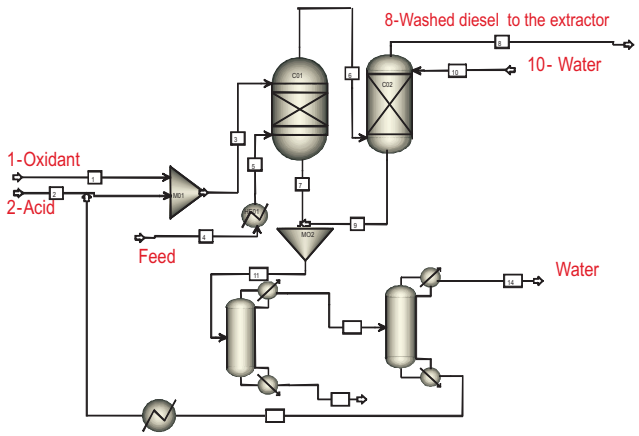
Technology for oxidative desulfurization of gas oil to ultra low sulfur diesel (ULSD)

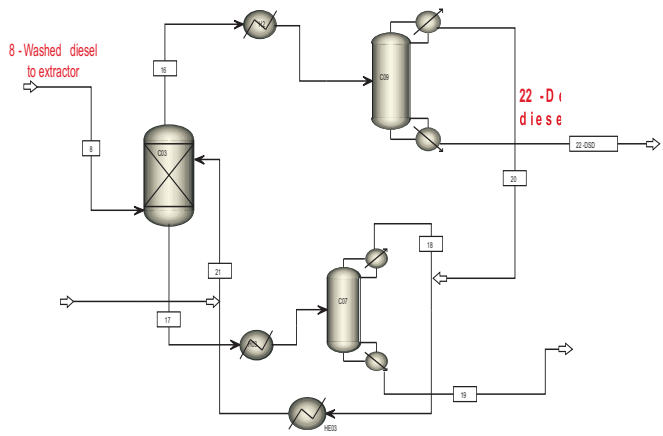
Creating future fuels

Conventional HDS of diesel can bring down sulphur content about 100 ppmw but for making ULSD with sulphur content < 10 ppmw deep hydrodesulphurization is required. Hydrotreating option will be more cost and energy intensive due to requirement of high temperature, high partial pressure of hydrogen along with production of green house gases (GHG). As alternative to HDS, Oxidative Desulfurization process has been developed at CSIR-IIP which involves oxidation of sulfur compounds in diesel to sulphones followed by their removal by adsorption/ extraction to obtain ULSD i.e. Total sulfur less than 10 ppm.

PFD: Oxidizing Section



PFD : Extraction Section



Salient features

- Mild operating conditions results in , less capital and operating cost
- No hydrogen, reduces GHG emissions thus less harm to the environment
- Solvents used is non-corrosive and environmentally friendly as well as good selectivity and capacity
- Hydrogenation route is unattractive for feeds with refractory sulfur compounds, as it requires higher severity of operating conditions
- New grass root units in hydrocarbon industries will employ engineers and shift operators hence will create employment
- Adsorbent used for polishing step are known in refining/chemical industry

Commercial status

CSIR-IIP developed the Technology Information Package,(TIP); TIP along with final report on project , submitted to : CHT, New Delhi Commercial unit yet to come.

Benefits

- Estimated Cost of the Plant: ~ USD 15 million/per plant for 0.5 MMTPA feed thru put (as compared to DHDS unit USD 88 million/per plant for 0.5 MMTPA feed thru put)
- Ultra low sulfur diesel (ULSD) as desulfurized product (raffinate) with total sulfur < 10 ppm wt
- Sulfones as by products may be utilized in pharmaceutical industry as precursor of certain drugs
- The payback period for the oxidative desulfurization for the production of ULSD from SRG is expected not to be more than four years

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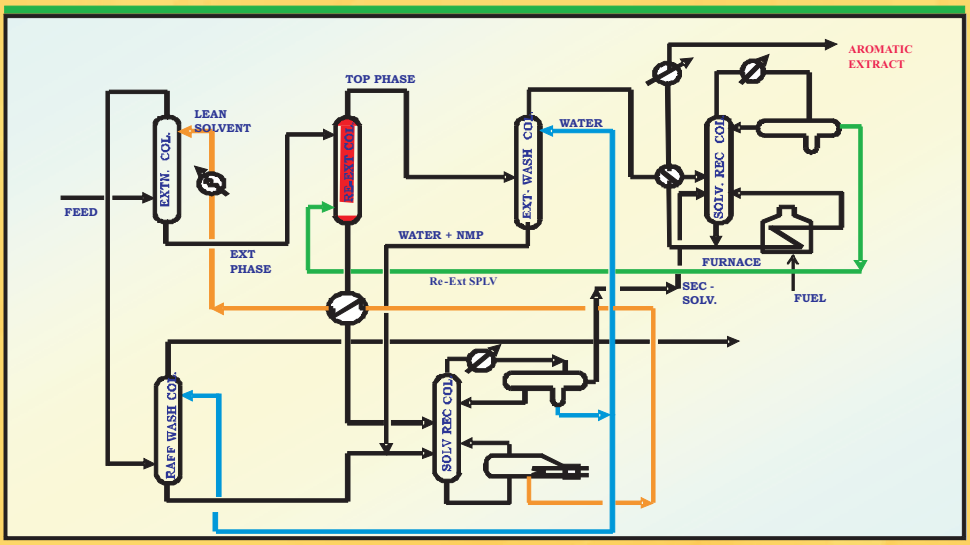
Technology for Dearomatization of middle distillates by using Re- extraction route for solvent recovery

Creating future fuels

Dearomatization of middle distillates by using conventional hydrotreating is difficult due to presence of high concentration of polycyclic aromatics and associated sulfur compounds with two/ three ring aromatics. Dearomatization of middle distillates using conventional solvent extraction scheme is not feasible due to boiling point overlap of solvent and feedstock. CSIR-IIP developed novel approach using re-extraction step to replace distillation for solvent recovery for dearomatization of kerosene/ diesel range fractions

FLOW SCHEME FOR DEAROMATISATION OF HYDROCARBON FRACTIONS WITH RE-EXTRACTION ROUTE



Commercial status

CSIR-IIP developed the Technology Information Package, Basic Engineering Design Package (BEDP) developed in collaboration with EIL. Detailed Engineering done by EIL Proces package Submitted to : IOCL, Guwahati and BRPL, IOCL, Bonagaigaon.

