TECHNOLOGIES AVAILABLE FOR TRANSFER AND COMMERCIALIZATION

PROMOTING INNOVATION TRANSFORMING LIVES

NATIONAL RESEARCH DEVELOPMENT CORPORATION

INDIA 's Premier Technology Transfer Organization

[An Enterprise of DSIR, Min. of Science & Technology, Govt of India]

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Foreword

India is celebrating its 75th year of Independence as Azadi ka Amrit Mahotsav and also assumed the G20 Presidency with the motto “Vasudhaiva Kutumbakam” or “One Earth-One Family-One Future”. Science, Technology and Innovation have played a momentous role in strengthening the global ecosystem in achieving SDGs. National Research Development Corporation (NRDC), a Govt. of India Enterprise was established in 1953 for the development, promotion and transfer of technologies emanating from R&D organizations and academic institution in India and abroad. It is functioning under the Department of Scientific and Industrial Research, Ministry of Science & Technology, Government of India.

Over seven decades of its existence, NRDC has developed a wide network with R&D organizations viz. CSIR (Council of Scientific and Industrial Research), NIOT (National Institute of Ocean Technology), DRDO (Defence Research and Development Organisation), ICMR (Indian Council of Medical Research), ICAR (Indian Council of Agricultural Research), universities, industry associations & many more. NRDC nurtures new ideas and inventions by providing support and rewards; ensuring intellectual property protection; effective transfer of know-how from laboratories to industry; providing access to new technologies from India and abroad; exporting Indian technological expertise and offering an array of IP and technology consultancy services.

It has been recognised as the largest depository of wide range of technologies ranging from agriculture, agro-processing, food processing specific to millets, chemical, herbal, electrical and electronics, biotechnologies, mechanical, marines etc. During its long journey NRDC has gained very rich experience in the field of technology/ IPR management, technology transfer and commercialisation. It has signed about 5000 technology license agreements and filed 2000 patents in India and abroad. It has also exported technologies and services to over 20 developing and developed countries including African countries like Senegal, Nigeria, Ivory Coast, Gabon, Madagascar, Ghana, Egypt, Kenya, and Ethiopia, NRDC is recognised, particularly in the developing countries as the source of reliable appropriate technology, machines and services, which are typically suitable for the socio-economic and technological upliftment of these emerging countries.

This compendium is a collection and compilation of the latest significant technologies available for commercialisation in the areas of agriculture, electrical, electronics, chemical, electrochemical, mechanical engineering, oceanographic, corrosion and allied areas including food and millet technologies. A total of 262 technologies having achieved TRL 6 and above are summarized in the compendium. These technologies shall serve as a ready reference for policy makers, industries, entrepreneurs, startups, MSMEs, research scholars, scientists and other stakeholders.

Jai Hind,
Cmde Amit Rastogi (Retd.)
Chairman and Managing Director

Technologies in
RENEWABLE ENERGY SECTOR

SOLAR TREE

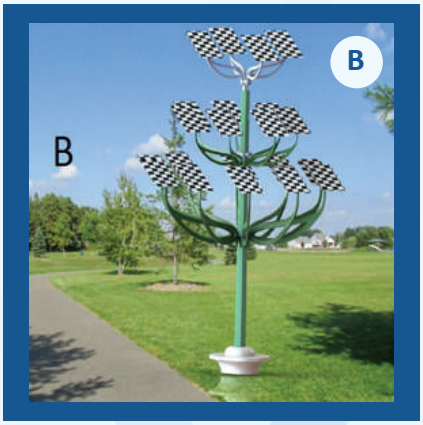
INTRODUCTION

Solar tree is a fusion of art and technological which can harvest 100 times more solar power by utilizing just 1% of land compared to conventional SPV layout. It plays major role in electrification of rural areas and national highways. It holds the panels at a higher height – gets more sun and it can be facilitated with water sprinkler at the top of the SPT. Solar trees are designed with a simple mechanism which can rotate panels to get more power. Two solar artifacts are available namely Sourya Attapatram (1KW) and Sourya Banaspati (5KW). Both the artifacts contain standard PV cells, inverter and battery banks for producing and storing electricity from sunlight.

A. Sourya Attapatram

- Maximum power generation capacity: 1 kW
- Load capacity: 0.5 kW for 3 hours
- Power Supply: 220V AC
- Dimension: Φ 5m x 2.5m Approx.

B. Surya Banaspati



- Maximum power generation capacity: 5 kW
- Load capacity: 1 kW for 10 hours
- Power Supply: 220V AC
- Dimension: 7 m x 5 m approx.

SALIENT FEATURES

- Requires less land
- Simple rotating mechanism.
- Strong metal frame
- Low maintenance
- Peak Power: 5KW;
- Full Load Capacity: 60% of the Peak;
- Battery Back Up: 2 hrs. (Full load);
- Footprint: 4 sq. ft.; Arial Span: 25 ft. Dia,
- Warranty: Panel: 25 Years

INDUSTRY SECTOR: Generating power

SCALE OF DEVELOPMENT: The process is under way to license the technology to five more companies.

WIND SOLAR HYBRID (WISH) SYSTEM

INTRODUCTION

Wind Solar Hybrid (WISH) System with State-of-the-art light weight rotor with advanced aerodynamic design and composite blades and having a Charge controller which ensures steady power supply (adapted to suit hybrid power system, with battery overcharge protection).The system includes a wind turbine, solar photovoltaic unit, charge controller, outdoor control panel and a battery bank. A 500W wind-solar hybrid system that is capable of providing power in standalone situations such as bore wells, pumps and other non heavy applications.

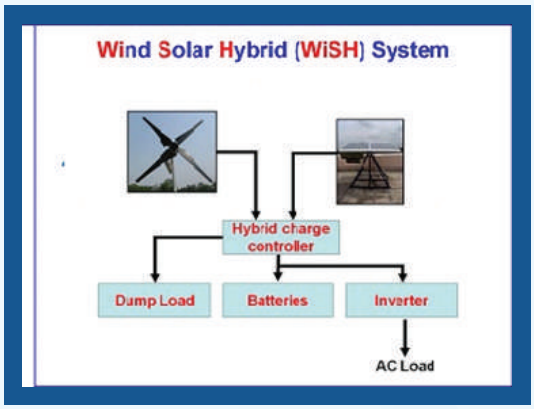
APPLICATIONS

- Catering to domestic and agricultural energy requirements in off-grid villages of the country.
- Roof top variant of WiSH system to meet the requirements of large domestic building in urban areas.

SALIENT FEATURES

- Superior performance for low speed Indian wind regimes, compared to international counterparts
- Auto furling over speed protection
- Charge controller which ensures steady power supply

SCALE OF DEVELOPMENT: Technology Commercialised.



BIOMASS GASIFIER BASED POWER GENERATION SYSTEM

INTRODUCTION

The technological innovation provided users with the option of dual-fuel operation. The existing diesel genset could run on both diesel and producer gas, instead of running only on diesel. The producer gas is fed into the diesel engine to let the engine operate in a dual-fuel mode, thereby reducing diesel consumption by more than 70%. Biomass gasifier system optimally utilizes biomass for power generation. It consists of a downdraft gasifier, a gas-cleaning train, and an engine. A gasifier is a reactor that converts biomass into clean gaseous fuel called producer gas (having calorific value of the order of 1000–1200 kilocalories per normalized cubic metre).

APPLICATION

- Effectively make up for the absence of grid electricity supply in many remote areas

SALIENT FEATURES

- Smooth fuel movement, with the gasifier allowing comparatively larger pieces of wood or fuel briquettes.
- Water seal arrangement with continuous grate-shaking mechanism simplifies ash and char removal without shutting down the system, thus enabling long uninterrupted operation
- Entry of preheated air at two levels helps obtain good quality gas, with low impurities in raw gas.
- Induction of a cooling tower minimizes water requirement for gas cleaning and also reduces the quantities of tar-laden water to be disposed of.

SCALE OF DEVELOPMENT: Technology commercialised.

