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Report 289

New Routes to Styrene and para-Xylene

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# Abstract

This report reviews new potentially commercial processes for styrene and para-xylene based on toluene and methanol feedstock.

Several technology developments/advances have been announced in the press in the last few years. One of them is in the field of styrene production by the Exelus process. The traditional technology for styrene relies on a two-step process, starting with benzene and ethylene. Both of these hydrocarbon feedstocks are often derived from petroleum refining. In addition to replacing the ethylene and benzene raw materials with toluene and methanol, the Exelus process—commercially called ExSyM (Exelus styrene monomer technology)—is reportedly based on an improved catalyst technology that avoids the need for a separate dehydrogenation step, resulting in a single-step process with high yields and high conversions. The process reportedly operates at significantly lower temperatures than the conventional route, making the overall process more energy efficient. Although this technology has been demonstrated only at the bench-scale level, if the claims of high selectivity are demonstrated in pilot tests, the costs of production and feedstock savings could be improved significantly over conventional styrene monomer processes.

Another technology advancement took place in the field of para-xylene production. SABIC and Lummus Technology announced plans in 2010 plans to jointly develop a new route to para-xylene (PX) that involves methylation of toluene with methanol. Previous catalysts reported in the literature for this conversion tended to deactivate quickly. The SABIC phosphorous-modified zeolites appear to significantly extend the life of such catalysts. Lummus has indicated that this type of process may provide a unique debottlenecking option for an aromatics complex. Typically, toluene is disproportionated to both xylenes and benzene. The SABIC/Lummus approach would allow toluene conversion to just xylenes.

Sinopec Yangzi Petrochemical (China) has independently developed and constructed the country's first toluene methanol alkylation plant with the capacity to produce 200 kta of para-xylene. Its successful start-up was in December 2012.

This report will present technology design and economic analysis of some of the new developing technologies based upon their latest R&D status with economic comparison to their conventional routes.

 

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