Commercial unit yet to come.

Salient features

- Process conceived is innovative in the Refining Industry
- Solvents used is non-corrosive and environmentally friendly as well as good selectivity and capacity
- Hydrogenation route is unattractive for feeds with high aromatic content, as it requires higher capital investment
- Solvent based dearomatization is more cost effective than hydrogenation
- Reduced hydrogen consumption and reduced GHG emission (CO_2) thus less harm to the environment
- Reduced load on hydrotreating unit
- Solvent recovery through less energy intensive route

Benefits

- Marginal cost of around INR 27 Crore for new grass route unit
- First Indigenous technology development for dearomatization of middle distillate
- Each Plant has the potential to fetch more than ~INR 2.9 Crore per annum as sales realized by selling the ATF product besides INR 2.4 Crore per annum for sales of SK
- Each Plant has the potential to fetch more than ~INR 20 Crore per annum as import substitution
- The payback period for the Indigenous development of plant for dearomatization of middle distillate would be less than four years.
- By product (extract hydrocarbons) can be sold as Remax-I and Remax-II to be used as a carrier solvent in major emulsifier formulations, agrochemical formulations etc. thus benefiting local farmers.

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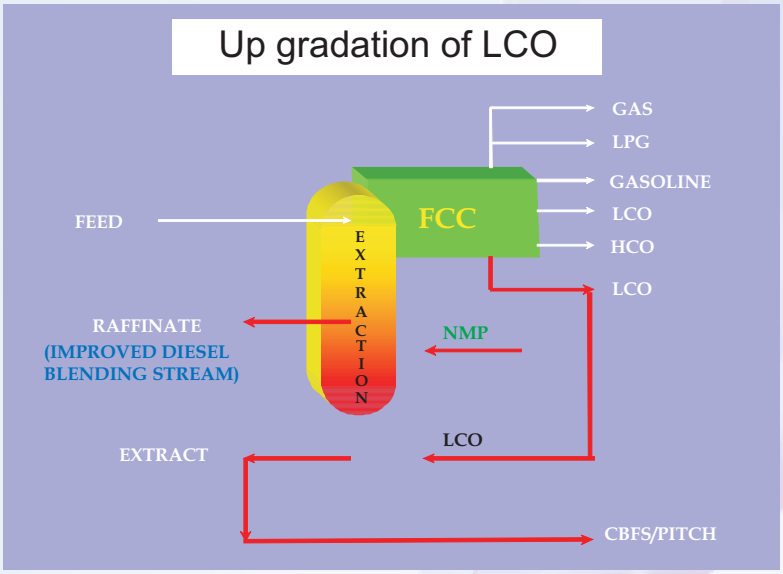
Technology for De-aromatization of Light Cycle Oil (LCO) by using extraction route for Poly cyclic aromatic (PAH) reduction

Creating future fuels

Environmental and human health concerns restricts the average poly aromatic hydrocarbons (PAH) level in diesel less than 5 % in Euro-VI and less than 11% in Euro-IV. Light cycle oil (LCO) fraction generated from FCC is significantly responsible for higher PAH concentration in diesel. CSIR-IIP developed a state of the art technology for reduction of PAH from LCO fraction and producing the aromatic rich extract of high BMCI and CBFS value.



Salient Feature

- Process conceived is different than hydrotreating route in the Refining Industry
- Hydrogenation route is unattractive for feeds with high aromatic content, as it requires higher capital investment
- Solvent based dearomatization is more cost effective than hydrogenation
- Operation of extraction and re-extraction columns at ambient conditions By product (extract hydrocarbons) can be rich source for 2,6 Dimethyl naphthalene (2 6 DMN) concentration > 50% among other isomers
- Alternatively extract rich in poly cyclic aromatics can be high BMCI material: a source for carbon blackReduced hydrogen consumption and reduced GHG emission (CO2)
- Reduced load on hydrodesulfurization (HDS) unit

Commercial status

CSIR-IIP conducted lab experiments with actual feedstocks, developed comprehensive Technology Information Package (TIP). Commercial plant is still awaited. Other customers in India and abroad have been contacted.

Benefits

- CSIR-IIP developed novel approach using re-extraction step to replace distillation for solvent recovery
- The technology was developed for dearomatization of light cycle oil (LCO) for high cetane diesel material with polar solvents
- Hydrotreating is avoided as poly aromatics can be brought down below 11% thus saving enormous energy, hydrogen consuming step leading to reduced GHG emission
- Emission from low PAH diesel will improve the air quality and emit less carcinogen products, thus improving the health of the people of metropolitan cities
- Marginal cost of around INR 27 Crore for new grass route unit
- The payback period for the Indigenous development of plant for dearomatization of LCO would be less than four years

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Value Addition to Naphtha Cracker Feedstock by Extraction of Pure Aromatics

Creating future fuels

Naphtha cracker (NC) is the heart of petrochemical complex. Aromatics in feedstock to NC are undesirable as they do not add any ethylene value due to their refractory nature and produce undesirable black oil. In the proposed technology for which technical knowhow is available at CSIR-IIP, naphtha feed before going to cracker will be routed to extraction column wherein it will be contacted with polar selective solvent to extract pure aromatics. The raffinate (dearomatized naphtha) produced will be sent to cracker as an improved feedstock due to its low (<2 wt.%) aromatic content.

