हिन्दुस्तान पेट्रोलियम कॉर्पोरेशन लिमिटेड
Hindustan Petroleum Corporation Limited

NEW GENERATION IDEATION CONTEST 2022

HPCL

Hindustan Petroleum Corporation Limited (HPCL) is a Maharatna CPSE and Forbes 2000 Company with Annual Gross Sales of about US$ 48 Billion during FY 2020-21. HPCL has a strong presence in Refining & Marketing of Petroleum Products in the country.

HPCL owns and operates Refineries at Mumbai & Visakhapatnam with design capacities of 9.5 MMTPA & 8.3 MMTPA respectively. HPCL also owns the largest Lube Refinery in the country at Mumbai for producing Lube Oil Base Stock with a capacity of 478 Thousand Metric Tonnes Per Annum (TMTPA). HMEL & MRPL are JVs of HPCL which add to the refining capacity of HPCL portfolio. HPCL, through its subsidiary Prize Petroleum Company Ltd., owns several E&P blocks. Overall, HPCL is a strong player in the field of Refining, Petrochemicals marketing infrastructure, Bitumen emulsions, Biofuels, Natural Gas, etc.

HPCL has a vast marketing network consisting of 21 Zonal offices in major cities and 133 Regional Offices facilitated by a Supply & Distribution Infrastructure comprising 43 Terminals, 47 Aviation Service Stations, 53 LPG Bottling Plants, 6 Lube Blending Plants, 41 Inland Relay Depots and 31 Exclusive Lube Depots.

HPCL is committed to the nation by transforming the energy landscape. HPCL employs latest technologies & marketing techniques to carter to the market demands & make our nation energy independent. HPCL walks hand in hand with nature & implements the mantra of Delivering Happiness, through safety, sustainable growth, and helping the community.

HPGRDC

HPCL has set-up its world class research campus 'HP Green R&D Centre' at Bengaluru, India with a goal to develop innovative & path breaking technologies and products. HP Green R&D Centre is being built in phases in a campus of 104 acres. The Phase–I of the R&D centre has laboratories in the areas of FCC / RFCC, Hydroprocessing, Catalysis, Bioprocesses, Crude Evaluation & Fuels Research, Analytical / Chemical Synthesis, Standard Testing, Process Modelling & Simulation and Nano Technology. The labs under Phase-II include Petrochemicals & Polymers, CoE Lube Research, Resid Upgradation, Engine Testing, Novel Separations, Corrosion Studies and Battery Research. All the labs are built with state-of-the-art research facilities / equipment. The R&D centre is recognized by the Department of Scientific and Industrial Research (DSIR) and has collaborations with various research institutes in India and abroad.

The R&D Centre has made major technical accomplishments in terms of developing & commercializing novel technologies/products in refineries, contributing towards meeting the renewable energy demands, which led to significant cost advantages and efficiency improvements in HPCL.

The R&D centre is an energy research centre par excellence, pioneering innovative & sustainable technologies & products, globally.

Delivering Happiness

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HP GREEN R&D CENTRE

NEW GENERATION IDEATION CONTEST 2022

ABOUT THE COMPETITION

HP Green R&D Centre embarked on an innovation drive in 2019 with an objective to encourage students in India to come up with new and innovative ideas to address modern world challenges such as rising energy demands, environmental pollution and growing consumerism. To support this initiative, HPCL is organizing "New Generation Ideation Contest" providing a golden platform for the students and young researchers to share their innovative solutions for the upcoming challenges. The third edition of the contest was launched in 2021 wherein three entries were selected as winners in the Undergraduate Category, and six entries in the Open Category; whereas, five ideas were awarded commendation prizes. In 2022, HP Green R&D Centre is all set to launch the fourth edition of the innovation drive - New Generation Ideation Contest 2022. In this edition also, various innovative ideas are welcomed from researchers, post graduate scholars and under graduate scholars from across the country in the 10 Themes: Circular economy, artificial intelligence, waste to fuels / chemicals, petroleum refining, hydrogen, CO_2 capture & conversion, advanced energy storage materials / devices, polymer and petrochemicals, novel materials and general.

