**Abstract**

**Process Economics Program Report 211A**

**HYDROCRACKING FOR MIDDLE DISTILLATES**

**(July 2003)**

Middle distillate is the collective petroleum distillation fractions boiling above naphtha (about 300°F, 149°C) and below residue oil (700°F+, 371°C+). Middle distillate products are marketed as kerosene, jet fuel, diesel fuel and fuel oils. Worldwide growth in demand for these products to 2012 is forecast to be the largest and the fastest of the petroleum products. Hydrocracking is a petroleum refining process where cracking occurs simultaneously with hydrogenation of the products. Hydrocracking for middle distillates is growing worldwide into a process critical to petroleum refinery profitability. The combination of desulfurized, denitrogenated lighter products of lower overall aromaticity makes hydrocracking an ideal process for producing diesel, jet and gas turbine fuels meeting the more stringent fuel specifications effective starting in 2005.

Currently the most common on road diesel fuel sulfur specification is 500 ppm (350 ppm in Europe) with higher limits in some countries. The European Commission adopted a 10 ppm sulfur specification for on road diesel fuel beginning in 2005 with full conversion by 2010. An U.S. EPA rule phases in 15 ppm sulfur highway diesel fuel starting June 1, 2006. In Japan, 10 ppm sulfur fuel in 2008 is proposed. Countries in other regions of the world are also working to reduce the sulfur in diesel fuel. The U.S. EPA recently proposed sulfur in off road diesel fuel be limited to 15 ppm in 2010. Although the proposal does not cover heating oil or jet fuel, a significant amount of these fuels may be desulfurized anyway due to refining and pipeline limitations and economics.

In order to meet the on road diesel fuel specifications, the capital investment needed by the refining industry is anticipated to be substantial (estimates range from $3 to 13 billion for the U.S. industry).

This report reviews the chemistry, technology and economics of producing middle distillates such as jet fuel and diesel fuel meeting the new near zero sulfur (NZS) specifications slated for 2005 and beyond. A number of improved hydrocracking processes and catalysts are commercially available. Revamping of existing hydrocrackers and the conversion of hydrotreaters to mild (low pressure) hydrocrackers is also reviewed. We evaluate the economics of a generic vacuum gas oil hydrocracker that produces jet fuel and NZS diesel fuel.

This report should provide a useful overview of hydrocracking and of middle distillate products and their properties with in-depth review of process developments and economics within the industry. People involved in the energy industry, professionals who research, develop, plan, operate, design plants or manage investments in the petroleum refining industry as well as those in allied industries could benefit from the information contained in this report.

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