Salient features

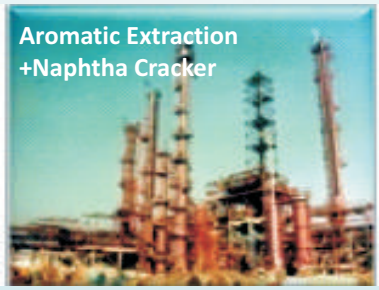
- Process conceived is totally new in the Refining Industry
- Designed with an innovative ideas which minimizes utility requirements and maximizes yield & purity of products.
- Aromatic lean naphtha as dearomatized product (raffinate) with aromatics < 2.0 % wt., resulting in high yield of olefins (>99%) (ethylene, propylene etc.) and minimization of pyrolysis oil
- High Purity Benzene > 99.99 % wt. with > 99.9 % Recovery and Toluene purity > 99.9 % wt. with > 99 % Recovery and Xylenes purity 99.5% with 98% recovery
- Highly thermal stable solvent system

Benefits

- Olefins demand is continuously increasing with the pace of 7% per annum. Hence value addition of naphtha cracker feedstock will always be a profitable business besides recovering pure Benzene, Toluene and Xylenes
- ~10% capacity addition can be obtained in the Cracker
- Decreased coke lay down
- Enabled the India to possess a technology not available elsewhere in the world.
- New units in hydrocarbon industries will employ engineers and shift operators hence will create employment

Commercial Status

- Process package for ~ USD 5 million / per plant for 50 ton/ hr. feed thru put submitted to SABIC, UK, Petrochemicals,
- Commercial unit yet to come



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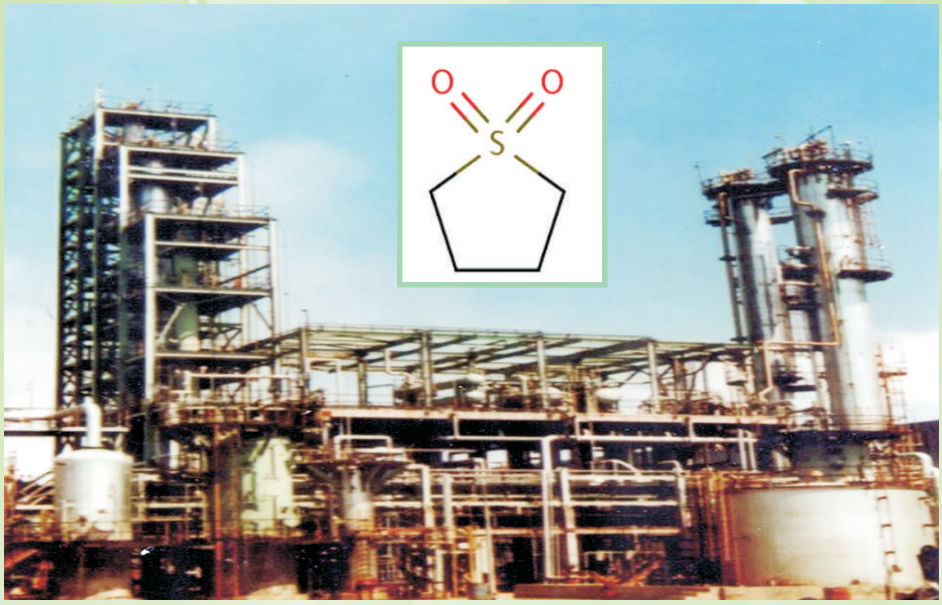
Sulfolane Solvent Based Extraction Technology for Production of Food Grade Hexane (FGH) and special boiling point (SBP) solvent

Creating future fuels

Food Grade Hexane (FGH) is a hexane rich heart cut naphtha having a boiling range of 63 – 69 °C. It is extensively used in the agro-industry for extraction of vegetable oils (used for cooking) from seeds. Special Boiling Point (SBP) solvents are a class of benzene lean narrow or wide boiling range solvents. They are used extensively in the Tyre, Rubber and Paint Industry. The technology developed in collaboration with EIL, India for dearomatization of light naphtha with boiling range of 50 - 120°C to produce the FGH and SBP .



Commercial Status

Technology was commercialized at BPCL, Mumbai (1989) for production of 25000 ton per annum (TPA) FGH and 80,000 TPA SBP and CPCL Chennai (1992) for production of 25, 000 TPA FGH.

Salient Features

- Operating cost of this technology is much than hydrogenation and thus produce cheaper products
- Hydrogenation route is unattractive for feeds with high aromatic content due to higher hydrogen consumption and sever operation
- Sulfolane extraction technology can accept feed with any benzene content without affecting processing cost.
- Sulforlane solvent used in the technology is no-corrosive and environmentally friendly
- CSIR-IIP developed the Technology Information Package, Basic Engineering Design Package (BEDP) developed in collaboration with EIL. Detailed Engineering done by EIL
- FGH/SBP production unit based on this technology is successfully running smoothly since more than 25 years.
- The payback period for the FGH/SBP units had been less than three years. Sulfolane has good selectivity and capacity

Benefits

- First Indigenous development commercial plant for production of FGH and SBP solvents
- Improved economy by putting almost complete brake to import thus saving enormous foreign exchange
- Creating jobs by putting new vegetable oil extraction/ refining units due to easy availability of FGH in the country
- Peoples' health will be less harmed by using improved FGH (< 100 ppm benzene) for refining vegetable oils
- New FGH unit will create more jobs for engineers and shift operators
- Technology may be sold to the clients abroad bringing foreign exchange to the country

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NMP Solvent Based Extraction Technology for Production of Food Grade Hexane (FGH)

Creating future fuels

Food Grade Hexane (FGH) is a hexane rich heart cut naphtha having a boiling range of 63 – 69 °C. It is extensively used in the agro-industry for extraction of vegetable oils (used for cooking) from seeds. The solvent extraction based technology developed in collaboration with HPCL, India for dearomatization of light naphtha with boiling range of 63 - 69°C to produce the FGH.

