



OIL
REFINING

Isomerization

Axens
SOLUTIONS

High octane C₅/C₆ cuts via isomerization processes

C₅/C₆ isomerization is a must-have for refiners who want to maximize the profitability of their gasoline pool. This process can be adapted to various configurations and allows improving C₅/C₆ naphtha cut octane numbers up to 92 without constraints on olefins and sulfur.

Axens is licensing a complete set of isomerization configurations in order to support refiners to resolve the evolving gasoline pool equation.

COMMERCIAL EXPERIENCE

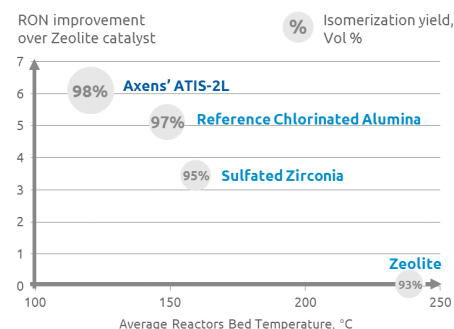
With a powerful R&D support at both lab and pilot scales, Axens has achieved a significant market penetration through the implementation of innovative process schemes combined with state-of-the-art chlorinated alumina catalysts.

More than 85 isomerization units have been licensed by Axens, and since the marketing of ATIS-2L catalyst in 2003, more than 60 new units have been designed.

Axens' ATIS-2L chlorinated alumina catalyst leads the pack

Chlorinated alumina is a catalyst of choice thanks to its high activity permitting operation at lower reactor temperatures that enable higher product RON and favor superior yields (figure 1). The use of molecular sieve adsorbents on the feed and hydrogen make-up streams ensures the removal of feed contaminants and long catalyst lifetimes.

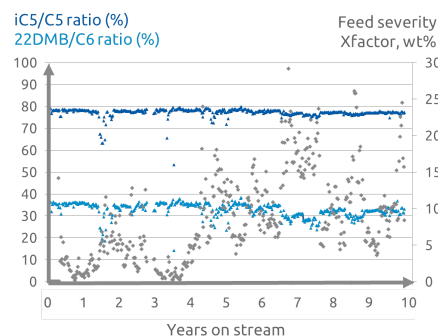
Axens isomerization technologies use ATIS-2L catalyst which provides an unsurpassed combination of high activity, low cost and low platinum content.



↑ Figure 1: Different catalyst type performances

{ CASE STUDY }

Based on more than 10 years of industrial experience, ATIS-2L has demonstrated a high degree of reliability, stability, and flexibility versus the feedstocks processed in the isomerization units.



↑ Figure 2: ATIS-2L response to feed severity variation over 10 years operation (Reactors effluent - Once-Through Scheme)

Axens' commitment to research & development

Although isomerization is a mature technology, Axens continues to invest in R&D to improve the designs and catalysts and aim at lower investment, operating costs and emissions.

One recent innovation is a plug & play system that allows to drastically reduce chemicals consumption combined with octane-barrel improvement.

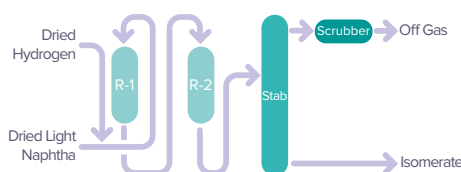
Tailor made technology selection

Axens isomerization technologies are ready to meet refineries' octane objectives. Relative differences between the isomerization schemes with regard to investment cost, operating cost and product revenue, are shown in the figure 3 (based on ATIS-2L catalyst). Axens isomerization technologies are also well suited for stepwise installation of octane improvement projects.

➤ Once-through C_5/C_6 isomerization

This least-cost path to moderate octane gain can provide, in some cases, a sufficient boost to the gasoline pool octane. Typically, the octane for a feed having a C_5 to C_6 ratio of 40:60 will have an increase in RON from 70 to 83-84 after isomerization.

The scheme (figure 4) is based on a permutable reactors design; that is, either reactor can be used in the lead or lag position or it can be operated independently during catalyst servicing. This insures a ultra-high on-stream service.