THEME 1: CIRCULAR ECONOMY

a) India's electronic waste challenge

India has seen a rapid increase in electronic items consumption in the past few decades. With cheaper electronics and quick obsolescence of technology, the single usage of electronic items has increased. At present only a fifth of e-waste generated is recycled safely. Some challenges therein are a general lack of awareness of the problem including hazards associated with disposal in landfills, compliance to the proper collection for disposal, use of unsafe methods of reclamation leading to exposure of workers to hazardous chemicals, pollution of the environment affecting the population at large, need for better technical methods to improve the economics of recycling/reclamation. Research ideas on managing India's electronic waste are important in this regard. Novel ideas and solutions are invited to address the above problems.

b) Cost-effective ways for spent catalyst valorization

Elements such as Ni, Co, Cr, Cu, Zn, Mo, W, Ga, Ge, Sn, Sb, Bi, and, Pb are widely used in catalysis by virtue of their inherent chemical activity. Their recovery from naturally occurring ores is an elaborate expensive process which is energy and water intensive. Besides high cost, exposure to these metals is hazardous to human health and ecology. Disposal of spent catalysts in secured landfill has adverse effect on economics and also poses risk of pollution in event of leaching and leakage to environment. Thus, proper handling and disposal of spent catalysts is an important environmental and economic matter. Reuse of spent catalysts by rejuvenation or reclamation of active metals or alternate uses for spent catalysts is highly desirable. Novel ideas and solutions are invited in this regard. The ideas can include
(i) Cost effective ways of regeneration and rejuvenation of the spent catalyst.
(ii) Alternate applications of spent or regenerated catalysts.
(iii) Cost effective and practical ways for recovery of valuable metals in spent catalysts in bulk scale.

c) Re-refining of used lubricating oil

Lubricating oils are widely used in industries to reduce friction and wear by interposing a thin film of oil between metallic surfaces. During normal use, impurities such as water, salt,dirt, metal scrapings, broken down additive components, varnish and other materials can get mixed in with the oil or be generated in it due to thermal degradation or oxidation. Therefore, the oil quality gradually decreases to a level that the used oil should be replaced by a new one . Disposing the used oil pollutes environment to a great extent . Due to the increasing necessity of environmental protection and the more and more strict environmental legislation the disposal and recycling of used oils become very important As a result, the used oil needs proper management to make it a valuable product. Conventional methods for treatment and recycling include acid – clay treatment, vacuum distillation, solvent extraction etc.
Ideas are invited on developing a cost effective, efficient & environment friendly process for recycling/re-use of waste lubricating oils.

THEME 2: ARTIFICIAL INTELLIGENCE

a) Role of AI in energy transition

Energy transition from fossil-based systems (oil, natural gas and coal) to renewable energy sources like wind and solar, with attendant energy storage has become a dire necessity due to the alarming rate of global warming and climate change, besides limited reserves of fossil resources. The key challenges with these renewable sources is their non-availability on a continuous 24x7 basis and lack of human control over the variation in their intensity with time. This introduces difficulty in matching energy generation with the energy consumption and smooth integration with alternate sources of generation or storage devices. AI can be a useful tool to this end. Ideas are invited for use of Artificial Intelligence techniques / methods which can ensure a smooth energy transition.

b) Machine learning for new alloy development

Corrosion is relentless. Incidents such as Aloha airlines or the Alaskan oil spill have shown us the need for proper corrosion monitoring and usage of corrosion-resistant materials. Several newer corrosion-resistant alloys are being developed to address a host of different corrosion issues. ICME (Integrated Computational Material Engineering) uses DFT as a bottoms-up approach for cutting down both time and cost in the development of new materials from first principles. It provides inputs to CALPHAD amongst other approaches. However, it is computationally very demanding and recommended only when other approaches including direct experimentation are limiting. The lead time for development is typically around 3-5 years, involving multiple trials of material combination and performance assessment. Advanced statistical techniques such as Machine Learning is emerging as a parallel approach which bypasses development of rigorous physically complex and self-consistent models. While it may have limitations in this respect it could add value through quick identification of potential materials which can then be taken up for rigorous modelling.

In this regard, Ideas are invited for use of Machine Learning which can reduce the lead time in alloy development.