Commercial Status

Technology was commercialized at HPCL, Mumbai (1997) for production of 50, 000 ton per annum (TPA) FGH and CPCL Chennai (2011) for production of 25, 000 TPA FGH.

Salient Features

- Operating cost of this technology is much lower than hydrogenation and thus produce cheaper products
- Use of aqueous NMP as extraction solvent facilities the online fine tuning of solvent power and selectivity as per requirement.
- Lower operating cost compared to sulfolane solvent based technology
- Product may contain < 100 ppm benzene thus meeting WHO spec
- Solvent used is thermally stable, non-corrosive and environmentally friendly
- Hydrogenation route is unattractive for feeds with high aromatic content due to higher hydrogen consumption and sever operation
- NMP extraction technology can accept feed with any benzene content without affecting processing cost

Benefits

- First Indigenous development commercial plant for production of FGH
- Improved economy by putting almost complete brake to import FGH thus saving enormous foreign exchange
- Creating jobs by putting new vegetable oil extraction /refining units due to easy availability of FGH in the country
- Peoples' health will be less harmed by using improved FGH (< 100 ppm benzene) for refining vegetable oils
- New FGH unit will create more jobs for engineers and shift operators
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Technology for Simultaneous Production of US Grade Gasoline and Benzene rich extract from FCC gasoline fraction

Creating future fuels

Environmental and human health concerns restricts the average benzene level in Gasoline less than 0.6% in USA and less than 1% in Euro-IV. Gasoline fraction generated from FCC is significantly responsible for higher benzene concentration in gasoline. CSIR-IIP in collaboration with Reliance (RIL) developed and commercialized a state of the art technology for removal of benzene from unprocessed FCC gasoline fraction having boiling range from 50-100 ^{0}C and producing the pure benzene (benzene > 97%)

Salient features

- Process conceived is totally new in the Refining Industry - First time in the world
- Designed with an out-of-the box process configuration which minimizes solvent loss, utility requirements, and maximizes yield & purity of products
- The process does not require any prior hydrogenation step (Naphtha SHU) to saturate di-olefins which makes it simple, energy efficient, and low cost
- Highly thermal stable solvent system
- Both columns (EDC & SRC) run at positive pressure (no requirement of vacuum)-No air ingress
- Recovery of benzene is very high i.e. more than 99%
- US Patent 8722952 granted in May 2014, and 1 Indian Patent has been filed
- Payback period of the unit: not more than 2.5 years (based on the market price of benzene / gasoline)

Commercial status

A 0.6 MMTPA unit based on this technology was successfully commissioned in RIL Jamnagar DTA site under J3 Expansion Project in May 2016

Benefits

- Revenue Benefits to Licenser :
  - Rs 3700 crores per year on the sale of gasoline
  - Rs 600 crores per year from sale of benzene.
- Positioned Reliance to introduce their gasoline in the Indian market and US market
- Emission from low benzene gasoline will improve the air quality and emit less carcinogen products, thus improving the health of the people of metropolitan cities.
- Enabled the India to possess a technology not available elsewhere in the world
- Provides the country a leadership position in marketing this technology to developed and developing nations of the world

