



# PETROCHEMICALS

Growth We **PROPEL**





## About IndianOil

Indian Oil Corporation Ltd. (IndianOil) is India's largest commercial enterprise, with a sales turnover of ₹ 3,99,601 crore (US\$ 61 billion) and profits of ₹ 10,399 crore (US\$ 1,589 million) for the year 2015-16. IndianOil is ranked 161<sup>st</sup> among the world's largest corporates (and first among Indian enterprises) in the prestigious *Fortune* 'Global 500' listing for the year 2016.

As India's flagship national oil company, IndianOil's business interests straddle the entire hydrocarbon value-chain – from refining, pipeline transportation and marketing of petroleum products to exploration & production of crude oil & gas, marketing of natural gas and petrochemicals, besides forays into alternative energy and globalisation of downstream operations.

Having setup subsidiaries in Sri Lanka, Mauritius and the UAE, the Corporation is simultaneously scouting for new business opportunities in the energy market of Asia and Africa.

### Downstream Major

IndianOil accounts for nearly half of India's petroleum products market share, over 35%

national refining capacity (together with its subsidiary Chennai Petroleum Corporation Ltd., or CPCL), and 71% downstream sector pipelines throughput capacity.

The IndianOil Group owns and operates 11 of India's 23 refineries with a combined refining capacity of 80.7 MMTPA. The Corporation's 11,750 km cross-country pipelines network transports crude oil to refineries and finished products to high-demand centres in an efficient, economical and environment-friendly manners, and makes it one of the largest pipeline networks in the world.

The Corporation has a portfolio of leading energy brands that include *Indane* LPG cooking gas, *SERVO* lubricants, *XTRAPREMIUM* petrol, *XTRAMILE* diesel, *PROPEL* Petrochemicals, etc. Besides IndianOil, both *SERVO* and *Indane* have earned the coveted Superbrand status.

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## Countrywide Reach

IndianOil has a formidable network of over 45,000 customer touch-points that reach petroleum products to every nook and corner of the country. These include over 25,000 fuel stations, including 6,200 Kisan Seva Kendra outlets (KSKs) in the rural markets.

## Cutting-edge R&D

IndianOil's sprawling R&D Centre is one of Asia's finest, and plays a key role in supporting the Corporation's business interests by developing economical, environment-friendly technology solutions. It has won recognition for four decades of pioneering work in lubricants formulation, refinery processes, pipeline transportation and alternative fuels, and holds over 450 active patents, of which 270 are international patents.

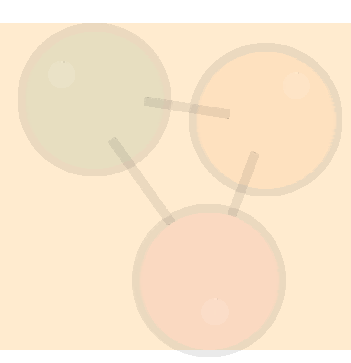
## New Businesses

As part of its Exploration & Production portfolio, IndianOil has participating interest in 8 domestic and seven overseas blocks that are located in Libya, Gabon, Nigeria, Yemen, Venezuela, Canada and the USA.

Diversifying into natural gas marketing in 2004, the Corporation has expanded its customer base significantly by leveraging its inherent strengths and countrywide reach. Its innovative 'LNG at the doorstep' initiative has benefited bulk users located away from gas pipelines.

IndianOil has ambitious plans to broaden its energy basket with alternative energy options such as wind, solar and bio-fuels.

As the flagship public sector enterprise of India, IndianOil has successfully combined its corporate social responsibility agenda with its business offerings, meeting the energy needs of millions of people every day, across the length & breadth of the country.



## Petrochemicals – Infinite Applications

IndianOil is one of the largest players in the domestic petrochemicals market, besides exports to about 70 countries. The Corporation offers a full slate of petrochemical products and intermediates under the brand name *PROPEL*.

IndianOil has implemented petrochemical projects worth ₹ 20,500 crore (US\$ 4.12 billion) so far. Further plans are on the anvil for various petrochemicals projects with a capex of ₹ 32,000 crore (US\$ 6.4 billion).

### World-scale Plants, World-class technologies

IndianOil made its big-ticket entry into petrochemicals with the commissioning of the world's largest single train **LAB** plant at its Koyali Refinery in August 2004. LAB (or Linear Alkyl Benzene) is used in the production of detergents.

The plant is based on the latest UOP DETAL technology and is designed to produce 120 TMT per annum.

An integrated **PX/PTA** (Paraxylene/ Purified Terephthalic Acid) complex came up at Panipat in Haryana in 2006. The PTA plant is the single largest unit in India, with a world-scale capacity of 5,53,000 MTPA, and produces polyester intermediates. The PX plant of 360 TMT capacity is based on UOP technology & PTA plant of 553 TMT capacity is based on Invista technology.

A world-class **Naphtha Cracker** with downstream polymer units, set up at Panipat in 2010, is the largest operating cracker capacity in India producing polymer (plastics) intermediates. It produces over 857 TMT of Ethylene and 650 TMT of Propylene using technology from ABB Lummus, USA.





## Downstream Units

Downstream units comprise a Polypropylene plant with two lines of 300 TMTPA capacity each, a dedicated High Density Polyethylene (HDPE) plant of 300 TMTPA capacity, a swing plant for LLDPE/HDPE of 350 TMTPA capacity, and a Mono Ethylene Glycol plant of 300 TMTPA capacity.