THEME 2: ARTIFICIAL INTELLIGENCE (contd.)

c) Advanced corrosion monitoring devices

New advancements in digitalization, automation, and machine learning are paving the way for further progress at the intersection of robotics and corrosion prevention, while increasing efficiency and safety, and even creating new jobs. A variety of robotic technologies are employed to access remote or hazardous areas, conduct precise and repeatable inspections, or perform tasks that are dull, dirty, or physically demanding In this regard, Ideas are invited for the development of advanced robotic technologies for corrosion monitoring.

d) AI based process intensification

AI can help in finding optimized solutions for systems with vast number of variables. For refining / chemical industry, AI based decision making can be a breakthrough in managing resources, pipelines etc. Research ideas/methods on AI based process optimization and intensification are invited in this regard.

e) Artificial intelligence for predicting fouling in heat exchangers

Fouling on process equipment and heat exchanger surfaces have a significant, detrimental impact on the working efficiency and operation of the heat exchangers. The existing research on fouling mitigation is predominantly on fouling prevention using anti-foulant chemicals. A predictive model which can foresee fouling can yield benefits through timely preventive maintenance which in turn can avoid unanticipated shutdowns, improve plant operation, minimize energy consumption and avoid loss of production.
Ideas are invited for use of Artificial Intelligence techniques for creating a prediction model which can predict fouling with precision & accuracy.

THEMES FOR IDEAS NGIC 2022

THEME 3: WASTE TO FUELS / CHEMICALS

a) Catalytic conversion of unconverted cellulose and hemicellulose of 2G ethanol plants:

Lignocellulosic biomass is used for production of 2G ethanol. However, considering the low yields of final ethanol production to make the 2G production plants more economically viable, ideas are invited for valorizing unconverted C5 and C6 sugars to value added chemicals. Considering various possible chemicals from the left biomass, ideas to include scouting of the chemicals basis their demand and value and ease of their production.

b) Bio-waste to fuels / chemicals

With the increasing usage of Ethanol in MS, it is evident that bio-waste is already a valuable resource in production of Ethanol for fuel. However, challenges related to usage of lignocellulose materials for usable chemicals remain. Ideas on valorization bio-waste to chemicals are invited.

c) Biomass to pharmaceutical chemicals

With the increase in pharamaceutical demands & need for valorisation of biomass, cost effective ideas for producing pharma chemicals from biomass is required. Ideas are invited on processes to produce industrial quantities of basic ingredients, or 'platform chemical', for useful pharmaceutical compounds. The focus can mainly be on Green chemistry routes.

d) New physical/chemical methods for dissolution of cellulose

Usually, physical and thermochemical methods available for cellulose hydrolysis are considered as energy and chemical-intensive and are therefore expensive. To develop cellulose-based biofuel technologies that are economical, newer and alternative solutions need to be found for carrying out the hydrolysis of cellulosic materials. Ideas are invited in the area of developing solutions for effective and cost-efficient hydrolysis of cellulose in biomass.

THEME 3: WASTE TO FUELS / CHEMICALS (contd.)

e) New physical/chemical methods for removal of lignin from biomass

The conversion of lignocellulosic biomass into biofuels or other value-added chemicals is majorly affected by biomass recalcitrance. The effectiveness of delignification-pretreatment technologies needs to be further improved for removing lignin effectively and without affecting the recovery of the hemicellulose component. Ideas are invited for developing cost-effective and efficient methods of delignification, which can eventually help in lowering the cost of lignin removal at commercial scales.

f) Development of new microbial strains

Enhancers for higher protein secretion by mycelial fungi, yeast cells

Filamentous fungi and yeast are excellent organisms that can be utilized as factories for the production of proteins at the industrial scale. Due to their metabolic diversity, fungi can utilize diverse types of monosaccharides including glucose, xylose, arabinose, galactose etc. and secrete homologous/heterologous proteins. The protein secretion in fungi can be further improved through bioprocess optimization or strain improvement. New ideas in the areas of cell factory engineering, growth medium development, new cultivation strategies etc. are invited for large scale production of fungal proteins.

Ways to improve protoplast fusion in yeast and mycelial fungi

Protoplast fusion is a widely used technique for improving specific properties of microbial strains. This method resolves the limitations of genetic alternation enforced by conventional mating systems and supports the transfer of relatively large segments of genomic DNA. However, protoplast fusion is successful only when the obtained recombinant is stable. Therefore, ideas are invited in areas related to improved methods/techniques for increasing transformation efficiencies to develop better recombinant yeast and fungal strains would be of immense interest.

THEME 4: PETROLEUM REFINING

a) Low temperature dry reforming of methane:

Dry reforming of methane not only alleviates CO_2 emissions but also produces syngas, which in turn can be used for chemicals and fuels production. High temperature dry reforming process is a well-studied reaction, but low temperature process is advantageous being less energy intensive. However, challenge lies in terms of designing a suitable bimetallic catalyst and ideas are invited for a catalyst design which shows stable catalytic activity under low temperature condition, while yielding results of high temperature process.