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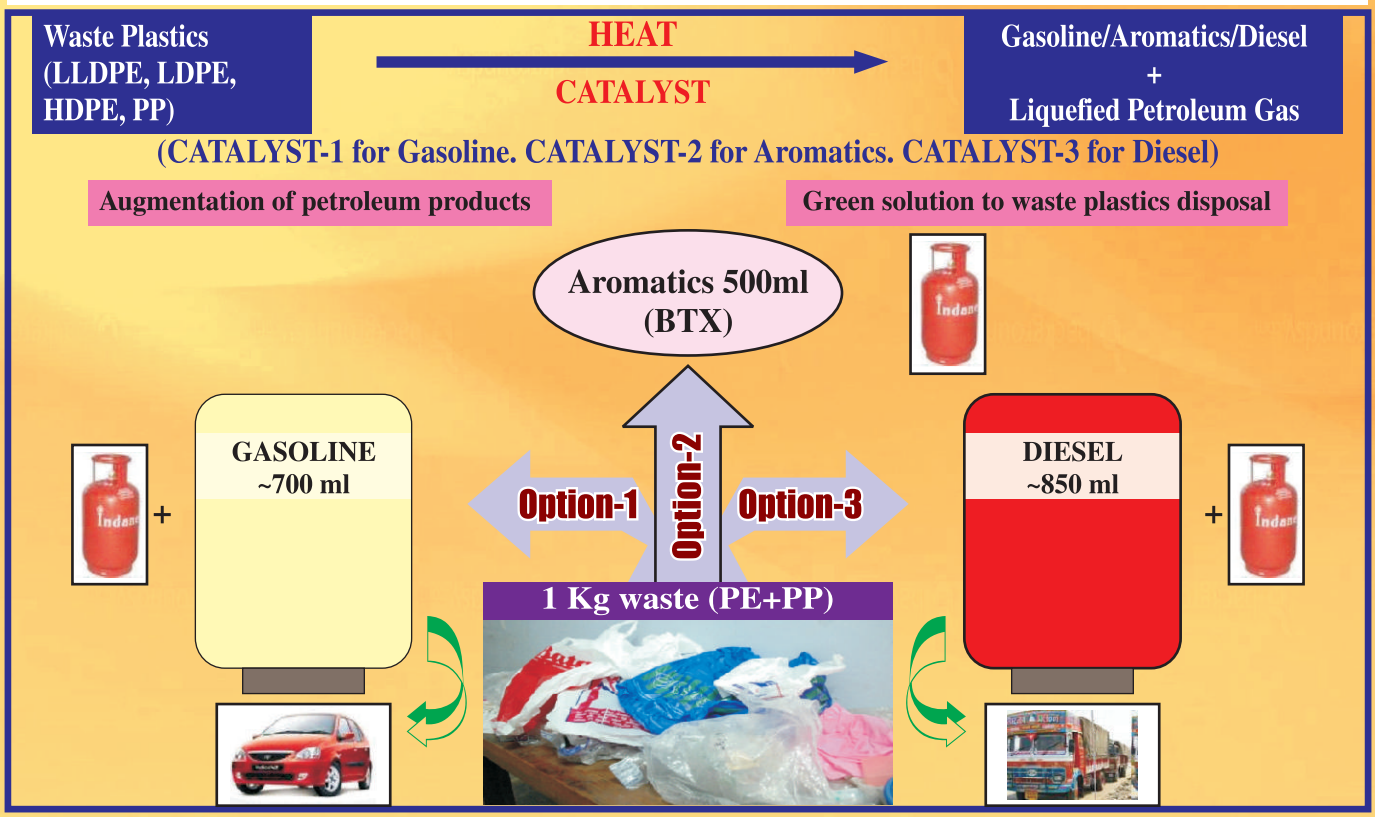
Converting Waste Plastics to Automotive Fuel & Petrochemicals (CSIR-IIP-GAIL Technology)

भापेसं
Creating future fuels

SALIENT FEATURES

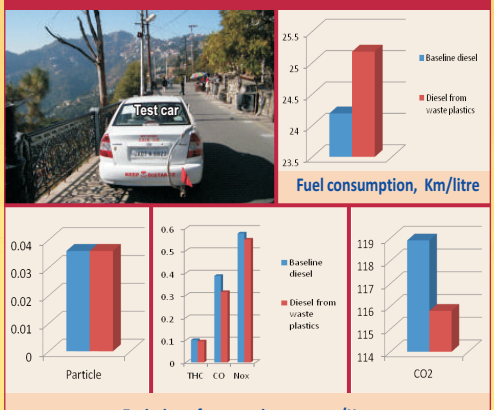
- Exclusive production of either gasoline, or diesel or aromatics alongwith LPG
  - Liquid fuel (Gasoline and Diesel) meeting standard fuel specification
- Aromatics rich in toluene and xylene
  - Scalable from 1-10 TPD capacity
  - All polyolefinic wastes, accounting for 65-70% of total plastic wastes, can be used
  - 1 TPD demo plant has been set up at CSIR-IIP



Properties	Indian Diesel Specifications to meet Euro IV norms	Diesel from waste polyethylene
Density @ 15 °C, Kg/m^3	820-845	821
Distillation 95 % vol at °C, max	360	350
Cetane index	46	51
Viscosity @ 40 °C, cst	2.0 – 4.5	2.2
PAH, max; % mass	11	6
Pour Point, °C	(Sum-12/win-3)	+3
CFPP, °C	(Sum-18/win-6)	+6
Flash point	35	50

BENCH SCALE REACTOR

National Award for Technology Innovation in 2012 for Innovation in Polymer Waste Management & Recycling



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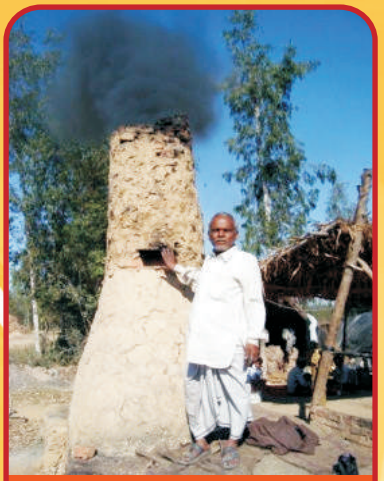
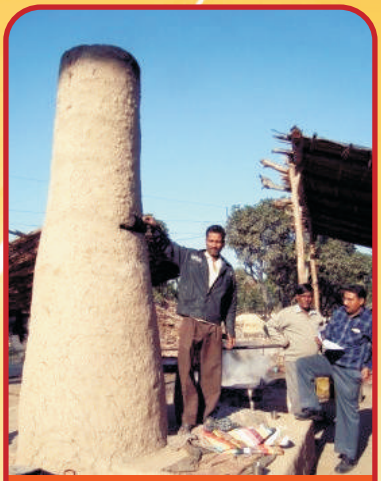
TECHNOLOGIES FOR THE RURAL SECTOR

INTRODUCTION

CSIR-Indian Institute of Petroleum has done considerable work in the development of fuel efficient technologies that can contribute to the needs of industrial, domestic and rural sectors. CSIR-IIP has developed these technologies through improvement in their existing designs with the aim to conserve energy and also reduce pollution and health hazard.