The **Polypropylene (PP)** plant is capable of producing homo-polymers, block co-polymers, and random co-polymers, including terpolymers, and is based on the renowned Spheripol-II technology from M/s. LyondellBasell, Italy. The PP plant can produce grades having a broad range

of MFI (0.3 to 100) with superior organoleptic properties.

The dedicated **High Density Polyethylene (HDPE)** plant, with a capacity of 300 TMTPA, is based on low-pressure stirred tank heavy diluents (STHD) slurry process technology (Hostalen) from LyondellBasell, Germany. The plant can produce bi-modal High Molecular Weight High Density Polyethylene (HMHDPE) grades besides unimodal HDPE grades. The product range includes MFI of 0.1 to 52 and a density range of 0.940 to 0.965 with the ability to produce pipes of PE 100 rating.



The **Swing Polyethylene** plant is based on solution process technology (Sclairtech) of M/s. Nova Chemicals, Canada. The plant can produce both LLDPE and HDPE with MFI range of 0.3 to 55. Density ranges from 0.917 to 0.965 using Butene or Octene.

The Naphtha Cracker Complex produces by-products such as Benzene, Carbon Black Feed Stock (CBFS), Polyethylene Wax (PE Wax), Diethylene Glycol (DEG) and Triethylene Glycol (TEG).

India's first **Styrene Butadiene Rubber (SBR) plant** of 120 TMTA capacity has been

commissioned in Panipat based on the Butadiene streams available from the Panipat Naphtha Cracker Complex (PNCC). The SBR project has been implemented by the joint venture company, Indian Synthetic Rubber Limited (ISRL) with IndianOil, TSRC, Taiwan, and Marubeni Corporation, Japan, as JV partners.

To further consolidate its presence in the petrochemicals business, IndianOil is setting up a **Polypropylene plant and an Ethylene glycol plant** at its Paradip Refinery. The 700 TMTA capacity polypropylene unit is based on stranded propylene from the Indmax (high severity FCC) unit.





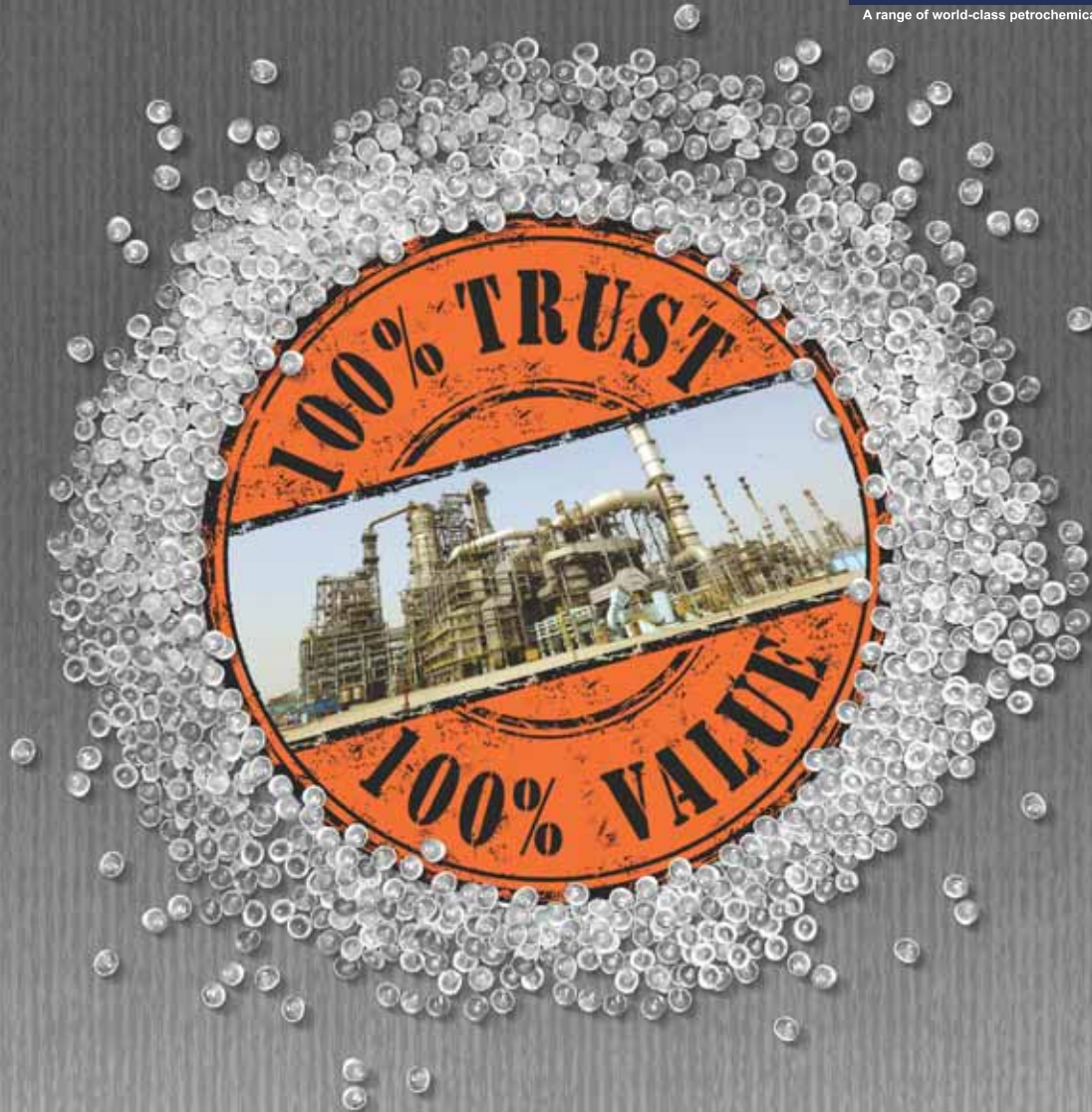
## Presenting **PROPEL** : The IndianOil promise

The brand name *PROPEL* implies propulsion or impetus with promise of growth to our customers' business. It denotes 100% trust, 100% value. It is backed by the promise of quality and commitment that IndianOil puts into its business. Customers stand to benefit from IndianOil's experience & expertise in the petroleum and petrochemicals businesses besides a pan-India service delivery network.