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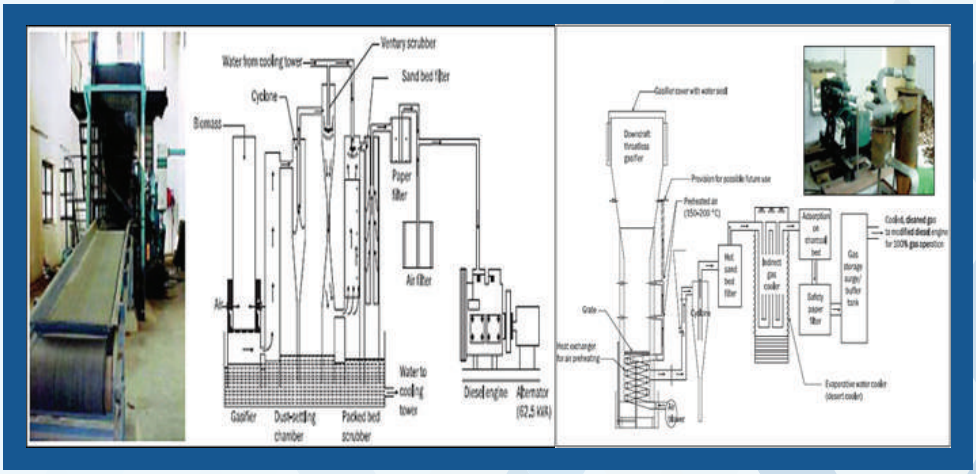


NATURAL GAS BASED POT AND MUFFLE FURNACES FOR GLASS INDUSTRY

INTRODUCTION

A model for environmental performance – natural-gas-based pot and muffle furnaces that are energy-efficient, which also make good economic sense. For Pot furnace Keeping the traditional design and mode of operation unchanged, the new system minimized energy wastage by using pre-heated air for combustion, and utilizing the heat of the outgoing flue gases. Also, the installation of efficient combustion systems and use of better refractory and insulation materials reduced functional and structural losses. The refurbished furnace was centrally fired by a single burner mounted on the furnace crown for better heat distribution.

A natural-gas-fired muffle furnace was designed and demonstrated by adopting a participatory technology development approach. The gas-fired design is very similar to the existing coal-fired units, both in terms of construction and operation. The gas-fired furnace has the provision to use better-quality muffles made of silicon carbide that can enhance the muffle life to more than three years. The design was optimized to achieve complete combustion of gas and better distribution of heat. The technological innovation has made it possible to increase production by 10%.

ADVANTAGES

- The glass units could benefit immensely as the gas-fired furnaces demonstrate energy savings up to 50% and 30% in the case of pot and muffle furnaces, respectively.
- The new technologies definitely make economic sense, they also boast of an envious combination of being environmentally sound and, most important, much less harmful to the workforce that would now sustainably continue to manufacture glassware for the nation.

SCALE OF DEVELOPMENT: Technology commercialised.

BIOGAS FROM MUNICIPAL SOLID WASTE

INTRODUCTION

The use of waste biomass to generate energy has a huge potential. This approach can decrease waste management problems, pollution, greenhouse gaseous emissions, global warming and the use of fossil fuels. Waste materials, particularly municipal solid waste, can be a resource if we can safely and efficiently convert it into energy. Municipal Solid Waste (MSW) in general contains a significant fraction of paper, food waste, wood and yard trimmings, cotton, leather etc and can be considered as a source of biomass. Materials derived from fossil fuels, such as plastics, rubber, and fabrics, are also found in MSW. The declining level of fossil fuel in its underground reserve triggers the production of biogas from municipal waste at different countries. Biogas production from organic waste is a well developed technology. In this process the laboratory has incorporated different technological interventions to make the process more mechanized and efficient. Biomass Grinder cum Stirrer in a single unit where grinding and String is being done simultaneously. Automatic gas evacuation system sensing the position of the floating dome mitigating the manual intervention will be done. Recycling of the slurry water improves the gas production yield and fresh water consumption.

APPLICATION

- Renewable, as well as a clean source of
- Energy from bio-degradable waste. By-product of the biogas generation process
- It is enriched organic (digestate), which is a supplement to chemical fertilizers.
  A simple and low-cost technology that
- Encourages a circular economy through minimal or manual intervention.

SALIENT FEATURES

- Gas generated through bio-digestion is non-polluting, it actually reduces greenhouse emissions (i.e. reduces the greenhouse effect).
- Digestate is enriched organic fertilizer
- Supplement to chemical fertilizers. Reduced Soil and Water Pollution by recycling and not allowing toxic liquids to drain or underground water sources.

CO-DIGESTION OF TANNERY SOLID WASTE FOR BIOGAS GENERATION

INTRODUCTION

Today tanneries in India face the twin problem of managing process solid waste i.e fleshing, a process solid waste and effluent treatment plant sludge. Fleshing pose serious environmental threat and reuse potential is scarce. Likewise, the treatment of effluent treatment plant's waste activated sludge (WAS) in a sludge digester demands huge investment cost. Keeping these two specific needs, technology has been developed for co-digestion of these two substrates i.e fleshing a process solid waste in combination with waste activated sludge (WAS) for biogas generation. The leather tanning and products industries play prominent roles in the world's economy, particularly for developing countries. Co-digestion is nothing but anaerobic digestion of two or more substrates simultaneously. A pilot scale demonstration plant of capacity 750 kg/day on wet weight basis has been implemented at Calcutta Leather Complex (CLC), Kolkata. After size reduction of fleshing, the fleshings and sludge will be mixed in an optimized mix ratio and will be fed into the anaerobic digester fitted with gas collection system. Digestate will be withdrawn in regular intervals of time and will be dewatered with the help of mechanical dewatering system. Mechanically Dewatered digestate is further dried and can be used as manure.

SALIENT FEATURES

- Protection of environment ie air, water and soil from contamination due to dumping of waste
- Disposal problem of fleshing and WAS in tannery sector can be minimized
- Odour and groundwater pollution problem can be minimized
- Minimization of carbon release into environment and thereby reduction in carbon foot print
- No additional treatment cost due to reusing the produced energy from the waste for operation the plant
- Improves the aesthetic value in and around leather complexes
- Digestate can be used as manure.

HIGH SOLID TREATING COMPACT DIGESTER CUM BIOGAS PLANT

INTRODUCTION

Biogas is a mixture of different components and the composition varies depending upon the characteristics of feed materials, amount of degradation, etc. Biogas predominantly consists of 50 to 70 per cent methane, 30 to 40 per cent carbon dioxide and low amount of other gases. Methane is a combustible gas. The energy content of biogas depends on the amount of methane it contains. Methane content varies from about 50 percent to 70 percent. The production of biogas from organic material under anaerobic condition involves sequence of microbial reactions. During the process complex organic molecule present in the biomass are broken down to sugar, alcohols, pesticides and amino acids by acid producing bacteria. The resultant products are then used to produce methane by another category of bacteria. The laboratory has developed a process for treating organic wastes in a compact digester working on dry digestion principle. It can treat any organic waste without any water addition, and it produces more biogas. The design of the system prevents mosquito breeding and the highly stable slurry (odour free) can be used as organic manure. Unlike the conventional biogas plants, this can operate under higher organic loading rate with better volatile solid removal efficiency (~90%). This scalable process unit presently operates from 5kg to 500 Kg/day wet weight of organic waste in the field.t

APPLICATIONS

Recovering biogas and manure from organic wastes from houses to commercial units.

SALIENT FEATURES

- Compact size
- Needs no water along with organic waste (high solid loading).
- Can treat any food waste (egg shell, lemon, onion, etc.)
- Yields more biogas with high methane content.
- No mosquito breeding problem
- Less slurry out that can be used directly as manure

BIOHYDROGEN PRODUCTION FROM BIOGENIC WASTE (SOLID /LIQUID)

INTRODUCTION

Technology is intended to produce Biohydrogen AND fatty acids from waste/wastewater through acidogenic fermentation apart from its remediation. A stand alone process for hydrogen production or as a unit operation in ETPs, Biohydrogen can be used as:

- Energy carrier for automobile sector.
- Raw material and process ingredients in various industries viz., chemical, pharmaceutical, petroleum, fertilizer, food, etc.
- Supplemented as additive in CNG to increase the efficiency Integrated process produce Biomethane and Biohythane. By-product can be used as platform chemicals after separation or as feedstock for production secondary bio-based product production.

