Refining Technology

Concerted efforts from fundamentals to commercialization including setting up of laboratory facilities, pilot plants, modeling & simulation have resulted into development of globally competitive refining technologies. Expertise has been developed for scale-up and process designs which have resulted in trouble-free commercialization of technologies in IndianOil refineries.

INDIANOIL's REFINING TECHNOLOGY BASKET:

- Indmax
- DHDT Food/ Polymer Grade Hexane
- Needle Coke
- INDAdept ATF HDT
- Sweetening Green NMP Extraction
- Delayed Coking Dist-Extra
- Zeosom Indalin Octamax Indalin Plus
- Catalyst

Catalytic Cracking, Thermal Cracking, Isomerization & Reforming:

Some of the hallmark technologies developed & commercialized by IndianOil R&D are -

- INDMAX: Involves conversion of residue to light olefins, high octane gasoline & LPG. A 100,000 TPA unit is operational at Guwahati Refinery since 2003. A 4.17 MMTPA unit is under installation at the upcoming Paradip Refinery. A 0.74 MMTPA unit at an IndianOil Refinery is at approval stage.
- INDALIN: Involves conversion of low value naphtha range streams to light olefins, LPG & gasoline rich in aromatics. The feasibility of establishing a demonstration unit at Barauni Refinery is being reviewed.
- INDALIN-Plus: Involves conversion of low value naphtha range streams to auto-grade LPG & high octane gasoline.
- Dist-Extra: Involves catalytic cracking of heavy feed for maximising middle distillate yield with improved quality.
- Needle Coke: Involves production of premium quality Needle Coke for manufacturing Graphite electrodes for steel industry. This technology has been proven and demonstrated at Guwahati and Bongaigaon Refineries.
- Delayed Coking: Involves conversion of long/short residue into distillate with minimisation of coke yield.
- Zeosom: Involves isomerisation of light naphtha to gasoline blending stock using Zeolite based catalyst with higher tolerance to feed impurities. The existing Xylene Isomerisation unit (154,000 TPA) at Bongaigaon Refinery has been revamped for light naphtha isomerisation, and is operational since September 2011.
- Octamax: Involves conversion of cracked C4 streams to high octane gasoline blending stock for production of Euro-IV / V equivalent gasoline. The feasibility of establishing a demonstration demo unit at Guwahati Refinery is being examined.

Hydroprocessing and Product Treatment

- Food Grade Hexane (FGH) / Polymer Grade Hexane (PGH): The technology has been demonstrated successfully at Gujarat Refinery in 2001 (unit capacity 28,000 TPA).

Another grassroots unit of 20,000 TPA capacity has been commissioned at HMEL Refinery, Bhatinda in 2012.

- Diesel Hydrotreating Technology (DHDT): It is a process technology for producing Euro-IV (sulphur: <50 ppm, cetane number: >51) and Euro-V diesel (sulphur: <10 ppm, cetane number: >51). A 1.2 MMTPA DHDT unit was commissioned at Bongaigaon Refinery in the year 2011.
- ATF Hydrotreatment: It involves selective Mercaptan removal for ATF production using the hydroprocessing route.
- INDAdept-G & D: It is an adsorbent based technology for deep desulphurization of gasoline and diesel. A 35,000 TPA unit for gasoline desulphurization at Guwahati Refinery has been approved, which is expected to be commissioned by the year 2015.

Distillation, Extraction & Deasphalting

- Deep Cut Distillation Technology: This technology has been deployed at Mathura Refinery. It helps in better utilization of bottom of the barrel to increase the profit margin of the Refinery for enhanced recovery of value-added fraction.
- INCOFEX Process: A co-solvent process to improve the raffinate yield of furfural extraction process.
- Green NMP Extraction: An improved energy-efficient, effluent-free NMP extraction process with versatility to handle all the grades of LOBS.
- Dual Mode Deasphalting: Dual mode de-asphalting process, which can produce feedstocks for both LOBS and secondary conversion processes.

Technical Services Offered

IndianOil has developed in-depth process insight & profound knowledge base and expertise for offering value-added technical services. Today, it is at the fulcrum of offering superior technical services to all its refineries.