Under the umbrella brand *PROPEL*, IndianOil offers a full range of products covering all segments of petrochemicals, viz., Linear Alkyl Benzene (LAB), Purified Terephthalic Acid (PTA), Paraxylene (PX), Mono Ethylene Glycol (MEG), Polypropylene (PP), Linear Low Density Polyethylene (LLDPE), High Density Polyethylene (HDPE), etc. for a wide range of applications across industrial, commercial and domestic segments - thus making *PROPEL* a household name.







## Hallmark of Trust in the World of Plastics



IndianOil is one of leading players in the petrochemicals sector in India. Identifying petrochemicals as one of the prime drivers of future growth, IndianOil is proud to present under brand PROPEL, a world-class range of petrochemical products catering to applications ranging from textiles to detergents, agriculture to automobiles and healthcare to infrastructure.

- LINEAR ALKYL BENZENE (LAB) •PURIFIED TEREPHTHALIC ACID (PTA) •HIGH DENSITY POLYETHYLENE (HDPE)
- LINEAR LOW DENSITY POLYETHYLENE (LLDPE) •POLYPROPYLENE (PP) •MONO ETHYLENE GLYCOL (MEG)



## Moulding **India**. Propelling **Future**.

IndianOil is one of the largest player in the petrochemical sector in India. Identifying petrochemicals as one of the prime driver of future growth, the corporation is proud to present under brand **PROPEL**, a range of petrochemical products to cater to applications ranging from textiles to detergents, agriculture to automobiles and healthcare to infrastructure.

LINEAR ALKYL BENZENE (**LAB**) ❖ PURIFIED TEREPHTHALIC ACID (**PTA**)  
HIGH DENSITY POLYETHYLENE (**HDPE**) ❖ LINEAR LOW DENSITY POLYETHYLENE (**LLDPE**)  
POLYPROPYLENE (**PP**) ❖ MONO ETHYLENE GLYCOL (**MEG**)



A wonder material to upgrade your lifestyle

<https://propel.indianoil.in>



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## LINEAR ALKYL BENZENE (LAB)

### Technology

IndianOil's LAB plant was commissioned at its Gujarat Refinery at Vadodara in August 2004 as a venture in the petrochemicals downstream segment. The plant uses Kerosene and Benzene produced by the Refinery as the main feedstock for manufacture of Linear Alkyl Benzene. With fuel oil also available in-house for energy, the LAB plant is fully integrated with the refinery. The plant is based on the latest UOP DETAL technology and is designed to produce Low Molecular Weight (LMW) and High Molecular Weight (HMW) LAB. This technology is not only superior but is also environment friendly.

N-Paraffin of required C-chain length is extracted from Kerosene in Molecular Extraction Unit. It is de-hydrogenated into corresponding olefins in PACOL and Defining unit. Thereafter, alkylation of Benzene is done with these mono-olefins to form Linear Alkyl Benzene. Some heavy Alkylate generated during the process is separated out by fractionation.

### Applications

Linear Alkyl Benzene, with appropriate chain length, is predominantly used as raw material in the manufacture of Linear Alkyl Benzene Sulphonic Acid (LABSA) by reaction with Sulphuric Acid in liquid phase or by Sulphur Trioxide in gaseous phase. In downstream segment, LABSA is then neutralized with Caustic Soda to form its Sodium salt LAS-Na. This surfactant is used to manufacture synthetic detergents in liquid, cake or powder form. Very small amounts of LAB are also known to have uses in ink and pesticide manufacture.

### Advantages of DETAL Process

The Advantages of DETAL process over traditional Hydrogen Fluoride (HF) or Aluminium Tri Chloride ( $AlCl_3$ ) process -

- Low non-alkylbenzene components, in particular low contents of Tetralins, and improved linearity are the parameters that contribute to the rate of higher bio-degradation of the ultimate LAS product. Higher bio-degradability contributes to environment conservation.
- Non generation of any acidic discharge and hence no effluent treatment is necessary in a LAB manufacturing unit.
- Due to lower Bromine Index, it gives high quality and maximum yield of LABSA with low Klett value colour which does not require further treatment.