SALIENT FEATURES

- Generates 50,000 liters of bio-hydrogen along with 60% of COD removal efficiency with operation loading rate of 50 g COD/L .
- Designed to apply for any kind of waste/wastewater with higher organic load (COD > 5 g/l; BOD/COD > 0.35) as feedstock.
- Can be designed with 10 m3/day to 100 m3/day of operation.
- Captive and Merchant Applications.
- Standalone process for bio-hydrogen production or as an unit operation in ETPs.
- Can be embedded with existing ETPs in industry for captive production.
- Focal technology for production of Bio-based products from waste.
- Simultaneous remediation with resource recovery.
- Sustainable and renewable technology.
- Supports circular bio-economy and can efficiently embedded with waste bio-refinery platform.

MAJOR RAW MATERIALS: Industrial Wastewater (BOD/COD > 0.35 with COD > 5 g/l) Solid waste viz., food/vegetable waste, organic fraction of municipal waste, sludge, biomass, etc.

MAJOR PLANT EQUIPMENT AND MACHINERY REQUIRED: Acidogenic bioreactor, Biogas holding tanks, buffering tank, gas flow meters, innoculum tank, biogas flare, redox control tank, feed/water storage tank, pumps, air compressor, safety valves, control panel, sensors , etc

SOLAR BIODIESEL HYBRID MINIGRID OF 50KW PEAK CAPACITY

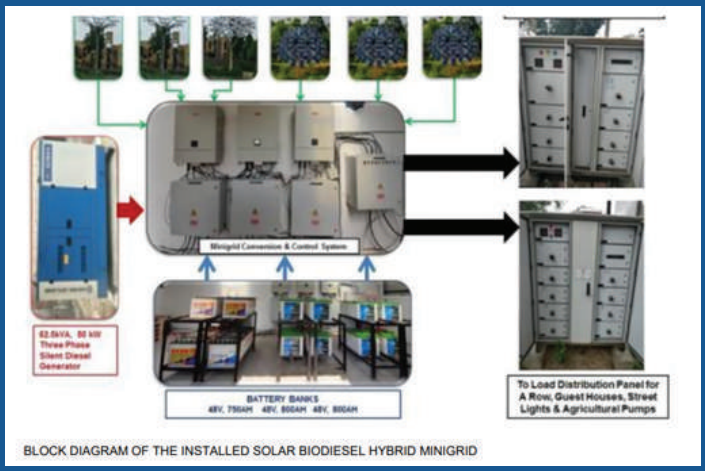
IINTRODUCTION

Demand for electricity in our country is increasing rapidly with improvement in standards of living. Currently, bulk of this demand (62%) is met from fossil fuel (coal, lignite, gas, Diesel etc.) based thermal power plants. However, rapid depletion of these limited fossil fuel reserves has led to the concerns of energy security. In this project CSIRCMERI developed efficient harnessing techniques for renewable energy like Solar Photovoltaics (PV), Biodiesel etc. through establishment of Solar Biodiesel Hybrid Minigrid at CSIR-CMERI, Ludhiana campus, for fulfilling energy needs of the residential colony. Solar Photovoltaics is a rich source of energy available throughout many parts of India. Biodiesel is also a renewable source of energy that can be produced from wide variety of feed stocks like Used Cooking Oil, Waste Vegetable oil, variety of seeds etc. Depending upon the availability of feed stock of the selected location, it can be produced throughout the country. These types of systems, besides being a unique solution for uninterrupted power in remote areas, villages, hilly area etc., also find applications in Smart city projects. Unlike in rural areas, power requirement of domestic loads in cities are higher along with huge fluctuations due to varied usage patterns making the power balancing a challenging issue. To address this issue, Experiments were conducted in the CoEFM residential colony during different times of day, month and different seasons to understand the performance of the developed system under different conditions of loading, solar radiation etc.

SALIENT FEATURES

Peak Capacity: 50 kWp
Solar PV Capacity: 48.35 kWp
Diesel Genset Capacity: 50 kW, 62.5 kVA
Battery Bank: 48V, 2350 AH
Load: Residential Colony (37 Households), Guest House (10 Rooms), Agricultural pumps (10HP Submersible pump & 5 HP Monoblock Pump), Street Lights (~2.5kW)

MAJOR RAW MATERIALS: Solar Panels, Diesel Generator, Biodiesel, Cables, Power conversion system, communication systems



BLOCK DIAGRAM OF THE INSTALLED SOLAR BIODIESEL HYBRID MINIGRID

SOLAR HYDROGEN GENERATION TECHNOLOGY

INTRODUCTION

Hydrogen is energetically dense by weight, storable and transportable. These properties make hydrogen attractive as a fuel for the storage and transport of solar energy. Solar Hydrogen Generation technology has a promising potential to resolve energy shortage and environmental concerns. It will allow us on the one hand to store renewable energy on a large scale, and on the other to use it as fuel in different sectors such as mobility, in the residential and industrial fields and also as a raw material in industry. Photocatalytic water splitting using particulate semiconductor materials has been studied as a simple means of hydrogen production. The photocatalytic systems made up of inexpensive materials for solar hydrogen generation with improved efficiency and stability have been developed.

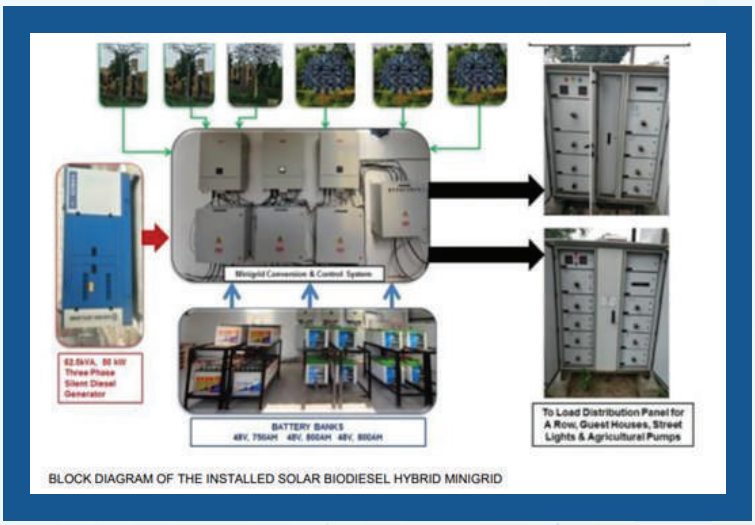
SALIENT FEATURES

A hetero-structured photocatalyst based system has been developed which show the the photocurrent density 7 mA cm-2 (many folds higher than that of reported in literature for any niobate photocatalyst) and 12,000 µmol g-1 h -1 H2 generation rate (TRL LEVEL-4/5).

An inexpensive carbon based photocatalyst system has been developed which show the H2 generation rate of the order of 21,000 µmol g-1h-1. (TRL LEVEL-4).

MAJOR RAW MATERIALS:

Solar Panels, Diesel Generator, Biodiesel, Cables, Power conversion system, communication systems.



BLOCK DIAGRAM OF THE INSTALLED SOLAR BIODIESEL HYBRID MINIGRID

RENEWABLE BIOHYDROGEN (H2) AND PLATFORM CHEMICAL FROM BIOGENIC (SOLID /LIQUID) WASTE

INTRODUCTION

The process aimed to produce hydrogen and fatty acids from waste/wastewater apart from waste remediation. The technology is a standalone process for hydrogen production or as a unit operation in ETPs. Hydrogen can be used in automobile (fuel), chemical industry and oil refining process. By-product can be used as platform chemicals after separation or as feedstock for production secondary bio-based products. The technology can be embedded with existing waste remediation units/ETPs.