Innovative ideas are invited on the area of novel reactors and improved reactor internals for petroleum refining applications.

b) Crude to chemicals

The evolution of modern petroleum refinery is bound towards direct production of valuable chemicals (and not fuel) such as ethylene, propylene, butylene and BTX directly from crude-oil. The production of functional precursors for all downstream chemical industries, e.g. pharma, food industry, polymers are rich in scope for young researchers. Ideas related to 'crude to chemicals' are important in this regard.

c) Refinery elemental sulfur valorization

Elemental sulfur is primarily recovered as a major by-product of the oil refining and natural gas purification processes. It is estimated that more than 70 million tons of sulfur are produced every year. Ideas are invited for i) Cost effective and environmentally benign Pavement applications as mixture of bitumen. ii) Simplified process for production of Sulfur Fertilizers. iii) Cost effective Sulphur polymers for high end applications (high refractive index polymers, Optically active materials).
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d) Alternative process for sulfur removal

Hydrodesulphurization (HDS) is the most commonly used process for the removal of sulphur and other impurities in the petroleum fractions. It is a catalytic process taking place in the presence of hydrogen at medium to high pressures and at elevated temperatures which is an energy intensive operation. Removal of impurities without hydrogen under atmospheric pressure is challenging and provide a substantial reduction in energy cost and GHG emissions along with considerable reduction in hydrogen

THEME 5: HYDROGEN

a) Hydrogen carriers

The transport of hydrogen may impose unexpected risks to the community owing to its wide flammability range. Some Hydrogen carriers are available for long distance hydrogen transportation. As gaseous hydrogen is not suitable for long-distance shipping, it can either be liquefied, converted to ammonia or bound to a liquid organic hydrogen carrier. The choice of an optimal carrier depends on its storage capacity, ease of release of hydrogen, the intended end use, purity requirements and the need for long-term storage. Ultimate storage targets set by DoE (USA) are 6.5 wt% based on the storage material.

Ideas are invited on development of novel materials for transport of hydrogen over long distances in a safe manner with the above characteristics as general guidelines.

b) H_2 fuel cell

Hydrogen, being a clean fuel, has gained huge attention as a future energy source. Fuel cells, in particular, proton exchange membrane fuel cells (PEM FCs) use the chemical energy of hydrogen to produce electricity. They are expected to be one of the key contributors as society transitions towards cleaner forms of energy. Despite the great research progress that has taken place in the field of fuel cells over the past few years, high cost is still hindering its practical implementation in larger markets. A primary reason for this is the use of high cost Platinum catalyst in the electrodes. This catalyst layer is one of the key components which determines the overall performance of the fuel cells. Therefore, intense research has been undertaken to produce alternate cost-effective catalysts with improved catalytic activity.

c) Design improvements of H_2 internal combustion engines

Hydrogen is going to be major sources of energy in the coming decades. Existing IC engines has to be modified to run with hydrogen The differences between a hydrogen ICE and a traditional gasoline engine include hardened valves and valve seats, stronger connecting rods, non-platinum tipped spark plugs, a higher voltage ignition coil, fuel injectors designed for a gas instead of a liquid, larger crankshaft damper, stronger head gasket material, modified (for supercharger) intake manifold, positive pressure supercharger, and high temperature engine oil. All modifications would amount to about one point five times (1.5) the current cost of a gasoline engine.These hydrogen engines burn fuel in the same manner that gasoline engines do.Ideas pertaining to engineering of H_2 engines / engine-components / hybrid-engines are invited.

THEME 6: CO2 CAPTURE & CONVERSION

a) Selective ethanol production from CO_2

CO_2 emissions is on the main reasons for global warming. There is a thrust for converting the CO_2 to various chemicals and fuels. Great research efforts have gone into converting CO_2 to methanol and demonstrated at pilot and commercial plants level. However, production of higher alcohols from CO_2 is challenging due to several elementary reactions involved and controlling the C-C bond length to improve selectivity of selective alcohol is still at research level. Selective conversion of CO_2 to ethanol not only reduces these emissions, but also the ethanol produced can be used as direct gasoline blend and it reduces nation's dependence on crude oil imports.