## SPECIFICATIONS

Sr.	Property	Test Method	LMW	HMW
1	Appearance	Visual inspection	Clear colourless liquid.	Clear colourless liquid.
2	Odour		Odourless	Odourless
3	Mono Alkyl Benzene content - total material less paraffin and DAT % Min	UMA B.IIc 1.1.1 or GLC UOP 673	98.6	98.6
4	Linear Alkyl Benzene content, % Min.	UMA B.IIc 1.1.1 GLC UOP 673	92.0	92.0
5	C-chain length distribution % typical range	UMA B.IIc 1.1.1 GLC UOP 673		
	Phenyl C9		1.0 Max	1.0 Max
	Phenyl C10		14 – 23	5 – 15
	Phenyl C11		30 – 45	28 – 45
	Phenyl C12		25 – 45	28 – 40
	Phenyl C13		10 – 30	10 – 30
	>/=Phenyl C14		1.0 Max	1.0 Max
6	Mean Molecular Weight	UMA B.IIc 1.1.1 GLC UOP 673	235 - 239	235 - 239
7	Total 2-phenyl isomer	UMA B.IIc 1.1.1 GLC UOP 673	18 - 32	18 - 32
8	Acid Wash test : 96% acid	ASTM D 848-03	Not darker than standard solution No. 3	Not darker than standard solution No. 3
9	Moisture, mg/kg. max	UMA B. IIc. 1.1.1	200	200
10	Br-index, mg Br2/100g. Max	ASTM 1491	10	10
11	Paraffin content, % Max	UMA B.IIc 1.1.1 GLC UOP 673	0.4	0.4
12	Colour, Max	Klett. Max	10	10
		Saybolt	+30	+30
13	Specific Gravity @15°C	ASTM d1298, uma b.ii.a. 16	0.856 - 0.865	0.856 - 0.865



## PURIFIED TEREPHTHALIC ACID (PTA)

### Technology

IndianOil's Purified Terephthalic Acid (PTA) plant was commissioned at Panipat Refinery, Haryana in June 2006 to expand in the downstream polyester sector and also in the light of availability of surplus liquid fuel (Naphtha) in the Northern region. The fully integrated plant uses Para-Xylene (PX) produced by Panipat Refinery as the main feedstock for manufacture of PTA. PX is produced from aromatic rich heart cut of Naphtha.

Initially, crude Terephthalic Acid is produced through oxidation of PX in the presence of a catalyst. Crude Terephthalic Acid is then purified through a process of hydrogenation, crystallization, centrifuging and drying to produce PTA. While PX plant is based on the latest UOP technology, PTA plant is based on the proven Invista T 10 (currently DuPont) technology.

The PX-PTA plant had a capital outlay of around ₹ 5100 crore. The nameplate capacity of 3,60,000 TPA of in-house PX is ideally matched with the rated capacity of 5,53,000 TPA of PTA. 25,000 TPA of Benzene is also generated during the process and is separated out by fractionation.

### Applications

PTA is predominantly used as raw material in manufacture of Polyester Staple Fibres, Polyester Filament Yarns and Polyethylene Terephthalate in conjunction with Mono Ethylene Glycol (MEG). Polyester Fibres/Yarns find application in the production of textiles and films. PTA also finds use in small quantities in the manufacture of paints, etc.

### Advantages of Invista T 10 Technology

The Invista T 10 technology is a proven and widely used process which provides the following advantages:

- Consistent mean particle size — helps in better control of operating parameters in downstream process
- Less Para-Toluic acid content — leads to better polymerization
- Product is suitable for application across all segments of the polyester sector.





100% TRUST. 100% VALUE.

A range of world-class petrochemicals

## PROPEL GRADE SHEET



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### SPECIFICATIONS

Sr. No.	Property	Unit	Specifications
1	Appearance	-	White dry free flowing crystals
2	Acid No	mg/KOH/g	675 +/- 2
3	4 Carboxyl benzaldehyde	ppm w/w	25 max
4	Paratoulic acid	ppm/ww	125 +/- 45
5	Ash	ppm/ww	6 max
6	Total significant metals (Mo, Cr, Ni, Co, Fe, Ti, Mn)	ppm w/w	6 max
7	Moisture	% Wt	0.2 max
8	Colour in 2N KOH solution	Hazen Units	10 max



## MONO ETHYLENE GLYCOL (MEG)

### Technology

IndianOil's Mono Ethylene Glycol (MEG) plant was commissioned at the Naphtha Cracker Complex, Panipat, Haryana in April 2010, to expand in the downstream polyester sector and also in the light of availability of surplus liquid fuel (Naphtha) in the Northern Region. The fully integrated plant uses Ethylene produced by the Naphtha Cracker as the main feedstock for manufacture of MEG.

The MEG plant is based on the proven technology of Scientific Design Co., USA. Ethylene Glycol is produced from Ethylene by non-catalytic hydration of Ethylene Oxide and water at elevated temperature and pressure.

The nameplate capacity of the MEG plant is 3,03,000 TPA with Di-Ethylene Glycol (DEG) and Tri-Ethylene Glycol (TEG) as its by-products. DEG and TEG production capacities are 21,600 TPA and 1000 TPA respectively. Since MEG and PTA are used in conjunction, the MEG plant capacity nearly matches the rated capacity of IndianOil's PTA plant.

### Applications

MEG is predominantly used with PTA as raw material in the manufacture of Polyester Staple Fibres, Polyester Filament Yarns and Polyethylene Terephthalate & Biaxially Oriented Polyethylene Terephthalate films. MEG also finds vast application in chemical industry like in coolants, brake fluids, anti-freeze, Alkyd Resin, Unsaturated Polyester Resin, etc.

With the MEG plant, the basket of raw materials from IndianOil for the Polyester industry becomes complete. It also partially bridges the demand-supply gap of MEG that was earlier being met only through imports.

DEG is a by-product of MEG plant and is mainly used for the production of unsaturated polyester resins (UPR) and polyurethane (PU).

TEG is also a by-product of MEG plant and finds end use in natural gas dehydration, plasticers, conditioning agents, etc.