T

- It is a sustainable and renewable technology and involves simultaneous remediation with resource recovery.
- It is focal technology for production of Biobased products from waste
- It supports bio refinery, circular bio economy and hydrogen economy.
- Technology is intended to produce Biohydrogen from waste/wastewater through acido-genic fermentation apart from its remediation that can be used in Energy carrier for automobile sector

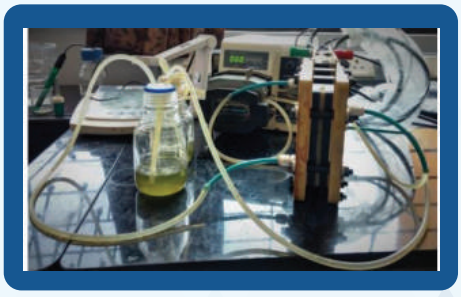
SUSTAINABLE INTEGRATION OF IRON REDOX FLOW BATTERY WITH A RENEWABLE ENERGY SOURCE

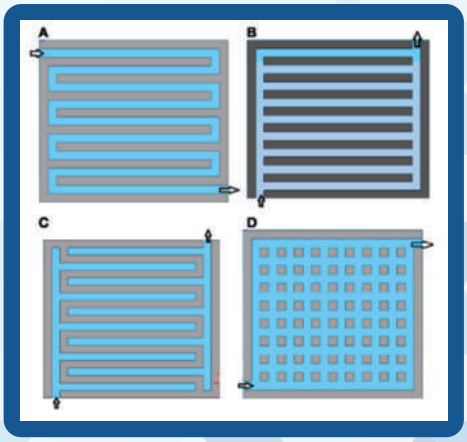
INTRODUCTION

Energy storage technologies are critical in meeting the constantly increasing demand for renewable energy sources such as solar, wind, and others. Due to their low operating costs, scalability and versatility, electrochemical energy storage devices (e.g., rechargeable batteries, flow batteries and supercapacitors) are considered the future electrical energy storage technologies. Redox flow batteries (RFBs) involving Fe, Zn, and V are widely recognized as potential storage options owing to the benefits of decoupling energy and power. The power and energy capacity of redox flow cells can be easily tuned and hence, energy storage flexibility improves. Power can be determined by the number of cells in the stack and the size of electrodes, while the concentration and volume of the electrolyte determine the energy storage capacity. Developing a high-performance iron redox flow battery (IRFB) can outperform the state-of-the-art storage batteries that are highly desirable as next-generation storage devices, particularly for storing large-scale electricity. The proposed project intends to assess the energy efficiencies and techno-economic feasibility of integrating a 500 W all-iron RFB system with a renewable energy source. Such innovative and sustainable energy storage technologies integrated with renewable sources align well with the current call with great novelty.

APPLICATIONS:

- The market readiness for Iron-based redox flow batteries is high. This technology uses eco-friendly, non-toxic, cost-effective iron salts as electrolytes. Compared to other material based technologies, the maintenance cost is also low in Iron-based RFB.
- The redox flow cell and bipolar plates were optimized using CFD analysis. The analyses found that the serpentine flow field exhibited the optimum results compared to the other flow patterns.





Technologies in

ENVIRONMENT MANAGEMENT & WASTE MANAGEMENT

GAS SENSOR FOR ENVIRONMENTAL MONITORING

INTRODUCTION

Industries manufacturing fertilizers, pesticides, chemicals, petrochemicals, etc. are the major sources for releasing dangerous gaseous elements. Due to gas leakage in Industrial and Domestic environment, there is need to employ Gas Sensors extensively to get early gas leakage alarms. Ammonia, Carbon monoxide, Nitrogen oxides and Volatile organic compounds are the cause for many lung disorders which may lead to diseases like cancer and eventually death. MEMS based gas sensors being miniaturized have various advantages as of low power consumption, robust and stable electrical properties. These gas sensors have three main components i.e. Sensor chip, Electronic circuit and power supply. Power requirements of the gas sensor chip decides the over-all power consumption of the gas sensor. The gas sensors have excellent transient performance which is a key feature for the gas sensor response. The system developed will be cost effective compared to available systems.

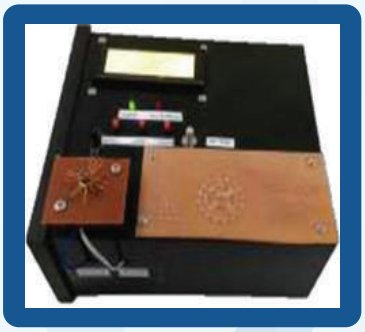
APPLICATIONS

- This reliable gas sensor technology can be a boon to many areas like pollution monitoring, explosive detection, alcohol breath tests, food quality check, and disease detection from breath etc...

SALIENT FEATURES

- It targets the wide range of detection of gases like Ammonia, CO, H2S, NOx, Alcohol, Benzene, etc.
- Miniaturized sensor chip size (2.5 x 2.5 mm) and power requirement: < 1 watt.
- Fast response time.....
- Integrated with portable electronics.

SCALE OF DEVELOPMENT: Technology commercialised.



PLASTIC WASTE SORTING SYSTEM FOR FIVE TYPES OF PLASTICS

INTRODUCTION

Untreated plastic waste is causing enormous damage to the environment, ecology and public health. Thus, recycling of used plastics is gaining importance and has become a great technological and societal subject. In many countries, most of the plastic waste is being manually graded and recycled into very low value raw material. The manual process is unhygienic and prone to subjective and manual errors. Realizing the importance of the problem, a Near Infrared (NIR) spectroscopy based plastic waste sorting system has been developed. This Technology is based on Near Infrared Spectroscopy and Chemo metric techniques, sort's singulated plastics moving on a conveyor. Embedded hardware with wireless interface for remote, safe handling and monitoring.

APPLICATIONS

- The system is useful for segregating waste plastics into different value-added polymer fractions for efficient recycling.
- It sorts plastic waste materials moving on a Conveyor into five types of plastics viz., Poly- Ethylene Teraphthalate (PET), Poly- Propylene (PP), Poly-Vinyl Chloride (PVC), Poly-Styrene (PS) and Poly-Ethylene (PE).
- Aids in easy management of solid plastic waste for recycling.

SALIENT FEATURES

- Real-time, non-destructive and fast sorting of waste plastics.
- Accurate classification of plastics (near 100% for PET
- Capable of sorting about 100 plastic items per minute or approximately 4 tons of plastics per day.
- Automated, low cost system using open source hardware and software Embedded motion control using microcontroller.
- User-friendly Graphical User Interface.
- Implemented on low cost embedded hardware and open source software.

SCALE OF DEVELOPMENT: Technology commercialised.

COMPOSITE BOARD FROM AGRO-WASTE

INTRODUCTION

Brief Description: Medium density boards or Composite boards are a type of board used in false partition, ceiling, table tops, furniture fixtures, mirror backings, etc. These are high grade composite material usually made various types of cellulosic materials. A board manufactured from particles of wood or other lingo-cellulosic materials agglomerated, formed and pressed together by use of an organic or synthetic binder together with one or more of the agents such as heat, pressure, moisture, catalyst, etc.

A process technology has been developed for making medium density composite boards from agricultural wastes like paddy husk, paddy straw and certain reed materials. Use of medium density particle/fibre board's (MDF) gives an added advantage of saving money instead of using real wood products in partitions and furniture products.

Comparative Advantage:

- Environment friendly process.
- The process utilizes agricultural waste, low density timber scrapings and a binder.

Scale of Development: The technology is ready for market launch.

PROCESS TECHNOLOGY FOR SEPARATION OF GLASS AND PHOSPHUR FROM WASTE CFL'S

INTRODUCTION

Fluorescent phosphor is coated on glass tubes which are filled by mercury vapors to make fluorescent lamps. The present technology enables complete recycling of these lamps. Metallic components, Glass and phosphor powder can be very easily separated.

PROCESS SPECIFICATIONS

- Processing Time: 15 minutes
- Use of Simple organic solvents
- Energy Efficient process

APPLICATIONS

- Process can be applied to waste CFLs, night glowing toys, tube lights and spent LED

ADVANTAGES

- Chemical Industry, Recycling Industry, Toys Manufacturers, LED Manufacturers.
- Complete Recycling of Waste CFLs and Tube lights.
- Recovery of Glass and Phosphor Material.

SCALE OF DEVELOPMENT: Technology Licensed awaiting commercialisation.

