Butadiene/Butylenes (92-1)

This comprehensive report details the current commercial processes for the production of various C-4 olefins and butadiene. In each case a cost of production is presented. There are also process descriptions and economics for newer technologies such as n-butylene isomerization to isobutylene. The commercial section covers supply/demand, producers and uses in the U.S., Western Europe, Japan, and East Asia.

The major sources of unsaturated C_4s in Europe and Japan are C_4 by-product streams from ethylene stream crackers and, to a lesser extent, refinery cat cracking operations. In the United States, where much of the ethylene capacity is based on lighter gas feedstocks that produce less by-product C_4 olefins, a larger percentage of the supply comes from refinery sources. The principal components of steam cracker C_4 streams are, in order of concentration, 1,3-butadiene, isobutylene, butene-1, butene-2 (*cis* and *trans* isomers). Minor components include *n*-butane and isobutane and small amounts of C_3 and C_5 hydrocarbons.

Isobutane dehydrogenation processes are becoming increasingly important in the synthesis of MTBE from field butanes. Several technologies are commercial (or close to being commercialized). Companies licensing dehydrogenation technology are UOP (Oleflex), Lummus (Catofin), Phillips (STAR), and Snamprogetti/Yarsintez (FDB).

Three processes are available for the separation of high purity butene-1 from either a raffinate-2 stream (after MTBE synthesis) or a fluid catalytic cracker C_4 stream. All three processes are preceded by a selective hydrogenation step in order to meet the tight specifications on butadiene and acetylene (100 and 10 ppm, respectively). The processes are: straight fractionation, extractive distillation, and molecular sieve absorption.

A BP/Mobil joint venture (ISOFIN), IFP (ISO-4), UOP (Butesom), Texas Olefins Company (SKIP) in conjunction with Phillips, Lyondell, and Snamprogetti have all announced new processes for skeletal isomerization of linear (normal) olefins to iso (branched) olefins. These skeletal isomerization technologies are discussed in the body of the report. Double bond isomerization such as employed in the Phillips Hydrisom process is also discussed.

The global demand for butadiene was 7.1 million metric tons in 1992 and is forecast to grow to about 8.8 million metric tons by 2000, representing a compound annual growth

rate of 2.7 percent. The demand is driven by styrene-butadiene in rubber and latex form, accounting for nearly 50 percent of demand. Polybutadiene and other rubbers account for most of the remainder. Smaller amounts of butadiene are used to make ABS and hexamethylene diamine.

The amount of mixed butylenes produced in U.S. refineries depends on refined product demand and refinery operations. Butylene production from cat crackers is expected to increase over the next few years. Total butylene production from steam crackers will increase with significantly higher production from heavy feedstocks and higher overall demand.