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Review 2014-13

On Purpose Octene-1 by Dow's
Butadiene Telomerization Process

By Mike Kelly

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Abstract

Most commercial linear alpha-olefin (LAO) plants produce a broad range of even-numbered alpha-olefins based on ethylene oligomerization technologies. Although initially targeted for plasticizer and detergent end-uses, LAO processes have become an important source of production for butene-1, hexene-1, and octene-1; comonomers all used in the production of polyethylene to enhance certain physical properties. As the polyethylene industry has evolved, demand for comonomers has increased, and the growth has led to a supply/demand imbalance in the distribution of LAOs which serve a broad range of end-use applications. This, in turn, has created opportunities for alternative comonomer production routes through on-purpose technologies, such as ethylene tetramerization, ethylene dimerization, and ethylene trimerization.

Another variation of on-purpose alpha-olefin technology can be found at the Dow Chemical plant in Tarragona, Spain. Dow established itself in Tarragona in the 1960s with low density polyethylene manufacturing. As demand for ethylene feedstock grew over the years, Dow began planning to build an ethylene unit at Tarragona, but ultimately cancelled those plans after acquiring one of the two ethylene crackers at the ENPETROL (now Repsol) refinery located in Northern Tarragona. The ethylene acquisition, which took place in the early 1980s, created a feedstock production hub for Dow just to the north of their original Tarragona facility. The ethylene capacity at the site expanded over the years, and in 2007, Dow commissioned a plant to produce octene-1 using butadiene telomerization technology, adjacent to the ethylene unit.

This review presents a techno-economic evaluation of the Dow butadiene telomerization technology to produce octene-1. In the process, butadiene contained in a crude C₄ stream is first reacted with methanol in the presence of a homogeneous organometallic catalyst to form 1-methoxy-2,7-octadiene (MOD-1). The MOD-1 is hydrogenated to 1-methoxyoctane (MOAN-1) in the second step, with the MOAN-1 ether cleaved in the final step to yield octene-1 and methanol.

The analysis and design results that follow are based on a plant with an annual capacity to produce 220 million pounds (100 thousand metric tons) of octene-1. While the capital and production cost results herein are presented on a US Gulf Coast basis, the accompanying iPEP Navigator Excel-based data module (available with the electronic version of this review) allows for viewing results for other major regions along with conversion between English and metric units.

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