### Advantages of Scientific Design Process

The proven and widely used Scientific Design process provides the following advantages:

- Better fibre grade product
- Less impurities







## MONO ETHYLENE GLYCOL (MEG) SPECIFICATIONS

Sr. No.	Property	Unit	Specifications
1.	Appearance	-	Clear, Colourless
2.	MEG Content	Wt. % Min.	99.9
3.	DEG Content	Wt % Max.	0.04
4.	Specific Gravity	@20/20 Deg C	1.1151 - 1.1156
5.	Distillation Range @ 760 mm Hg IBP End Point 5 - 95 vol% range	Deg C Min. Deg C Deg C Max.	196 199 1.0
6.	Water	Wt. % Max.	0.04
7.	Colour (before heating)	Pt-Co Units	5
8.	Acidity (as acetic acid)	Wt. ppm Max.	10
9.	Chlorides (as CL)	Wt. ppm Max.	0.1
10.	Sulphates		Nil
11.	Iron	Wt. ppm Max.	0.1
12.	Ash	Wt. ppm Max.	10
13.	Aldehydes (as formaldehyde)	Wt. ppm Max.	10
14.	Transmission in UV Wavelength(nm) 220 Transmittance 275 Transmittance 350 Transmittance	% Min.	80 95 99

## DI-ETHYLENE GLYCOL SPECIFICATIONS

Sr. No.	Property	Unit	Specifications
1.	Appearance	-	Clear, Colourless
2.	DEG Content	Wt. % Min.	99.8
3.	MEG & TEG Content	Wt % Max.	0.10
4.	Specific Gravity	@20/20 Deg C	1.1170 - 1.1190
5.	Distillation Range @ 760 mm Hg IBP to DP	Deg C	4 including 246
6.	Water	Wt. % Max.	0.1
7.	Acidity (as acetic acid)	Wt.ppm Max.	50
8.	Chlorides (as CL)	Wt.ppm Max.	0.1
9.	Colour	Pt-Co Units Max.	10
10.	Iron (as Fe)	Wt.ppm Max.	0.1
11.	Ash	Wt.ppm Max.	50

## TRI-ETHYLENE GLYCOL SPECIFICATIONS

Sr. No.	Property	Unit	Specifications
1.	Appearance	-	Clear, Colourless
2.	TEG Content	Wt. % Min.	99.2
3.	DEG Content	Wt. % Max.	0.5
4.	PEG Content	Wt. % Max.	0.25
5.	Specific Gravity	@20/20 Deg C	1.121 - 1.126
6.	Distillation Range @ 760 mm Hg 5-95 vol%	Deg C	280-295
7.	Water	Wt. % Max.	0.1
8.	Colour	Pt-Co Units Max.	0.05
9.	Ash	Wt.ppm Max.	50



### 1,3 BUTADIENE & C4 RAFFINATE

- Butadiene Extraction unit (BDEU) at Panipat commissioned in Oct'2014.
- Capacity of 138KTA.
- Based on BASF technology.
- Butadiene is used primarily in the production of SBR, PBR, ABS, SB Latex.
- C4 Raffinate (LPG) commercial sales commenced in May, 2014.
- C4 Raffinate (LPG) is well established for application across all segments like Poly Iso Butylene production, other chemicals.





## 1,3 BUTADIENE SPECIFICATIONS

Sr. No.	Components	Unit	Specifications
1.	1,3 Butadiene	wt.%	99.6 min
2.	1,2 Butadiene	wt.ppm	20 max
3.	Propadiene	wt.ppm	5 max
4.	Total Acetylene	wt.ppm	20 max
5.	Carbonyl content (as acetaldehyde)	wt.ppm	10 max
6.	Total Sulphur content	wt.ppm	10 max
7.	NMP	wt.ppm	5 max
8.	Inhibitor (pTBC) content	wt.ppm	70 min
9.	Butadiene dimer	wt.%	250 ppm max
10.	Appearance		Clear and free of entrained matter
11.	Organic Peroxide	wt.ppm	5 max
12.	Non Volatile residue	wt.%	0.05 max

## C4 RAFFINATE SPECIFICATIONS

Sr. No.	Parameter	Specification	Unit	Results
1.	Methyl Acetylene	To Report	wt.ppm	<1.0
2.	Isobutylene	To Report	wt. %	36 to 42
3.	1,3 Butadiene	<0.43	wt.%	0.06
4.	Vinyl Acetylene	To Report	wt.ppm	<1
5.	Dimmers'	To Report	wt.ppm	<1
6.	H <sub>2</sub> S	To Report	wt.ppm	ND
7.	NMP	≤5	wt.ppm	<1.0
8.	Total Sulphur	To Report	wt.ppm	<0.20
9.	Butene - 1	To Report	wt.%	26.68
10.	Trans Butene - 2	To Report	wt.%	9.86
11.	Cis Butene - 2	To Report	wt.%	9.65
12.	C <sub>2</sub> 's	To Report	wt.ppm	15
13.	Propane	To Report	wt.ppm	121
14.	Propylene	To Report	wt.ppm	3
15.	Propadiene	To Report	wt.ppm	276
16.	C <sub>5</sub> 's	To Report	wt.%	20 ppm
17.	Water	No Free Water		No Free Water



## SPHERIPOL PLANT FOR POLYPROPYLENE (PP)

### Technology

IndianOil has set up a Polypropylene plant at Panipat (Haryana) having two production lines with capacity of 300 KTA each. The plant is based on the state-of-the-art bulk & polymerization technology (Spheripol-II) from LyondellBasell. The plant is capable of producing homopolymers, block co-polymers & random co-polymers, including ter-polymers. Spheripol-II is a renowned & well established technology globally and 100 such plants are already operating worldwide with total production of ~ 20 million MT with market share of around 48%. Spheripol-II is a two stage process. Bulk polymerization in loop reactors is capable of producing homo/random/ter-polymers and combination of bulk & gas-phase polymerization is capable of producing impact co-polymers. Spheripol processes have a capability to produce a wide range of products for all applications with consistent product quality.