Innovative ideas are invited on catalyst design for stable and selective production of ethanol through single step CO_2 conversion.

b) CO_2 conversion to valuable Fuel

The primary energy supply comes from fossil fuels like oil, natural gas and coal. The dependency on fossil fuel brings serious environmental problems in addition to the scarcity of energy. One of the most concerning environmental problems is the large contribution to global warming because of the massive discharge of CO_2 in the burning of fossil fuels. Therefore, the preparation of valuable fuels from CO_2 has attracted great attention because it has made a promising step toward simultaneously resolving the environment and energy problems.

In this respect ideas are invited to explore novel catalytic materials and technology which can effectively convert CO_2 to valuable fuel.

c) Novel chemicals/strategies for CO_2 and H_2S absorption

The ideas can include (i) New generation amine chemicals. (ii) homogenous/heterogeneous promoters to enhance the CO_2 and H_2S absorption capacities. (iii) Additives for promoting low temperature regeneration. (iv) Chemicals to mimic the enzymatic promoters for CO_2 and H_2S absorption.

THEME 7: ADVANCED ENERGY STORAGE MATERIALS / DEVICES

a) Flexible solar-cells / transistors

The flexibility of an organic electronic device provides the flexibility of application, opening the imagination scope of the architect. Commercialization of modern flexible OLEDs have demonstrated the possibilities of flexible electronics. Key challenges in flexible solar panels are lower conversion efficiency, fragile mechanical nature, shorter life, use of toxic materials (disposal), faster UV degradation and delamination than rigid panels, besides higher cost. Research ideas are invited to address the above mentioned challenges.

b) Thermo-electrics

The lost heat of electronics / appliances can be recaptured to generate electricity. This approach provides a path towards optimization of heat-losses and increasing overall efficiency of used power. Research ideas on inorganic or organic thermo-electrics are invited.

c) New battery materials

E- Mobility symbolizes a promising trend for the future of mobility by reducing the dependency on fossil fuels. Battery is an indispensable part for e-mobility and as well as stationary applications. Government of India has announced plans to promote e-vehicles and renewable storage on a huge scale by 2030. Currently, Lithium –Ion battery (LIB) technology has been most widely used in e-mobility and stationary storage applications for its high energy density and cycle life. However, mass production of Lithium ion batteries in India is facing major challenges due to the scarcity of key raw materials (nickel, cobalt and lithium) and complicated manufacturing process. Hence, innovative ideas are invited for the development of safe energy storage devices, suitable for Indian ecosystem and diversified climatic conditions.

d) Super capacitors

Presently, rechargeable batteries are solely dominating in e-mobility sector but its progress is hampering for long charging time and moderate power density, which are the very essential parameters for advanced e-Mobility applications. Where the supercapacitor has been recognized for fast charging and high power density but suffering from less energy density. Hence, innovative ideas are invited to develop efficient, novel and cheap electrode materials by Green Synthesis approach for symmetric/asymmetric supercapacitor having high energy density, power density and cycle life.

THEME 8: POLYMER AND PETROCHEMICALS

a) Biodegradable conducting polymeric materials

The biodegradable conducting material is a new class of electroactive biomaterials which possess both electrical conductivity as well as biocompatibility. Novel approaches can be applied to overcome the problem of lack of biodegradability of conducting polymers, mainly through (1) Synthesis of block copolymer in which modified electroactive oligomers connected via degradable ester linkages and (2) synthesis of modified electroactive and biodegradable macro monomers based on polyesters used in a second step copolymerization with conductive monomers (3) Other routes. The conducting biomaterials have a huge application in tissue engineering, biosensor, drug delivery and antibacterial and antimicrobial application. Ideas are invited for synthesis of biocompatible materials with good electrical conductivity.

b) Polymeric electrochromic materials

An electrochromic material is one where a reversible colour change takes place upon reduction (gain of electrons) or oxidation (loss of electrons), on passage of electrical current after the application of an appropriate electrode potential. State-of-art electrochromic devices have wide application in the field of display devices and smart window etc. The conventional electrochromic devices comprise at least 7 layers (i)Transparent substance (e.g. glass), (ii)Transparent conductor (ITO or conducting polymers), (iii) Electrochromic conductor, (iv) Supporting electrolyte or ion conductor (LiClO4), (v) Electrochromic conductor, (vi) Transparent conductor, (vii) Glass substrate. If one material can work as both transparent conductor and electrochromic conductor then simplest device will be 3 layered structure with all polymer materials, which will reduce weight and lifetime of the device will be longer as number of layers are decreased. Ideas are invited for development of transperant conductors which are also electrochromic in nature.

