol, who is able to selectively separate octene-1 from its syngas feedstream. Sasol brought on stream a 50,000 ton/year octene-1 facility earlier this year and plans to add a second unit of similar size in 2001. Further details of CAHA's study are available on CAHA's website at www.colin-houston.com or from Colin A. Houston & Associates, Inc., 20 Milltown Road, Suite 206, Brewster, NY 10509; Phone: 845-279-7891; Fax: 845-279-7751