### Key Features of Spheripol-II Technology

- Lower transition time & easy transition for grade change-over.
- Superior lot-to-lot quality consistency.
- High yield catalyst utilization & high production rates.

### Product Attributes

PP Plant can produce grades having broad MFI range of 0.3 to 100 gm/10 min with lower oligomers and with superior organoleptic properties. It can produce reactor-grades with very high flexural modulus (>2000MPa), CR-Grades, superior impact grades and lower SIT random co-polymers.

### Product Envelope

This plant can produce PP grades which are used for manufacturing packaging films, flat tapes, woven sacks, fibrillated yarn and mono/multifilament yarn, pipes, sheets, household items, caps & closures, crates, battery cases, appliances, furniture, products for medical & hospital use, blow moulded bottles & moulded luggage, moulded industrial products, including automotive components like bumper, dashboards, doorframes, and non-woven fabric, etc.





## POLYPROPYLENE (PP) GRADE SLATE

FAMILY	SECTOR	GRADE	MFI(L <sub>2</sub> )	SPECIAL CHARACTERISTICS	APPLICATIONS
HOMO POLYMER	INJECTION MOLDING	1030MG	3	Good balance of impact and rigidity, Good processability	Industrial products, Household products, General purpose extrusion, Blending with Raffia.
		1060MG	6	Good balance of impact and rigidity, Good processability	Industrial products, Household products, Also used in blends in Thermoforming & Raffia.
		1110MG	11	High flow and high rigidity, Very good gloss.	Rigid Packaging, Household articles, Furniture, Caps & Closures.
		1110MAS	11	A superior grade having high flow, very high stiffness with excellent gloss. The grade offers better productivity and reduces energy consumption. DMF approved	Furniture, Household articles & Auto components where high stiffness is required.
	RAFFIA	1030RG	3.5	Good processability, Low water carry over, Good balance of tenacity & elongation.	Woven sacks for Cement, Chemicals, Fertilizer, Food grain packaging, FIBC for bulk industrial packaging applications.
	BOPP FILM	1030FG	3	Gel free, Good stretchability and processability.	General purpose & co-extruded BOPP film, Metallisable film, Cast PP films, etc.
	TQ FILM	1100FS	10	Very good processability, Excellent gloss and clarity, Contains Slip and Antiblock.	TQ films for packaging of snacks and bakery foods, Garment packaging, Textiles over wraps.
THERMOFORMING	1030TC	20	Good melt strength, stable extrusion even at high spinning speeds and stretch ratios.	Lower denier bulk continuous fibre, Continuous Fibre and Staple fibres, High tenacity continuous filament for straps, Low denier staple fibres for spun bond and non-woven.	
	FIBRE AND FILAMENT	1350YG	35	High melt flow, High speed production of fine denier fibre, Anti gas fading properties	Spun bonded non-woven fabric for Diapers, Medical and sanitary tissues, Fine fibre yarn, Packaging bags for rice.
RANDOM CO-POLYMER	MOULDING	2120MC	12	Excellent clarity & good processability, the grade offers higher productivity and energy saving opportunities in processing. DMF approved.	Transparent injection moulded rigid containers, Housewares, Syringes, ISBM bottles.
IMPACT CO-POLYMER	INJECTION MOLDING	3030MG	3.5	Medium flow, Good stiffness and high impact strength balance.	Injection moulding of components for automobiles, Home appliances and Industrial products, Caps & Closures.
		4080MA	8	Medium flow for easy processing, Good impact & stiffness balance, anti-static properties.	Paint Pails, furniture and industrial components.
		4100MH	10	Medium flow, Very good processability, Long term heat ageing, Good impact & stiffness balance.	Battery containers, Industrial mouldings, Components requiring long heat exposure like under-the-hood automotive components.
		5080MG	10	Good processability, No break (Superior impact strength)	High impact automotive components, impact modifier in specialty PP compounds.
		3120MA	12	Medium flow, Good processability, Good impact and stiffness balance, Anti-static properties.	Home appliances, Automotive components, PP compound for automotive components, Houseware, Moulded furniture, Luggage shells.
		3400MN	40	High flow, Good processability, Low warpage, Nucleated grade.	Home appliances, PP Compound for automotive components, Thin wall Injection Moulding.
		3650MN	65	High flow, Good processability, Low warpage, Nucleated grade.	PP Compound for automotive components, TWIM, Appliances.
	3550MN	55	High flow, Good processability, Low warpage, Nucleated grade.	PP Compound for automotive components, TWIM.	
EXTRUSION COATING	3250MG	25	High flow, Very good processability, Low neck-in.	Extrusion coating on PP Raffia fabric, Sandwich Lamination of Raffia fabric with BOPP film or Craft Paper, etc. in blends with suitable grades of LDPE.	



## HOSTALEN PLANT FOR HDPE AND HMHDPE

### Technology

IndianOil has set up a dedicated High Density Polyethylene (HDPE) plant with a capacity of 300 KTA to produce HDPE & HMHDPE grades. This plant is based on state-of-the-art low pressure Slurry Process Technology (Hostalen) from LyondellBasell.