Conventional Plant



Improved Plant

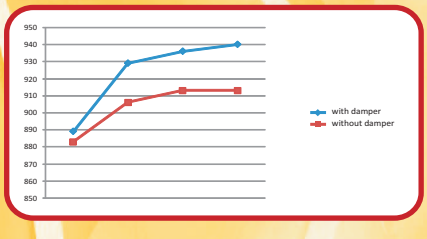
CSIR-IIP improved Gur Bhatti

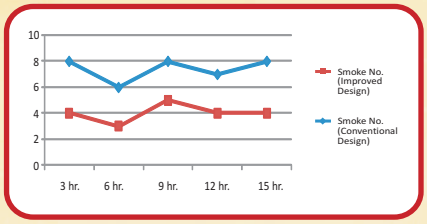
FEATURES

- Inclusion of fire grates for fuel combustion.
- Use of fire bricks for construction.
- Redesigned chimney proper draft.
- Use of dampers in the chimney to control draft.
- Concrete platform for easy charging of fuel.

ADVANTAGE

- 20% reduction in fuel consumption
- 15% increase in daily Gur production capacity
- Significant reduction in smoke and emissions
- Easy charging of fuel into furnace
- Increased life of Gur making plant





"SONA" Energy Saving Vessel

"SONA" ESV (Energy Saving Vessel) is a fuel saving cooking vessel made with aluminum, which when used with domestic and commercial burners save fuel. It is essentially designed to have jacket around the body of a conventional cooking vessel. The hot flue gases which gets dispersed into the atmosphere, now travels through the annular passage between the outer wall of the vessel and the inner wall of the jacket before getting dispersed into atmosphere through gas vent holes. With this, heat content of the flue gas is partially recovered.

Advantage of 'SONA'	How to use
Saves fuel (LPG) from 5-10%	Fuel flow rate must be controlled
Saves time of cooking	Empty "SONA" ESV should not be placed over high flame
Keeps cooked food hot for a long period	Round brush should be used for cleaning annular space
Very good for boiling rice, pulses, potatoes and other vegetables	"SONA" ESV should be moved with lifting handles

Cooking & Lighting Devises

Improved kerosene multi wick stove "NUTAN" has been developed with increased heat output and thermal efficiency. By use of the improved design stoves, about 10 to 15% fuel saving can be achieved as compared to the conventional designs. Technical know how has been given to 10 commercial firms.

Conventional

"NUTAN" Wick Stove

Hurricane Lantern

Improved design of hurricane lantern has been developed to increase its luminous intensity, luminous efficiency and better hurricane proofness. Various parameters in burner and other parts of the lantern have been modified / optimized to achieve these improvements.

Improved

Improved Biomass Chullha

Conventional Chullha		Improved Chullha	
Thermal Efficiency (%)	Total Suspended Particulates (µg/m3)	Thermal Efficiency (%)	Total Suspended Particulates (µg/m3)
15.12	1000	26	950

CSIR-IIP ADDRESS

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Wax De-oiling Technology

About Technology

CSIR-IIP has developed a 'Wax De-oiling Technology' to produce petroleum waxes. This technology is for production of 'Paraffin Wax' and 'Microcrystalline Wax (MCW)' from petroleum streams. Paraffin Wax (PW) is used for making candles, polishes, food packaging etc., while Microcrystalline Wax (MCW) is used mainly in cosmetic industry. There is a great demand of Paraffin Wax and Microcrystalline Wax in the country. The current wax production capacity of Paraffin Wax and Microcrystalline Wax is just enough to meet country's one fourth of Wax requirement only. The deficit in wax demand is met through import. The commercialization of CSIR-IIP's technology at Numaligarh Refinery helped to reduce the demand-supply gap of petroleum waxes in the country.

Salient Features of the Technology

- Uses single solvent (MIBK)
- Lower solvent-to-feed ratio
- Unique multi-stage dilution pattern employing combination of delayed dilution, cold dilution and incremental pattern for maximum gains.
- High filtration rate, lower chiller/filtration area & refrigeration requirements
- Controlled crystallization for producing larger wax crystals with narrow crystal size distribution
- Lower Cost in comparison to foreign technology
- Energy efficient process with built in operational flexibility
- No furnace in solvent recovery system - by applying pinch analysis - which helped NRL to reduce carbon foot print

Commercialization of Technology

The technology has been commercialized at Numaligarh Refinery Limited (NRL) situated in North-East part of India. This is the 1st wax plant set-up by any petroleum refinery in the country based on indigenously developed technology with the largest investment. Numaligarh Refinery Limited (NRL) has started commercial production of Paraffin Wax.

Dedication of NRL Wax Plant to the Nation

The Numaligarh Wax plant was dedicated to the nation by Honorable Prime Minister on 5th February, 2016.

Benefit to the Refinery

High Profitability

After setting-up of wax plant at NRL, the refinery profitability has increased.

Societal Benefits

- The wax plant generated direct employment for local people
- Setting-up of ancillary medium and small sized plants created avenues for generating large scale indirect employment in neighboring areas in North-East region of India.

Benefits to the Nation

The key benefits of setting the wax plant to the nation are :

- It cut down the wax import by 50%
- It saved a substantial amount of foreign exchange

Photograph of NRL Wax Plant

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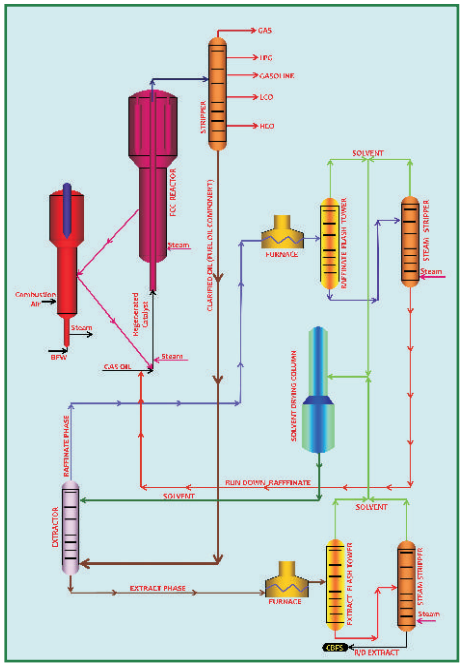
Innovative Technology for Upgrading FCC Clarified Oil into Premium Refinery Products

