Introduction

Globally, crudes are becoming heavier yielding higher amount of residues enriched with contaminants. On the other hand, the demand of heavy distillate (fuel oil) is decreasing. Therefore, the foremost challenge to the refiners is to upgrade the residual streams to lighter valuable products for sustaining the refinery margin.

It is forecasted that propylene market share will grow even faster than ethylene market. In view of the recent trend of significant capacity build up of gas based thermal crackers, need for propylene production from alternative sources is likely to gain momentum.

Considering the above, IndianOil R&D has developed a novel technology, INDMAX, to produce high yield of light olefins and high octane gasoline from various petroleum fractions. The technology has been demonstrated by setting up a unit of 100,000 MTPA capacity at Guwahati Refinery of IndianOil in 2003. Since then, the unit is being operated in different modes with heavy feed CCR up to 4 wt% depending on the market demand and contributing significantly to profitability of the refinery.

The technology is being globally licensed by M/s Lummus Technology Inc., USA (a CB&I Company). INDMAX unit is designed by Lummus employing proprietary efficient hardware components with basic process design from IndianOil.

Process description

INDMAX employs circulating fluidized bed Riser-Reactor-Stripper configuration similar to conventional FCC technology along with single stage full combustion Regenerator system.

The catalyst system and operating conditions employed in INDMAX process are tailor-made and different from the conventional FCC technology. The specially designed catalyst of the INDMAX process consists of various synergistic components for upgradation of heavy molecules maximising conversion with higher light olefins selectivity.

Salient Features

- Employs high riser outlet temp (ROT) of more than 540°C and high catalyst to oil ratio (C/O) of more than 12.
- Employs proprietary catalyst system with low coke and dry gas make, higher metal tolerance and selectivity towards light olefins.
- Excellent heat integration - Single stage full burn Regenerator; use of catalyst cooler for feed with higher CCR (>6 wt%).
- Highly efficient hardware components
  - MicroJet™ Feed injector
  - Proprietary SCT riser reactor design
  - High efficiency Modular Grid stripper design
  - Direct-coupled cyclone separator
  - Efficient catalyst regeneration system (multi zone pipe grid distributor with MSO nozzle)
  - Advanced catalyst cooler design
- Typical product yields, wt% of feed

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<tbody>
<tr>
<td>LPG</td>
<td>30 - 55</td>
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<tr>
<td>Gasoline</td>
<td>20 - 40</td>
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<td>Propylene</td>
<td>12 – 27</td>
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<td>Butylenes</td>
<td>10 – 20</td>
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<td>Ethylene</td>
<td>3 – 14</td>
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- Operability at wide range of severities with a given hardware to maximize either light olefins or high octane gasoline depending on refiner’s objective.
- Lower catalyst consumption owing to lower regenerator temperature with a given feedstock and excellent metal tolerance of catalyst.

Advantages

- Highly attractive yields of light olefins (ethylene, propylene and butylenes), Toluene and Xylene for integration with Petrochemical complexes.
- Higher octane of gasoline (RON > 96).
- Capability to handle wide range of feed stocks, starting from hydrotreated VGO to residue of 10 wt% CCR.

Backup strength

- INDMAX technology has been successfully demonstrated in 100,000 TPA capacity plant at Guwahati Refinery of IndianOil. The unit is currently being revamped to 150% capacity.
- 4.17 MMTPA INDMAX unit is under implementation at Paradip Refinery of IndianOil and is expected to be commissioned by 2014.
- Proven experience in design and technical services on revamp, troubleshooting, optimization, etc. of process units employing circulating fluidized bed systems.
- Wide operating experience of FCC units / INDMAX unit.
- Micro-reactor and Pilot plant facilities for accurate product yield estimate.
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