The Hostalen process is the high-tech slurry process delivering outstanding HDPE Bimodal products. A key feature is the excellent combination of processability with final product performance. Depending on product needs, the Hostalen process can be run using different set-ups of the two reactors to produce a variety of unimodal and bimodal HDPE grades.

Hostalen is a well accepted technology globally and 36 such plants are already operating worldwide with total production of ~ 6.5 million MT.

### Key Features of Hostalen Process

- Product density range 0.940 to 0.965 g/cc
- MFR range 0.12 to 60.0 ( $I_5$ ) g/10 min
- High resistance to environmental stress cracking.
- High toughness and elongation at break
- Very good chemical resistance
- Higher notch impact strength

### Product Envelope

HDPE is used for making Injection moulded caps, heavy duty crates, containers, bins, textile bobbins, household goods, luggage ware, storage bins, pressure pipes (for gas and water), high molecular weight films, woven sacks, small blow moulded bottles, L-ring drums, jerry-cans, mono filaments, etc.





## GRADE SLATE

SECTOR	GRADE	MFI(I <sub>2</sub> )	DENSITY	SPECIAL CHARACTERISTICS	APPLICATIONS
HM Film	002DF50	0.22	0.950	Bimodal grade with very good processability with high molecular weight. Excellent dart impact strength.	Counter bags, Shopping bags, Films for wrapping, Liners.
	003DF49	0.30	0.949	Bimodal grade with good processability and bubble stability, Down gauging, Grade exhibits superior gloss of films.	Counter bags, shopping bags, films for wrapping with higher gloss.
GPBM	012DB54	1.20	0.954	Bimodal grade with very good processability, Good balance of stiffness, ESCR and impact properties. DMF approved.	Blow moulded containers for edible & lubricating oil packaging, Pharmaceutical & other general purpose packaging. DWC pipe.
MBM	003DB52	0.35	0.952	Bimodal HMHD grade with very good processability, High stiffness, toughness & good ESCR properties.	Blow moulded containers upto 100 litres. Sheet extrusion, DWC Pipe. Blow moulded water tanks.
LBM	001DB52	0.12	0.952	Bimodal HMHD grade with good processability, Good balance of stiffness and impact properties.	Large containers and L-Ring drums for packaging of industrial products upto 220 litres.
PIPE	002DP48	0.22	0.948	Bimodal grade with good processability. Excellent impact & stiffness. Meets PE-100 (MRS 10) rating requirements (Enova Certification).	Pressure pipes for water & gas transportation, Irrigation pipes, etc.
	004DP44	0.44	0.946	Bimodal grade with very good processability, Meets PE-80 (MRS 8) rating requirements.	Pressure pipe for water and gas transportation.
	010DP45	0.9	0.945	Bimodal grade with good processability. Meets PE-63 (MRS 6.3) requirements.	Sprinkler pipes, bore well pipes, ducts & non-pressure pipes.
	010DP45U	1.0	0.945	Bimodal grade with good processability. Meets PE-63 (MRS 6.3) rating requirements. It is UV stabilised grade. CACT approved for OFC ducts for telecom applications.	Sprinkler pipes, Bore well pipes, Tele ducts for housing OFC in telecom applications & non-pressure pipes.



## SCLAIRTECH SWING PLANT FOR LLDPE & HDPE

IndianOil has set up a Polyethylene plant at Panipat (Haryana) with a capacity of 350 KTA. The plant is based on the state-of-the-art solution process technology (Sclairtech) from Nova Chemicals, Canada. The plant is capable of producing general purpose Linear Low Density Polyethylene (LLDPE) and High Density Polyethylene (HDPE) as well as specialty LLDPE grades using 1-Octene as co-monomer for niche application segments.

Sclairtech is a well accepted technology globally and 11 such plants are already operating across the world with a cumulative production capacity of ~3.5 million MT.

In the process, both catalyst and the resulting polymer remain dissolved in a solvent that is subsequently removed to isolate the polymer. Solution processes have a wider window of operation in terms of densities and melt indices.

This plant can produce grades with MFI range of 0.3 to 150gm/10min and density range of 0.917 to 0.965g/cc.

### Key Features of Sclairtech Process

- Lower transition time for grade change-over.
- Viscosity/Temperature control is easier - no possibility of runaway reaction.
- Superior lot-to-lot consistency.
- Narrow to broad molecular weight distribution.
- Capability to produce Butene, Octene & Ter-Polymer grades.

### Product Attributes

The Swing plant can produce variety of grades based on Butene-1 or Octene-1 as co-monomer with controlled MWD, gel free resins with excellent mechanical & sealing properties.

### Product Envelope

The Swing plant can produce the LLDPE grades which are used in applications such as packaging films, shopping bags, lamination films, films for canal lining and other agricultural uses, extrusion coatings, garbage bags, drip laterals, stretch wrap film, general purpose films, rotational moulded items like overhead tanks, etc.

HDPE produced from swing plant is used in applications such as injection moulded heavy duty crates, woven sacks, containers, bins, household goods, blow moulded general purpose bottles, pipes, base resin for steel pipe coating, insulation for PIJF cables, co-extrusion films & liners.