↑ Figure 4: Once-through isomerization with permutable reactors

➤ Octane enhancement with deisopentimizer (DIP) or/and deisohexanizer (DIH) or/and depentanizer (DP)

The maximum octane number available from a once-through system is limited by the thermodynamic equilibrium of the C_5/C_6 mixture (figure 4). Distillation is one way

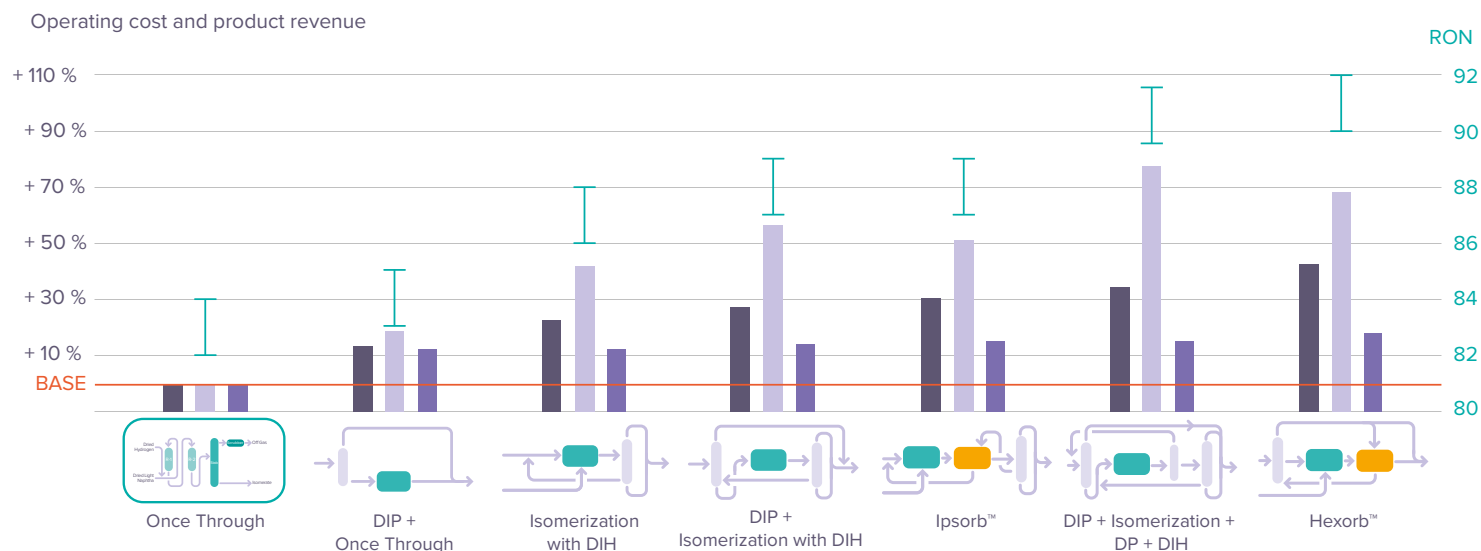
to achieve octane improvement by either allowing isomers to bypass the reactors (DIP) or by recycling normal paraffins to the reactors (DIH, or combination of DIP, DP and DIH)(figure3). However, these approaches still leave normal paraffins in the product.

➤ Advanced recycle: IPSORB™ / HEXORB™

Ipsorb™ and Hexorb™ processes are an alternate path available to convert all normal paraffins to their iso-paraffins. A vapor phase molecular sieve section is used to adsorb normal paraffins (figure 3) for recycling to the reactors.

BENEFITS

- Chlorinated alumina catalyst is today's catalyst choice
- Axens' ATIS-2L leads the pack
- Highest isomerization yields
- Continuous innovation in technology
- Best answer for maximizing the octane-barrel performance
- Tailor made technology selection



↑ Figure 3: Economics for each isomerization processing scheme using ATIS-2L chlorinated alumina catalyst

GRAPH
 ● ISBL Investment Cost
 ● Operating Cost
 ● Product revenue

SCHEMES
 ● Once Through
 ● Molecular Sieves



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Axens is a group providing a complete range of solutions for the conversion of oil and biomass to cleaner fuels, the production and purification of major petrochemical intermediates as well as all of natural gas treatment and conversion options. The integrated offer includes technologies, equipment, furnaces, modular units, catalysts, adsorbents and related services, commercialized under "Axens Solutions", "Heurtey Petrochem Solutions" and "Axens Horizon" brands.

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