GASIFICATION OF POWDERY BIOMASS/COAL/INDUSTRIAL WASTES

Brief Description:

Gasifier reactor has been adopted to improvise the mixed flow and plug flow reactor characteristics to ensure full suspension of powdery biomass/coal in a vigorous radial mixing condition in the reactor and to achieve high intensity reaction and gasification which are essential for entrained flow gasification. The gasifier-reactor attains a temperature in the range of 900-1200°C to take the advantages of the kinetics of the process and produce low tar and char formation. The endothermic steam induced reactions with a steam injection coupled with the gasification reactions conserves the sensible process heat in the form of more hydrogen and carbon monoxide.

Major application area of this technology is Rice Mills, Coir industries, Saw Mills & other agro-processing industries. Raw material and machinery.

Comparative Advantages:

- Capable of handling feed stocks with wide range of particle sizes
- Renewable source of energy generation
- Reduction in carbon emission
- Value addition to huge agro-wastes/industrial wastes

Scale of development: Licensed awaiting commercialisation

UTILISATION OF MUNICIPAL SOLID WASTES (MSW) FROM LANDFILL FOR ROAD EMBANKMENT CONSTRUCTION

Conventional road construction uses soil fills for preparation of embankments. Contemporary regulations for use of soil in construction at many places raise the cost of constructing roads. The application of municipal solid waste from landfill for road embankment construction solves the twin problems of cost efficiency as well as environmental hazards of municipal solid wastes dumped as landfills. The process involves segregation of MSW into different size fractions before its use as an embankment material.

SALIENT FEATURES

- Methodology for utilisation of Municipal Solid Waste from landfills.
- Segregated MSW to the extent of 65-75% can be used.
- Typical design cross sections have been arrived for 3m and 5m height MSW embankment.
- The knowhow evolved can be appropriately redesigned based on case specific requirements to suit different projects.

COMPARATIVE ADVANTAGES

- Reduces pollution
- Protects environment and health hazards
- Results in sustainable road construction
- Preserves urban land
- Scale of Development
- Process ready for adoption on field projects.

PROCESS FOR THE PREPARATION OF WASTE PVC (POLY VINYL CHLORIDE) MODIFIED BITUMEN- USEFUL FOR PAVING APPLICATIONS

The process developed uses most toxic plastic waste i.e. PVC waste which is difficult to recycle and which has no safe disposal method and which is the most polluting in terms of dioxins can be safely reused in bituminous roads. Raw materials like VG10 bitumen, waste PVC pipes and additives are the main components in this process.

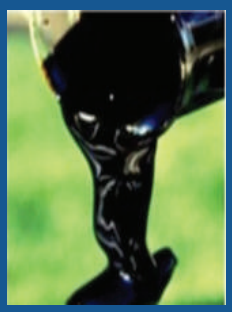
SALIENT FEATURES

- Extends the life of pavement.
- Strength of bituminous mix is enhanced by way of improvement of properties of neat bitumen
- Process allows to get rid of hazardous PVC plastic waste in a safer way.

COMPARATIVE ADVANTAGES

- Utilises waste product PVC- waste to wealth approach.
- No adverse effect on environment.

SCALE OF DEVELOPMENT: Laboratory Scale



GEOPOLYMER CEMENT

New sustainable technologies are being adopted to meet the twin paradox of balancing demand and reducing carbon footprint of the processes. Geopolymer Cement utilising waste by-products like fly ash and blast furnace slag is one such technology that while retaining most features of ordinary Portland cement, is also green. It has significant carbon emission reduction potential (over 70% as compared to OPC) and contributes positively towards the environment.

SALIENT FEATURES

- Properties similar to Portland Pozzolana Cement.
- Fire resistant up to 900 degrees Celsius.
- Major raw materials include fly ash, ground granulated blast furnace slag, chemical. admixtures, and commercial grade alkali hydroxide or silicates.

COMPARATIVE ADVANTAGES

- LEED Green Building Technology compliant.
- Higher durability than OPC .
- 70 % less CO2 generation.

RAPID COMPOSTING OF MUNICIPAL SOLID WASTE

BRIEF DESCRIPTION:

Rapid composting aims at enhancing the rate of organic matter degradation while keeping the nutrient content of the compost high. Most influential parameters on composting are: Temperature, pH, aeration, moisture, size, nature and volume of substrate, C/N ratio, C/P ratio etc. The approach of rapid composting is to keep all the vital parameters in optimum levels to speed up the process of composting. Rapid composting is achieved either by changing the working environment of degrading microbes or modifying the substrate for composting by physical, chemical or biological methods.

The four ton compost pilot plant for 240 houses and 1000 population employs aerobic composting process for organic fraction of municipal solid waste. Compost is used in campus gardens and colony as good quality soil conditioner. In a novel approach, the spores of Trichoderma reesei have been capsuled with suitable binder and bulking agents to simplify storage of this microbe and to use it in a user-friendly way.

ADVANTAGE:

- Rapid composting shortens the composting period with considerable reduction in C/N ratio
- The developed technology reduces composting period from 6 weeks to 2 weeks by employing cellulolytic fungi, Trichoderma reesei along with initial glucose supplementation

Scale of Development: Awaiting commercialization

Fig: Door to door waste collection from colony

Fig: Operation at compost Plant

Fig: Final Compost

PLASMA DISPOSAL OF PLASTIC WASTE AND GENERATION OF SYNGAS FOR POWER GENERATION

BRIEF DESCRIPTION:

The rapid rate of worldwide urbanization has led to increasing plastic waste generation. This increase has resulted in a large amount of plastic waste, particularly plastic bags and PET bottles, being littered on land filled. To address this problem a new technology has been developed for volume reduction of the waste streams through plasma pyrolysis resulting in by-product syngas which is a clean fuel

Salient Features: The bricks and building material obtained by this process have

Uniform gasification, Offers a single step treatment
Complete destruction of plastic waste
Reduce the need for landfill
Safer disposal of plastic waste

Advantage:

Energy recovery system- contributing saving of resources
Provides volume reduction of the waste streams
The extreme high temp. of plasma kill stable bacteria
Provide electricity to power the process
Supply excess electricity for sale
Formation of complex molecules , such as dioxins, is prevented
Reduce the need for landfill
Supply excess electricity for sale

Scale of development: Commercialized

RECYCLING OF PLASTIC WASTES INTO TILES FOR STRUCTURE DESIGNING FOR SOCIETAL USAGE

BRIEF DESCRIPTION:

The plastic products have become an integral part of all our lives, and play an irreplaceable role in our day to day activities. Disposal of Plastic Waste is a major problem worldwide. It is non-biodegradable and it mainly consists of low density polyethylene plastic bags, bottles etc. Burning of these waste plastic bags causes environmental pollution. The main objective of the present project is to utilize waste plastic bags for designing of materials for utilization of tiles in building of toilets and rooms for general public for societal benefits.

Utilization of waste plastic bags and bottles in the form of tiles which can be used for designing the structure for making a smart toilet or any other structure for societal usage. Various issues like mechanical strength, flame retardency, water permeability and UV protection from sunlight and antistatic response is the novelty of concept.

ADVANTAGE:

The advantage of the innovation is the utilization of waste plastic bags and bottles in the form of tiles which can be used for designing the structure for making a smart toilet or any other structure for societal usage. One of such waterless toilet structures made at is shown in figure.