Creating future fuels

About Technology

In petroleum refinery, Fluid Catalytic Cracking (FCC) unit is one of the important units to produce petrol and diesel. FCC unit always requires good quality feed stocks. CSIR-IIP - has developed an 'Innovative Technology for Upgrading FCC Slurry Oil into Premium Refinery Products'. This technology is based on an innovative concept of combining apparently two distinct and unrelated disciplines i.e. 'solvent extraction' and 'catalytic cracking'. This novel approach provides a unique solution for producing additional quantity of feed for FCC unit, In the process, Clarified oil is subjected to 'solvent extraction' for selective removal of undesirable polynuclear aromatics from it. The de-aromatized clarified oil is circulated along with fresh feed to FCC unit to produce better quality products, while the aromatic extract is taken out as standalone marketable Carbon Black Feed Stock (CBFS) used for carbon black manufacture or as a feed for mesophase pitch.



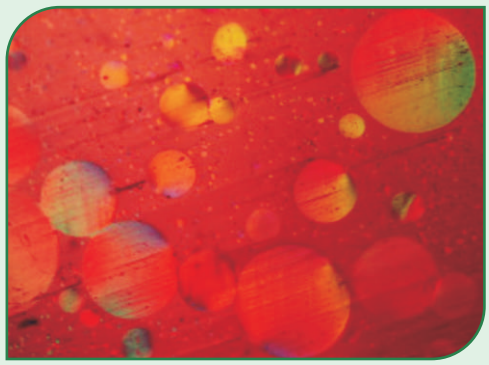
Schematic of the Innovative Process for Up-gradation of FCC Residue into Premium Refinery Products

Salient Features of the Technology

Improved Quality Feed for FCC Unit : The process provides an improved quality feed stock for FCC unit which results in reduction in coke lay down on cracking catalyst and increase the life of cracking catalyst.

High Profitability : Implementation of this technology in one of the Indian refineries showed increased gross refinery margins (GRM)

Environmentally Benign Technology : Since, this technology lowers down carbon deposition on catalyst, it helps in reducing catalyst consumption, load on FCC catalyst regenerator and CO2 emissions and will also help in meeting future carbon emission legislations of the refinery.



Mesophase Pitch Produce from Aromatic Extract

Commercialization of Technology

The technology has been commercialized at one of the Indian Refineries. Mumbai.

NMP Extraction Unit at HPCL Mumbai Refinery

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Technology for Making Petroleum Based Electrode Grade Impregnating Pitch

Creating future fuels

About Technology

CSIR-Indian Institute of Petroleum (IIP) has developed a process for production of petroleum based pitches. Pitch is a vital constituent for production of various carbon materials. This technology is for production of petroleum base impregnating and binder pitches. These pictures one utilized for making and carbon electrodes used in Graphite and Aluminum industries. Theses pitches can also be used as starting materials for making carbon fibers, C-C composites, carbon foam etc. World over there is only one known producer of petroleum based impregnating pitch. CSIR-IIP second time has developed this technology. CSIR-Indian Institute of Petroleum (IIP) has successfully developed and commercialized a technology for production of petroleum based impregnating pitches. The novelty of this process is the use of small dose of organic catalyst which enhances chemical reactions at a faster rate which results in increased.

Petroleum Pitch

Salient Features of the Technology

- It can be used for making some other types of specialized pitches suitable for productions of carbon fibers, carbon spheres and needle coke etc.
- It is much more economical in terms of energy saving
- The by-products can be utilized as a source of naphthalene and for industrial solvents
- It can be easily integrated with petrochemical plants and refineries and offers a great value addition

View of Petroleum Pitch Plant

IIP's Product Comparison with International Product

Properties	A-240 Pitch	CSIR-IIP's Pitch
Softening Point, Deg C	115	112
Coking Value (% wt)	51.38	51.3
Quinoline Insolubles (% wt)	0.07	0.02
Toluene Insolubles (% wt)	0.42	6.2

Major Applications

This technology is for the production of petroleum base impregnating and binder pitches used in Graphite and Aluminum industries. Theses pitches are also the starting materials for carbon fibers, C-C composites, carbon foam etc.

Commercialization of Technology

CSIR-IIP has licensed this technology to a leading graphite electrode manufacturer of our country. This technology is now a proven technology, as pitch produced in plant was found satisfactory in quality and in performance during actual electrode manufacturing process. It is also well comparable with world class product, which is widely used as impregnating pitch in most of the graphite electrode plants world over

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NMP Lube Extraction Technology

About Technology

CSIR-IIP along with EIL and CPCL has developed NMP Lube Extraction Technology for production of Group-I Lube Base Oils. The process uses a tailor made solvent to selectively remove low Viscosity Index (VI) aromatic hydrocarbons from Vacuum distillates/Deasphalted Oils (DAO) and produces paraffinic rich raffinate. This raffinate is used as a feed for Solvent De-waxing Unit to produce Group-I lube base oils. The process can also produce feed for isodewaxing/wax isomerization unit to produce high performance Group-II/III lube base oils. This process after fine tuning can also be utilized to upgrade paraffinic FCC Clarified Oil to generate additional feed for FCC unit. The by-product of this process can be utilized as feed stock for Carbon Black, Rubber Extender Oil, Petroleum Pitches and premium quality Petroleum Coke.