THEME 8: POLYMER AND PETROCHEMICALS (contd.)

c) Thermally conductive polyolefin composites

The advantages of thermally conductive plastics compared to typically used metals and ceramics include improved corrosion resistance, lighter weight, and the ability to adapt the conductivity to suit the applications needs. For example, a thermally conductive plastic is ideally suited for heat sink applications, such as lighting ballasts and transformer housings. The literatures concerning thermal conductive plastic composites are particularly focused on the use of different kinds of fillers, such as boron nitride (BN), aluminum nitride (AlN), silicon nitride (Si_3N_4), alumina (Al_2O_3), silicon carbide (SiC), silica (SiO_2), and diamond. Carbon based materials like graphite, exfoliated graphite, graphite nanoplatelets, carbon nanotubes, carbon fiber, conductive carbon black, and graphene have been extensively studied as conductive fillers to improve corrosion resistance. UHMWPE nanofibers with thermal conductivity 104 $Wm^{-1}K^{-1}$ is reported in literature. While this is a good advancement, the thermal conductivity is still lower than that of metals and carbon materials which are commonly used for such applications. Ideas are invited for development of plastic materials / composites with high thermal conductivity, ease of processing and good mechanical properties.

d) Self-reinforced polymer composite

Self-reinforced composites (SRC), also known as single polymer composites, are fibre reinforced composite materials. The fibre reinforcement in these materials is a highly orientated version of the same polymer from which the matrix is made. For example; a UHMWPE matrix reinforced with highly orientated UHWMPE fibres. Self-reinforced polymer composites are currently being developed using numerous different thermoplastic polymers such as polyamide, polyethylene, polyethylene terephthalate and polypropylene. Research ideas are invited for the development of self reinforced polymer composites.

THEME 8: POLYMER AND PETROCHEMICALS (contd.)

e) Polyolefin adhesives

Polyolefin polymers are used extensively in producing plastics and elastomers due to their excellent chemical and physical properties as well as their low price and easy processing. However, they are also one of the most difficult materials to bond with adhesives because of the wax-like nature of their surface. Advances have been made in bonding polyolefin based materials through improved surface preparation processes. If we use polyolefin itself as adhesive to bond polyolefin parts, it will have many advantages. Polyolefin adhesives are odor free and Volatile Organic Compound (VOC) emission free adhesives. Since, we are bonding polyolefin parts, no surface treatment is required. These adhesives are fast, high performing, efficient adhesives, require lower application temperature, and shows longer pot life. Polyolefin that can be used to make polyolefin adhesives includes, Polyethylene, Polypropylene, Metallocene ethylene propylene copolymer, Chlorinated polypropylene, Low density polyethylene. Research ideas are invited for development of polyolefin based adhesives.

THEME 9: NOVEL SEPARATION MATERIALS

a) Membranes for CO_2 separation

CO_2 separation and capture have become need of the hour in order to achieve Net Zero. Membrane separation is one of the technologies available for CO_2 separation/capture which needs further research and developments to make it commercially & economically viable. Ideas are invited in the area of membranes development for a) separating CO_2 from raw biogas b) Separating CO_2 from industrial flue gases.

b) Li-capturing membranes

Lithium which is used in batteries (LIB) plays an important role in renewable energy and e-mobility. With the increasing growth in use of LIB there are concerns of long term availability of virgin Li. Thus recovery, recycle and reuse of Li is important. Hydrometallurgy and pyrometallurgy are currently used for recovering Li from brine or ores. These processes culminate in its precipitation as Li_2CO_3. These processes are energy intensive and have adverse environmental impact due to generation of waste. Membrane based technologies for recovering Li would be useful in mitigating harmful aspects of conventional methods and improving purity of Li product. Li is an s-block element and thus not prone to form coordination complexes like transition metals. As such, capturing Li metal is a challenging task. Ideas related to Li-capture using membranes are invited.

c) Nanomaterials application in oil & gas industry

Nanomaterials have unique properties such as optical, magnetic, excellent thermal and electrical conductivity due to their small size, quantum effects, tuneable band gap, high surface area. Nanomaterials plays a vital role in the various electronics, tunable energy (solar and battery), medicine, catalyst, environment, food, defence, coatings, sensors, paints, and textile applications due to their unique physical and chemical properties.
Ideas are invited for the real and practical application of nanoparticles / nanomaterials in oil and gas industry by solving the problems like agglomeration, cost effective and ease of material synthesis.