Fluid Catalytic Cracking (FCC / RFCC / INDMAX)

- De-bottlenecking & revamp
- Process design of Reactor-Regenerator section including internals
- Performance scanning & improvement
- Troubleshooting including review of performance of internals
- Unit optimization through change of process parameters & catalyst
- Light olefins maximization
- Evaluation / selection of catalyst / additive
- Health monitoring of equilibrium catalyst

Catalytic Reforming (CRU / CCRU)

- Catalyst health monitoring
- Selection of fresh catalyst & remaining life assessment using proprietary method

Delayed Coking

- De-bottlenecking & revamp
- Troubleshooting & optimization

Visbreaking

- FO reduction through optimisation of unit conversion without affecting stability
- Yield optimization by integration with other secondary conversion processes

Hydroprocessing

- Troubleshooting & Optimization
- Remaining life assessment of catalyst system
- Performance prediction with change in feed mix
- Revamp study
- Catalyst system selection

Distillation, Extraction & Deasphalting

- Detailed crude evaluation / assay
- Fingerprinting of crude oil including heavy / opportunity crudes
- Solution to transportation of high pour crudes
- Mitigant based solution for processing high acidic crudes
- Optimization of distillation columns
- Troubleshooting NMP extraction process to contain solvent & oil loss
- Troubleshooting solvent de-waxing process to increase melting point of paraffin wax, etc.

General

- Refinery configuration study
- Profitability improvement study
- Providing training in the areas of FCC / RFCC / INDMAX, Delayed Coking, Visbreaking, Reforming, Isomerization, Hydro-processing, Solvent processes, etc.

Catalysts

FCC/RFCC Catalysts

FCC catalysts used today in the refining industry are the most sophisticated and manufactured with high active crystalline material with selectivity for gasoline range products. IndianOil has developed a process for the manufacture of FCC catalyst, named Lotus-24, which exhibits superior performance.

FCC Catalyst Additives

Over the years, IndianOil has developed a series of FCC Additive formulations such as i-MAX Premium, i-MAX Supreme and i-MAX Ultra, having superior performance characteristics, which can be chosen depending on refinery-specific operational requirements.

For upgrading bottom of the barrel, IndianOil R&D has developed a novel metal passivation additive named ‘IndVi’ which is capable for handling heavier hydrocarbon feedstocks (high CCR, Ni &V) in RFCC unit. The latest product for up-gradation of bottoms in FCC/RFCC process named ‘RUA’ (Residue Up-gradation Additive) is currently under plant trials.

DHDS / DHDT Catalysts

Hydrotreating technologies employ robust high-performance catalysts, which can produce ultra low-sulphur diesel (ULSD) meeting the required cetane and other quality criteria. IndianOil R&D's Diesel Hydrodesulfurisation / Hydrotreating Catalyst, INDICAT-DH-IV, is suitable for production of diesel with sulphur content of 10-50 ppm. The catalyst has seen nearly three years of commercial operation at CPCL's Manali Refinery enabling production of BS-IV compliant diesel fuel.

Modeling & Simulation:

Over the years, IndianOil-R&D has successfully developed comprehensive kinetic models for different secondary processing units. Built on structure oriented lumping approach, these models can capture the underlying reaction mechanism of a process. The process models have widespread application which is reflected in their excellent prediction capability in troubleshooting, optimization and revamp studies, evaluation and remaining life assessment of catalyst.

Pipeline Research:

IndianOil R&D, in association with Bhabha Atomic Research Centre, Mumbai, has developed 12", 14", 18" and 24" sizes of Instrumented PIG (IPIG) and Caliper PIG (CPIG). As part of demonstration of the capabilities of these indigenously developed tools, about 1500 Km of various sections of IndianOil's pipeline network has been inspected so far using these tools.

Pilot wet test loops of 12" & 24" diameter and about 500m length, each simulating pipeline conditions, are available for evaluation of IPIG / CPIG tools. A Linear pull through rig (LPTR) facility, capable of dry evaluation of IPIG / CPIG is also available for quick evaluation of the indigenous tools under simulated velocities.

Rheological Studies:

Studies on pumpability of waxy crude through a given pipeline configuration are undertaken for optimization of the blend ratio. Viscometry of the blend, estimated wax appearance temperature and the details of pipeline terrain along with operating conditions are used as inputs for a customised model to predict and compare the pressure drop and flow rates.

Advanced Materials & Metallurgy Research:

One of the important areas that differentiate the best from the rest is the asset reliability management. Equipped with the state-of-the-art facilities such as Servo-hydraulic universal testing machine, Accelerated stress rupture testing system, Automated instrumented impact tester, Scanning electron microscope with X-ray analysis and some of the advanced non-destructive evaluation facilities, IndianOil R&D provides advanced techno-economic solutions to the refineries for:

- Fitness for service assessment as per API - 579 guidelines
- Remaining life assessment of high temperature components with creep / carburization as the damage mechanism
- Metallurgical health assessment of critical high temperature facilities during shutdown
- Non-destructive testing and evaluation through advanced ultrasonic techniques such as Time Of Flight Diffraction (TOFD) and Phased array ultrasonics
- Gamma scanning of process columns for trouble shooting and optimisation of process parameters
- Evaluation of filming type corrosion inhibitors for their performance efficacy using pilot plants