Salient Features of the Technology

- Solvent composition can be tailor made for processing of wide range of lubes (spindle, LN, IN, HN, BS) and other applications
- Low solvent-to-feed ratio
- Low operational temperatures as compared to furfural extraction
- Better heat integration in the solvent recovery sections
- Better products quality etc

Major Applications

- The process uses N-Methyl Pyrrolidone (NMP) solvent to selectively remove low Viscosity Index (VI) aromatic hydrocarbons from Vacuum distillates/Deasphalted Oils (DAO) and produces paraffinic rich raffinate. This raffinate is used as a feed for Solvent De-waxing Unit to produce Group-I lube base oils
- This process can also produce feed for isodewaxing /wax isomerization unit to produce high performance Group-II/III lube base oils.
- This process after fine tuning can also be utilized to upgrade paraffinic FCC Clarified Oil to generate additional feed for FCC unit

Status of Technology

India is the second country to develop this technology followed by USA

Commercialization of Technology

A grass root NMP Lube Extraction Unit of combined throughput 350,000 TPA has been commercialized at one of the India

NMP Lube Extraction Unit at IOCL-Haldia Refinery

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LPG SWEETENING CATALYST

CSIR-Indian Institute of Petroleum, Dehradun in collaboration with Bharat Petroleum Corporation Ltd. (BPCL), Mumbai has developed a globally competitive catalyst ***Thoxcat ES*** applicable for extractive sweetening of LPG, LSRN or pentane and also liquid-liquid sweetening of lighter petroleum fractions like light naphtha or light cracked gasoline.

Catalyst Specifications

Product Name : **Thoxcat ES**
Form : Liquid solution
Color : Dark blue
Odor : Odorless
Specific Gravity @ 15/15°C :1.06 ±0.02
Active ingredient, kg/bottle : 0.5(in 4.7 litres)

Commercial Status

The catalyst has been successfully commercialized in the following units with better performance than other catalyst being used by them.

- BPCL, Mumbai (2008)
- HPCL, Mumbai (2009)
- HPCL, Vizag (2010)
- BORL, Bina (2011)
- HMEL, Bhatinda (2011)
- MRPL, Mangalore (2012)
- IOCL, Digboi (2012)
- RIL, Jamnagar (20012, 2014, 2015)
- ORPIC, Oman (2016)

Awards

- CSIR-Innovation Award-2007
- OCEANTEX Outstanding Award - 2008
- DST-Lockheed Martin Award- 2010
- Most Significant CSIR Technology Award-2015

Patents

Granted : Total 9; USA 2, UK 2, France - 2, India 3

Salient Features

- **Thoxcat ES** catalyst is globally competitive.
- Economical due to its low cost
- Consumption is less for similar conversion
- No investment will be needed for any plant modification
- Applicable in conventional as well as fibre-film contactor sweetening processes

Licensee

License for production and sale of this catalyst **Thoxcat ES** has been given to **M/S Lona Industries Limited**, Alta Bhavan, 532 Senapati Bapat Marg, P.O. Box No. 17006, Dadar, Mumbai-400028 (India).

Catalyst Production Unit

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CSIR-INDIAN INSTITUTE OF PETROLEUM, DEHRADUN 248005
TRAINING PROGRAMMES OFFERED

Creating future fuels

- Petroleum Refining Technology (2 to 7 weeks)
- Petroleum Refining and Petrochemicals Technology
- Application of Fuels & Lubes in Automotive/Industrial Machines
- Vehicular Pollution
- Operation and Maintenance of CFR Engines
- Deposit Rating of Small S.I. Engine Components
- Vehicular Emission & Control
- Physicochemical Analysis and Performance Test Methods for Lubricating Oils and Additives
- Advances in Petroleum Refining & Petrochemicals Technology
- Advances in Processing & Handling of Heavy Crudes
- Crude Assay Using Physicochemical and Analytical Methods
- Testing of Bituminous Materials & Instrumental Techniques
- Adulteration & Analysis of Petroleum Products
- Analysis of Petroleum and Petroleum Products
- Solvent Extraction Technology
- Heat Exchanger: Design, Operation and Trouble Shooting
- Fluid Catalytic Cracking Process Technology
- Corrosion Control & Selection of Material
- Process Integration in Refining Industry for energy conservation

INDIAN CLIENTS

Bharat Petroleum, IndianOil, HP, NRL, BRP, ESSAR, EIL, NTPC, Castrol, HMEL, L&T, ONGC MRPL, CPCL, Chevron Oronite Indian Additives Limited, FLUOR, GAIL, सड़क परिवहन और राजमार्ग मंत्रालय MINISTRY OF ROAD TRANSPORT & HIGHWAYS Government of India, Reliance Industries Limited, UOP A Honeywell Company, IPOL, HONDA POWER PRODUCTS, Raj Group, SUD CHEMIE, NPL Nandan Petrochem Limited

FOREIGN CLIENTS

sabic, Axens IFP Group Technologies

THE NETHERLANDS

Kenya Petroleum Refineries Ltd

Ministry of Water and Energy

SAUDI ARABIAN STANDARDS ORGANIZATION

TEMA LUBE OIL, GHANNA
SSRC, DAMASCUS, SYRIA
MOWIE, ETHOPIA
SASO SAUDI ARABIA
SUDAN

CSIR-IIP imparted training to more than 8000 personnel since its inception. During the last fifteen years, IIP has organized more than 200 training programmes. IIP offers a variety of courses for scientific, technical and management personnel employed in petroleum refining & hydrocarbon industry, Government and academic institutions. These are moderately priced courses designed to impart the necessary knowledge and skills and are conducted by talented and highly competence and experienced scientists. Participants shall be provided ample opportunities to have hands-on experience.

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