THEME 9: NOVEL SEPARATION MATERIALS (contd.)

d) Continuous flow zeolite synthesis

Zeolites are crystalline alumino-silicates with uniform nanometer-sized pores. Their unique frameworks and high surface areas make them widely used in chemical and petrochemical processes, such as fuels production, fine chemicals and pharmaceuticals synthesis, membrane reactors, sensors, etc. Hence, consumption of zeolites is expected to increase with the emergence of newly commercialized applications. Synthesis of most zeolites is carried out as a batch operation. Depending on the targeted framework and composition, several hours to days are required to complete the synthesis of a crystalline product. Batchwise synthesis poses several challenges in terms of economic efficiency, quality control, operational flexibility and in-situ characterization when large-scale manufacturing is considered.

In contrast, continuous flow process overcomes these drawbacks. To realize continuous flow production, shortening the synthesis period is therefore an issue of utmost importance. Moreover, with a remarkably short synthesis period, the continuous flow synthesis would be advantageous for the mass production of industrially important zeolites.

Innovative ideas are invited in the area of process development for continuous synthesis of zeolites.

THEME 10: GENERAL

a) Waste water treatment and waste water recycling technologies

Water treatment and recycle technologies are going to play major role for better livelihood. Ideas are invited on i) Cost effective ways for membrane development for waste water treatment processes. ii) RO membranes for water treatment. iii) RO reject water regeneration technologies.

b) Photocatalytic hydrogen production using waste water

Upcycling of wastewater via effective solar-assisted photocatalytic hydrogen production is vital for future green energy technology because this technique would become readily available as an ecofriendly and inexpensive method for treating industrial wastewater as well as developing alternative energy sources. Among various attractive methods for water splitting photocatalysis is one of the emerging techniques for the development of energy conversion technology . For photocatalytic hydrogen production, developing a novel semiconductive material is essential to enhance the charge separation because the large number of photo-generated charge carriers may promote the photocatalysis reaction. In general, semiconductor materials exhibit the increased potential energy from the photocatalytic reaction because of their flexible constitution and diversity of properties. Even though a variety of inorganic semiconductors showed a potential hydrogen production ability through photocatalytic reactions, there has been a serious drawback in water-splitting due to its absorption of visible light and bandgap variations . Ideas are invited on the development of materials with enhanced efficiency.

c) Process intensification in refining industry

Process Intensification (PI) makes dramatic reductions in the size of unit operations where by its reduces capital costs and allows for integration of equipment/processes to achieve high capacity, reduced footprint (area), increased selectivity and enhanced heat and mass transfer rates. Ideas are invited from the participants in the area of process intensification with respect to oscillatory baffled reactors, spinning disc reactors, Rotating packed beds, Compact heat exchangers, Micro reactors & Catalytic plate reactors.

In refineries, distillation is used in many processes such as Crude oil distillation, Propane –propylene separation, Cracked distillate separation, BTX separation, hydrotreater diesel separation, etc and being energy intensive process it consumes nearly 40-60% of energy in the refining industry. Hence, novel ideas are sought for reducing the energy / space requirement of the distillation processes.

THEME 10: GENERAL (contd.)

d) E-Mobility

Role of Oil Industries in Future Automotive Technologies Automobile industry is racing towards a new world, driven by sustainability and currently going through a transition phase where various technologies are constantly evolving, hydrogen vehicles, hybrid vehicles, fuel-cell vehicles, connected, autonomous, shared and electric (CASE) vehicle and smart mobility are some of the examples. As automotive industry is one of the biggest consumers for oil companies products, any change in the functionality of automotive industry would have a significant impact on oil and gas industries business.

Ideas are invited from the participants to address the question "How would an oil industry conduct R&D in order to match the pace of the innovations currently the automotive industry is going through?"

ARCHIVES

2021

Award Ceremony – NGI Contest 2021

Award Ceremony – NGI Contest 2021

Award Ceremony – NGI Contest 2021

Poster Session – NGI Contest 2021

Poster Session – NGI Contest 2021

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2020

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Award Ceremony – NGI Contest 2019