Scale of development: Technology Demonstration completed

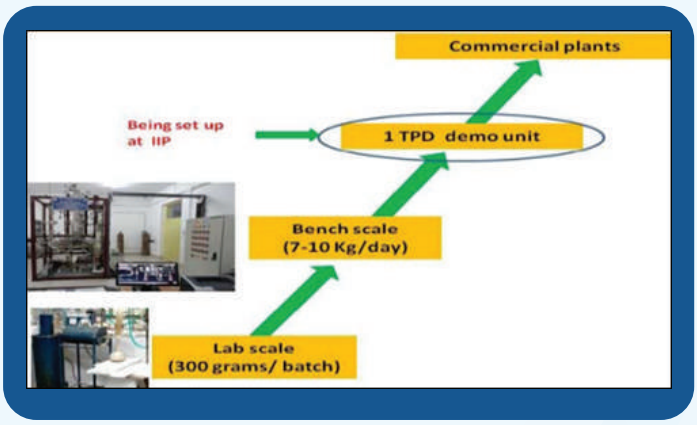
WASTE PLASTICS TO FUEL AND PETROCHEMICALS

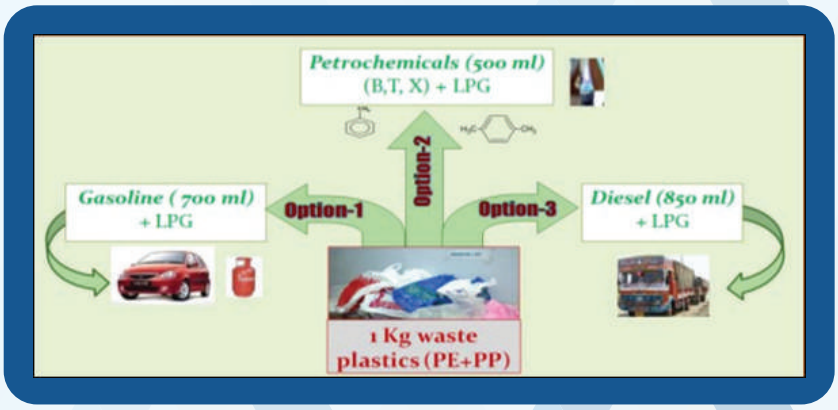
BRIEF DESCRIPTION:

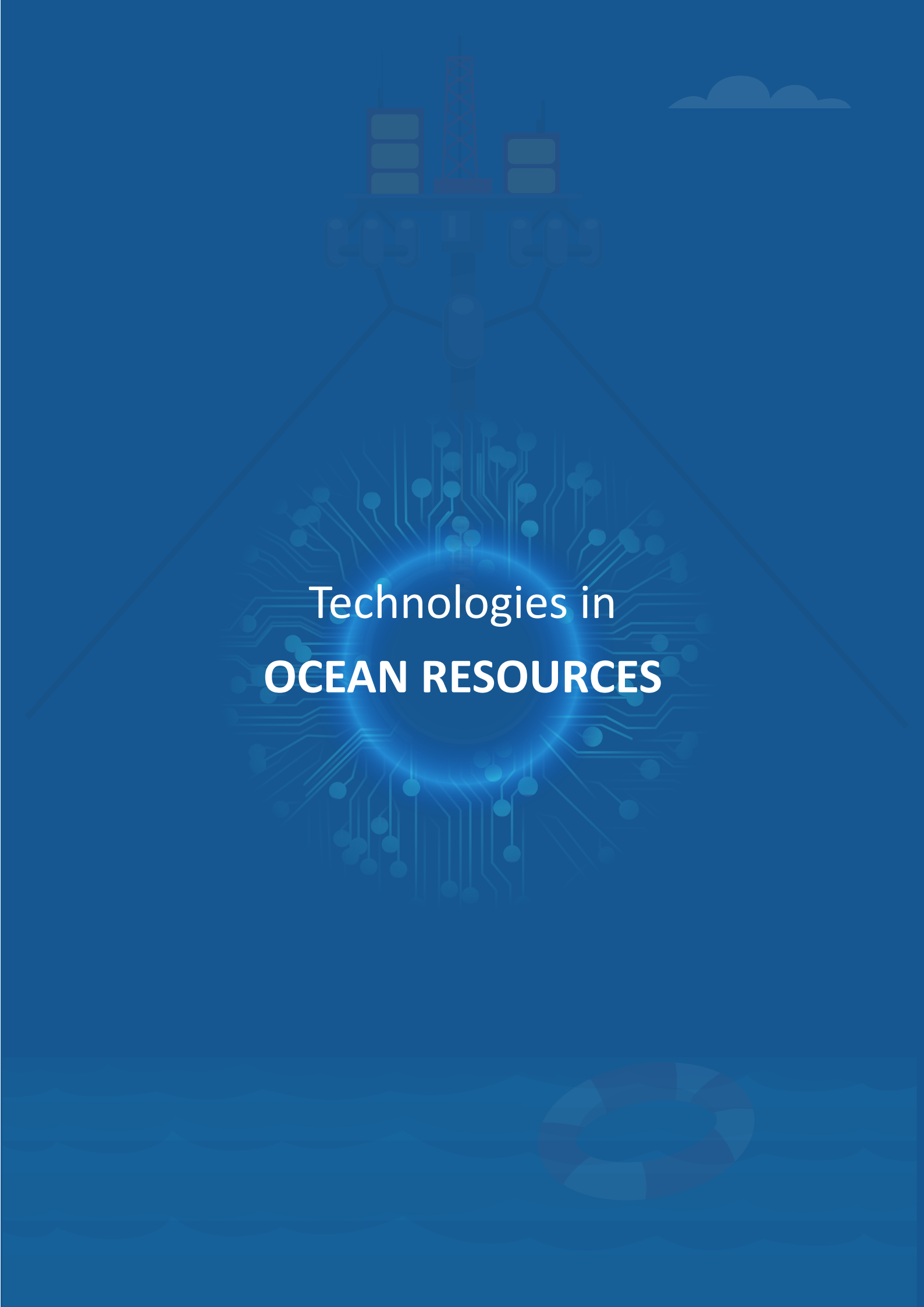
This technology is for the conversion of waste plastics (polyethylene and polypropylene) to exclusively any one of the products viz. gasoline, diesel or aromatics. The gasoline and diesel meet most of the BS IV/VI specifications while the petrochemicals are rich in toluene and xylenes. Conversion of waste plastics to exclusively either automotive grade gasoline or diesel or petrochemicals; 1 Kg of clean plastics can produce either 800 Ml of diesel or 700 ml of gasoline or 500 ml of petrochemical; Process is environment friendly as no toxic gases are evolved

ADVANTAGES:

- It converts waste plastics (polyethylene and polypropylene) to exclusively any one of the products viz. gasoline, diesel or aromatics of the BS IV/VI specifications
- Urban local bodies, Indian railways, shrine board etc. - The waste plastics being collected by these can be converted into diesel
- Clean and economical automotive grade fuel from alternative source
- Impetus to waste plastics collection
- Economic benefits to rag pickers
- Green solution to waste plastics disposal






Technologies in
OCEAN RESOURCES

AUTONOMOUS UNDERWATER VEHICLE (AUV) OPERATIONAL UPTO 150 M

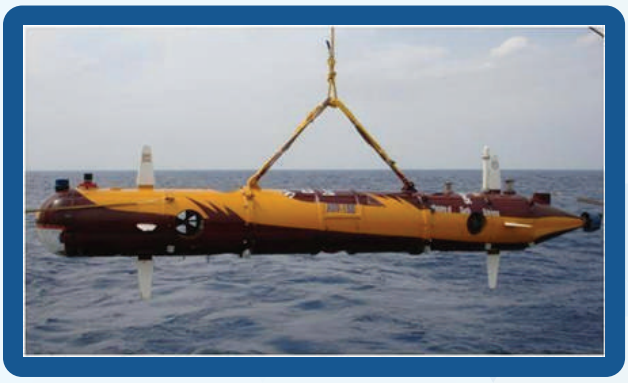
BRIEF DESCRIPTION:

Modular streamline structure helps to integrate additional payloadswith very less efforts with reasonably lesser drag without changingthe original configuration.It is stable against roll motion making it suitable for the sea-bed mapping application in addition to relevant scientific data collection.Degrees of Freedom (DOF) have been reduced from six to five through mechanical design, thereby balancing the roll motion of the system and reducing control complexity.Design for slight positive buoyancy for better diving control and safety i.e., prevention of AUV getting lost on the sea due to any malfunctioning.Controllability of a system with large dimensions (Length 4.9 m., Diameter: 0.5 m.)Dual communication including both RF and Acoustic communication.Emergency handling with power management and leak detection subsystems.Single ground reference point (SGRP) for electrical Isolation and Grounding of the complex AUV system.Capable of autonomous navigation through and pre-defined trajectory.

ADVANTAGE:

AUV-150 can be deployed for seabed mapping, coastal surveillance,mine counter measure and oceanographic measurements during adverse weather conditions.It can perform various jobs related to underwater inspection with camera, surveying etc.