## LLDPE / HDPE GRADE SLATE

PRODUCT	SECTOR	GRADE	MFI(I <sub>2</sub> )	DENSITY	SPECIAL CHARACTERISTICS	APPLICATIONS
LLDPE	LL FILM	010F18S	0.9	0.918	Good processability, Low gel, Good mechanical properties, Excellent optical properties. Contains slip and antiblock.	Liquid packaging film, Multilayer film for adhesive lamination, Carrier bags, Drip lateral.
		010F18A	0.9	0.918	Good processability, Good mechanical properties, does not contain slip and antiblock.	Multilayer film for adhesive lamination, Mulch Film, Drip lateral, Cling film, Drip lateral.
		020F18A	2.0	0.918	Easy processability, Low gel, does not contain slip & antiblock.	Cast film, stretch cling film, Drip laterals.
LLDPE	ROTATIONAL MOULDING	042R35A	4.5	0.935	Very good processability, Ease in de-moulding, Good mechanical strength.	Overhead water tanks, Loft tanks, Septic tanks, Chemical storage tanks, Toys, Garden furniture.
LLDPE	INJECTION MOULDING	500M24A	50	0.924	Very good flow and processability.	Carrier resin for master batches, Injection moulding of flat and large warpage-free products and lids.
LLDPE	EXTRUSION COATING	065E24A	6.5	0.924	Good processability. Low neck-in, Good adhesion on substrates.	Extrusion coating on HDPE Raffia fabric, Paper etc., Base resin for XLPE compounds.
HDPE	INJECTION MOULDING	080M60	8	0.960	Good processability, Superior mechanical properties, Good ESCR property.	Crates for vegetables, milk, fish and material handling, Injection moulded Pallets, Caps & Closures.
		080M60U	8	0.960	UV stabilised, Good processability, Superior mechanical properties, good ESCR property.	Soft drink crates, Industrial crates for outdoor usage, Injection moulded Pallets, Caps & Closures.
		180M50	20	0.950	Excellent flow properties, very good processability, DMF approved.	Houseware, Thin wall injection moulded products, Drippers.
HDPE	RAFFIA	010E52	0.9	0.952	Excellent orientation characteristics, Low water carry over, Excellent mechanical properties.	Woven sacks for fertilizer packaging, wrapping fabric, tarpaulin, Agri shade net, Raschel bags, Extruded sheets.
		012E50	1.2	0.950	Narrow MWD, Excellent orientation characteristics, Low water carry over. Superior mechanical properties.	Tarpaulin, Woven sacks for wrapping fabrics, Monofilaments for mosquito nets, fishing nets, etc.



## GAME CHANGING GRADE – 080M60

### IndianOil's high productivity grade HDPE 080M60 - an advanced solution to both quality and productivity in injection molding process

In continuation of its commitment to providing value added polymer grades to the Indian polymer industry, IndianOil has introduced a high productivity HDPE grade, *PROPEL* HDPE 080M60, for injection moulding applications. Such high productivity polyethylene grade is being introduced for the first time by any polymer resin manufacturer in the world, thereby bringing cutting edge competitive advantage to the end use customers.

The new high productivity HDPE grade offers significant improvement in product performance in injection moulding applications such as:

- Material handling crates
- Caps & closures
- Household articles
- Thin walled products

Enhanced properties of this grade deliver two vital benefits for end use customers -

- Reduced cycle time
- Excellent mechanical properties (Flexural Modulus)

- thus resulting into increased productivity, energy saving, enhanced product aesthetics and excellent dimensional stability.

### Benefits

The field trials conducted in different application segments as well as our in-house study have confirmed that this grade offers:

- Higher Stiffness - Flexural Modulus more than 940 Mpa.
- Cycle time reduction up to 10% (depending on product & equipment).
- Reduced specific energy consumption.
- Very good dimensional stability and low warpage in mouldings.
- Easy Demoulding (mould release) of the product.
- Industry standard impact test such as drop test & ball drop test for crates & dimensional stability, printability and fitment test for caps & closures, etc., were well within the desired specification.





## Success Stories

### Caps and Closures

- Good production quality and dimension stability at shorter cooling time
- IndianOil HDPE 080M60 overrides the nucleation effects of pigment, allowing stability of the manufacturing process
- Beverage/Liquor Bottle Cap: Around 5% reduction in cycle time

Product	Product wt.	Cooling time with Conventional HDPE	Cycle Time with Conventional HDPE	Cooling time with HDPE 080M60	Cycle Time with HDPE 080M60	% Cycle Time Reduced
Beverage/Liquor Closures	3.2 (gm)	3.40 (Sec)	7.47 (Sec)	3.00 (Sec)	7.07 (Sec)	5%

### Industrial Crates and Pallets

- Reduction in cycle time means reducing cost or investment in capacity.
- Better flatness improves assembly of crates and pallets.

Product	Product wt.	Cooling time with Conventional HDPE	Cycle Time with Conventional HDPE	Cooling time with HDPE 080M60	Cycle Time with HDPE 080M60	% Cycle Time Reduced
600x400x425 Crate	3550 (gm)	50 (Sec)	108 (Sec)	40 (Sec)	98 (Sec)	9%
600x400x240 Crate	2200 (gm)	40 (Sec)	74 (Sec)	35 (Sec)	69 (Sec)	7%

### Beverage & Vegetable Crates

- Cycle time reduces without compromising mechanical properties of the parts.
- Crates passed drop test and ball drop test.

Product	Product wt.	Cooling time with Conventional HDPE	Cycle Time with Conventional HDPE	Cooling time with HDPE 080M60	Cycle Time with HDPE 080M60	% Cycle Time Reduced
Vegetable/Fruit Crate	1500 (gm)	34 (Sec)	55 (Sec)	31 (Sec)	51 (Sec)	7%



# *Bringing Energy to Life*



# Global Footprint of **PROPEL**



● POLYMERS \* DEG/TEG + LAB ● BENZENE

(Map not to scale)



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