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HP GREEN R&D CENTRE

NEW GENERATION IDEATION CONTEST 2022

हिन्दुस्तान पेट्रोलियम कॉर्पोरेशन लिमिटेड

Hindustan Petroleum Corporation Limited

RESULTS 2021

UNDER GRADUATE CATEGORY

Position	Title of Idea	List of All Authors	Name of institution
1st	Metal organic framework based Janus solar absorber for effective photo thermal desalination	Abhyavartin Selvam	Amity Institute of Nanotechnology
2nd	Wastewater treatment and wastewater recycling technologies coal bed adsorption for wastewater treatment	Bhushan Murjani,Manasi Bansod Pankti SavlaSudarshan Shreenivas Saloni Vaidya Parikshit Kadus	ICT Mumbai
3rd	Direct band gap $g\text{-}C_3N_4$ nanoribbons with tunable electronic & photocatalytic properties for OER/HER:A combined DFT and ML ctudy	Anwesh Kumar	RGIPT, Amethi
Commendation Prize	Recovery of base oil from waste grease	Raj Khare	NIT Raipur
	MgB_2-aspartic acid (ASP)-layered double hydroxide (LDH) as a super corrosion resistance material under CO_2 corrosion condition	Alok Kumar	RGIPT Amethi

OPEN CATEGORY

Position	Title of Idea	List of All Authors & Institute	Name of institution
1st	Pulling the hot electrons of black gold for storing sun energy into CO_2	Rishi Verma Ritaj Tyagi Robert Bericat Vadell Rajesh Belgamwar Vamsee Voora Jacinto Sá Vivek Polshettiwar	TIFR, Mumbai
2nd	Block chain-based decentralized digital platform for creating sustainable circular economy in plastic waste management field	Nikhil Kumar Panchal Divya Rupam Swathik Mahathi Pradeep	IIT Madras
	Turquoise hydrogen generation using warm plasma under swirl induced flow	Bharathi Raja Rajasekaran Dr. R. Vinu Dr. R. Sarathi	IIT Madras
3rd	Exploiting rhodococcus opacus as microbial cell factories for the production of fatty acid methyl esters (FAME)	Sandhya S Dr. Senthilkumar S Dr. Selvaraju N	IIT Guwahati
	Cellulose based nano-eutectogels as potential superabsorbent for sustainable hygiene products from waste lignocellulose	Debiparna De Malluri Siva Naga Sai B. Satyavathi	IICT Hyderabad
	Recovery of pure hydrogen and sulfur from industrial waste H_2S by greener electrochemical approach	Mukesh Kumar Dr. Tharamani C.N.	IIT Ropar
Commendation Prize	Trifunctional electro catalysts for CO_2 reduction, methanol and H_2O oxidation utilized in rechargeable Zn-CO_2 battery	Sukhjot Kaur Dr. Tharamani C.N.	IIT Ropar
	Green synthesis of carboxylic acids from the industrial emitted gaseous feed stock: Sustainable approach to mitigate the GHS	Athmakuri Tharak Ranaprathap Katakojwala S Venkata Mohan	IICT Hyderabad
	Inexpensive membrane Electrolyser for production of alkaline ionized water	Dr Sridhar Sundergopal Sugali Chandra Sekhar M Shyam Sunder, Manideep P Fatima Saeed, Aarthi T, Sai Kishore Butti	IICT Tarnaka

BEST INSTITUTE AWARD

Council Of Scientific And Industrial Research-Indian Institute Of Chemical Technology (CSIR-IICT), Hyderabad for submission of maximum number of appropriate ideas

Hindustan Petroleum Corporation Limited

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Who should participate?

Competition seeks participation from under graduate students, post graduate students & research scholars from different Institutes, Universities and Colleges, and also from any individuals across India.

How to submit the ideas ?

Participants should submit the ideas on or before **Saturday, 15th October, 2022**

Please visit https://ngic.hindustanpetroleum.com/ **for submission of ideas**

Instructions

- The write-up on Idea should be limited to 1000 words.
- One participant can submit multiple entries through multiple submissions.
- Write-up should be original. Plagiarism is strictly prohibited.
- Ideas will be evaluated based on its Novelty, Applicability, Clarity, Scalability and Integration Potential.
- Shortlisted ideas will be qualified for the next round. The details of next round will be disclosed subsequently.

Prizes will be awarded under two categories:

A) Open Category

B) Under Graduate Category

PRIZES FOR THE WINNERS

1st PRIZES WORTH INR 1,00,000/-

2nd PRIZES WORTH INR 50,000/-

3rd PRIZES WORTH INR 25,000/-

COMMENDATION PRIZES WORTH INR 10,000/-

"Best Institute Award for - NGIC-2022" for contributing maximum number of Shortlisted Ideas in NGIC-2022

CONTACT DETAILS

For any queries / clarifications, please write to us in the following email id:

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