Scale of development: Ready for licensing of Technology



REMOTELY OPERATED VEHICLE (ROV)

BRIEF DESCRIPTION:

Deep water electric work class remotely operated vehicle (ROV) ROSUB6000 (capable of operatingup to 6000m water depth and 500m depth rated for shallow water applications) is developed tomap the coral reefs, to examine the corals and assess the extentof damage or rejuvenation that might be taking place since the great damages happened earlier. The images of corals recorded by the ROV are useful to study the biodiversity of coral reefs andtheir evolution. The water temperature ranged between 31oC at surface and 30.5oC at 1 m water depth.It further decreases in deeper waters as recorded by the ROV based sensor.

ADVANTAGE:

The ROV's can be used not only for research and scientific exploration purposes but also for severalengineering applications. For instance, it can be deployed to conduct underwater inspection of pipelineof an oil and gas company.

Scale of development: Ready for licensing of Technology

AUTONOMOUS UNDERWATER PROFILING DRIFTER

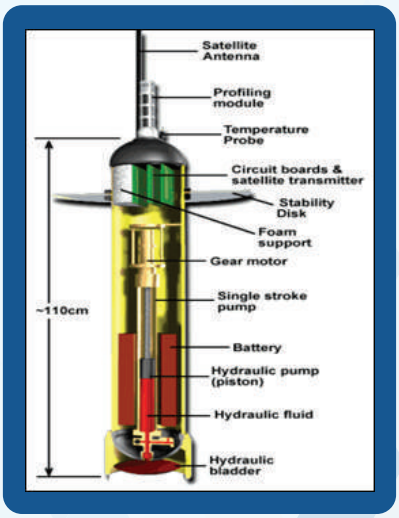
BRIEF DESCRIPTION:

The AUPD is common underwater platform which carries CTD (Conductivity, Temperature and Depth) sensor and profile the sea water measurement at pre-determined depth. These floats drift freely at a predetermined depth, then periodically ascend to the sea surface, report to satellite and descend again back to their parking depth for the next cycle, a typical period of 2 days. These floats are powered by Primary Lithium battery and pre-programmed for typical profiling cycles controlled by a micro controller based embedded electronics. It contributes to the global description of the seasonal and inter-annual variability of the upper ocean thermohaline circulation.

ADVANTAGE:

The main elements of AUPD are high pressure rated hull, buoyancy engine, and controller. The Pressure enclosure (hull, top and bottom cover) protects the subsystems from the external pressure and is pressure rated for 200 bar. Hull is made of Aluminum Alloy (Al 6061) which is light weight and corrosion resistive. Conductivity sensor, pressure and temperature probe are mounted on the top end of the profiler. Change in buoyancy is accomplished by inflating and deflating a rubber bladder using a piston cylinder driven by a geared motor.

Scale of Development: Ready for licensing of Technology.



WIRELESS EXPENDABLE CONDUCTIVITY, TEMPERATURE AND DEPTH PROFILER SYSTEM

BRIEF DESCRIPTION:

An Expendable Bathythermograph (XBT) is a temperature probe that is dropped into the ocean from a ship, either by hand or using an automatic launching system. In this convention method, the temperature profiles are recorded as the probe descends at a known speed about the upper layer (500m) of the ocean and it uses wire ropes for ascending and descending operation of the system. The temperature and salinity is one of the important parameters for deriving sound velocity in the seawater which is used for vessel based sonar's. The continuous and periodical measurements of conductivity, temperature is essential for climates mitigation. Embedding all the necessary requirements, an expendable conductivity, temperature and depth system is developed for oceanography measurements.

It can be freely dropped by hand from any ships without environmental interventions also and data is collected, transferred using wireless communication technology. The data can be collected either in descending or ascending operation which is being implemented using positive and negative buoyancy methodology. The WXCTD is a system used to measure and store the CTD data in real time upon surfacing in Ocean

ADVANTAGE:

- It is widely used to study and understand about upper ocean thermal structures.
- The high accurate conductivity and temperature data is collected throughout the profile incorporating pressure-based depth sensor without any calculation or assumption.
- Accurate depth measurement using pressure sensors
- Single float can be configured for various depth ranges.
- Data transfer through wireless communication which avoid float losses
- Either by hand or automatic launcher. Low power operated system with rechargeable batteries.
- RTC update is possible.
- The user configurable depth profiling data is obtained and stored for transmission.

Scale of development: Ready for licensing of Technology

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SUB BOTTOM PROFILERSYSTEM

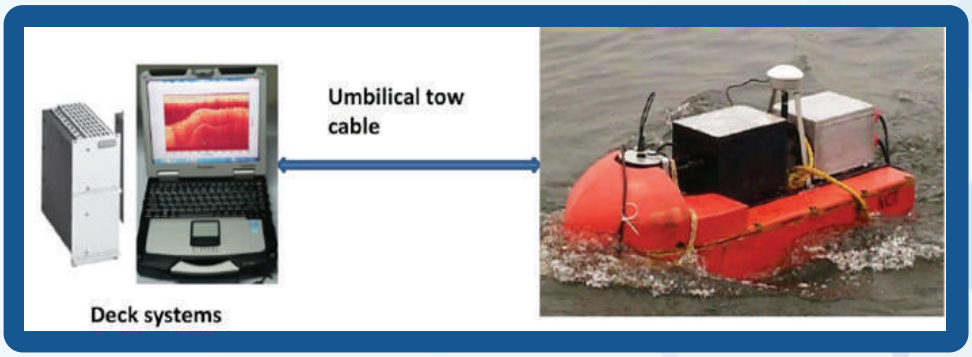
BRIEF DESCRIPTION:

Shallow water Chirp sub bottom profiler was developed that can profile sea bed with penetration up to 1m in fine sand/clay operable up to 30m depth. It is a tow body-based sonar system which can be towed behind a vessel even in very shallow waters where small fishing vessels can operate. The sub bottom profiler operates in the low frequency range in 2-24 kHz and is user friendly. The sub systems like Signal generator, Power amplifier, Transmitter, Hydrophone arrays, Preamplifiers, Data Acquisition systems (DAQ), signal processing software etc are fully Indigenous and Patent applications are also filed for the individual systems.

ADVANTAGE:

An umbilical tow cable having conductors for power and Ethernet is used to establish the link between these dry and wet end systems. The deck system consists of only an industrial laptop with MATLAB (for real time signal processing and image generation) and all other sub systems like AC-DC converter (230VAC- 220 VDC) to power up the are housed inside the tow body. The system has user friendly GUI which is installed in the deck side industrial laptop. Operational parameters of the system like frequency of operation, pulse length, transmittingsignal power, data acquisition duration, gain of programmable gain amplifiers, etc. are configurable in the GUI.

Scale of development: Ready for licensing of Technology.



DRIFTING BUOY SYSTEM

BRIEF DESCRIPTION:

Drifting buoys are widely deployed to measure near surface ocean currents and temperature. Drifting buoy was indigenized in India with geostationary satellite communication (INSAT communication) to have near real-time data at every hour. The measurement scheme in the drifting buoys is capable to measure variability in sea surface temperature and small mesoscale surface eddies. The drifter buoys and agro floats technologies were developed with an objective to understand the circulation pattern in Indian Seas and to study the air sea interaction process. Even useful to study the role of ocean in climate variability and El-Nino. These equipments quantitatively describe the upper ocean dynamics and the patterns of ocean climate variability. This information is essential to document seasonal to decadal climate variability and its predictability

ADVANTAGE:

- Durable ABS/ Acetal moulded float
- Components with proven, micropower parametric measurement.
- Data forwarding electronics
- A choice of parameters for measurements, long power autonomy and customizable transmission parameters
- To initialize ocean & coupled ocean-atmosphere forecast
- Better understanding of ocean dynamics and air-sea interaction

Scale of development: Demonstrated and commercialized

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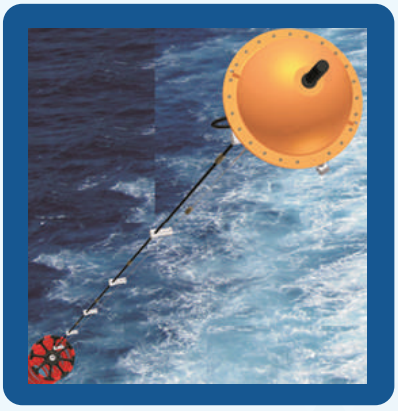


DRISHTI

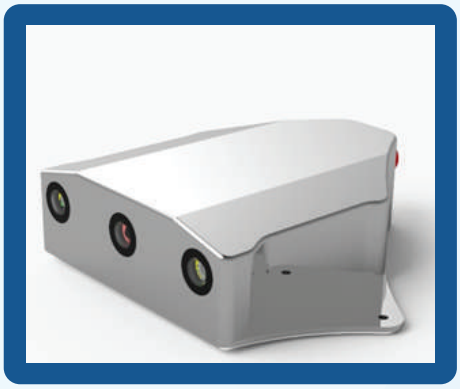
BRIEF DESCRIPTION:

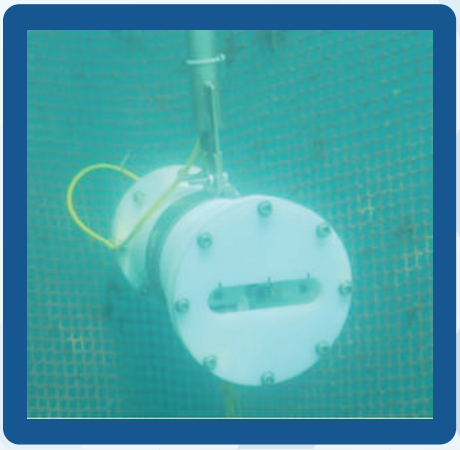
दrishti is an IOT device for fish farmers that provide real-time fish weight estimate, supports in fish feed control and timely harvest. It provides insights direct from the field through SMS, assists in farm management, reduces feed wastage and input costs, while supporting grid and off-grid power modes. It is a field deployable unit to detect the fish, analyse the data for Biomass estimation. The Length-Weight Allometric equation which is available for various fish species is used for biomass estimation in real time.

SALIENT FEATURES AND APPLICATIONS:

- I-BIOMES is a battery powered standalone unit to detect and predict the Fish Biomass. The system can be used for identification of marine pathogens and their symptoms in fishes.
- The innovation is underwater miniature low power edge device that can use AI for providing field-based data insights and reduce continuous manual intervention in the field.
- It requires minimal scheduled maintenance.
- The I-BIOMES system is deployed in open floating type fish cage of Andaman in March, 2020. The real time results are acceptable and adequate enough with high efficacy. The accuracy for length measurement using this system as compared to manual measurement and existing methodologies are close to actual and it categorized and good performance.

Scale of development: Ready for licensing of Technology





MARESOL

BRIEF DESCRIPTION:

Bioremediation process uses microorganisms or their enzymes to remove/neutralize contaminants within the environment (i.e., within soil and water) to their original condition. The hydrocarbonoclastic bacteria become functionally active in oil contaminated environment. The present indigenous technology of bioremediation is a process of using consortium of hydrocarbonoclastic bacteria isolated from deep sea to play a key role in the removal of toxic and harmful petroleum hydrocarbons.

Applications:

The bioremediation package has been demonstrated effective mitigating of: Engine oils, Spent engine oil, Crude oil; Diesel, Petrol, Toluene, Xylene, Kerosene, Naphthalene and Phenanthrene etc. This technology has wide application in coastal, marine surface oil spill, deep sea oil plumes and sludge treatments in refineries.

Microbial Consortia:

The present marine microbial consortia were isolated from marine environment of Indian EEZ. The isolated bacterial consortiums effectively produce biosurfactant that enhances the bioavailability of contaminants for degradation process.

Efficiency:

Biodegradation of crude oil by this technology is proven in laboratory. Approximately 95% of the total hydrocarbon was degraded into non-toxic end products within a period of 21-28 days.

Scale of development: Ready for licensing of Technology

C-PROFILER

BRIEF DESCRIPTION:

This developmental work of C-Profiler will aid in collecting near real-time in-situ CTD profile using a tow fish operated from a moving ship/boat in an economical way. The invention is an indigenous C-profiler is designed for collecting real-time in-situ profiles using a tow fish with conductivity, temperature and depth (CTD) sensors from moving ship. The equipment can be used as standard deck equipment for both research and mapping expeditions at lower cost per data

SALIENT FEATURES AND APPLICATIONS:

- Continuous collection of CTD data without stopping the ship without lifting the tow-fish from water.
- Change of sensor heads on deck can be done swiftly.
- Precise, Low-cost and Rapid method to observe Ocean currents and Eddies.
- System control can be made remotely in C-Profiler
- The C-Profiler trial cruise with 20 profiles was conducted in Bay of Bengal in January 2022.

Scale of development: Ready for licensing of Technology

Winch at NIOT

ROSHINI (SALINE WATER LANTERN)

BRIEF DESCRIPTION:

Off Grid power is becoming much common even for well connected communities Climate changes weather disasters etc have fuelled up the requirement of emergency power systems. With current stark warnings on irreversible global warming, the world is switching over to green and sustainable forms of energy. Taking forward the institute has developed a portable light weight Sea water lantern ROSHNI (Renewable Ocean System for Harnessing Novel Illumination).

SALIENT FEATURES AND APPLICATIONS:

- The lamp can operate continuously up to 12 Hrs for every replacement of sea water.
- In case Sea water is not available 300 ml of tap water can be used with 10 gm of table salt.
- A higher version of the saline lantern is available with provision for Mobile charging.
- The lamp is designed with three lamps which can be used as torch, reading lamp and a USB based mobile charger.
- Sea water lantern finds it utility among the local communality which has limited access to the power such as the fishermen community and the island population.
- Also it can be very useful for the community in case of an emergency during natural disasters such as floods, hurricanes, earth quakes etc in the event of grid disconnection.

Scale of development: Demonstrated and commercialized

RECOMBINANT ECTOINE FROM DEEP SEA BACTERIA

BRIEF DESCRIPTION:

Recombinant Ectoine: A major compatible solute from halophilic bacteria, Bacillus clausii: Ectoine and 5-hydroxyectoine belong to the family of compatible solutes which are known to stabilize the cell's essential functions by maintaining the stability of proteins under stress conditions like high salinity, heat or aridity stress, UV irradiation and dryness. Compatible solutes are usually synthesized under elevated saline conditions and then accumulate in the cell. The present invention relates to a method for producing recombinant ectoine or a derivative thereof, using the recombinant plasmid containing genetic material coding for biosynthesis of ectoine. Products developed in this invention represent a new supplement in derma pharmacy industry.

PRODUCT DESCRIPTION:

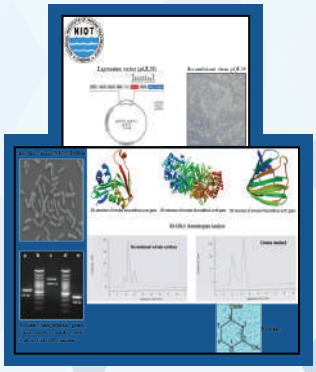
A recombinant E.coli M15 bearing the ectoine biosynthesis genes from deep sea Bacillus clausii and optimized methodology for production and purification of recombinant ectoine in laboratory conditions.

PROCESS:

The present invention reports the construction and optimization of ectoine biosynthesis gene in Bacillus clausii as well as the construction of plasmids for expression of intracellular ectoine in Escherichia coli M15 (expression host), and subsequent mass production by submerged fermentation.

- The biosynthesis genes derived from the genome of Bacillusclausii is a novel strain of Bacillus clausii NIOT-DSB04 isolated from the deep-sea sediment collected from, Andaman Sea.
- The ectoine biosynthesis genes (EctA,B&C) coding for enzymes DABA acetyltransferase, DABA-2- oxoglutarate transaminase and ectoine synthase was amplified by PCR.
- The ectoinebiosynthesisgenes were cloned in pTZ57R/T.
- Expressed in Escherichia coli M15 expression host using in pQE30 vector.
- The heterologous expression of ectoine was optimized using IPTG.
- A maximum ectoine production of 6.7 mg/L was achieved at concentration for 1 mM IPTG.

Scale of Development: Technology demonstrated and commercialized.



PROCESS FOR THE PRODUCTION OF LUTEIN

BRIEF DESCRIPTION:

Lutein, is a xanthophyll carotenoid essential for protecting the cellular components ofvitalorgans from oxidative damage. Lutein is a vital macular pigment in the retina of the eye andprotects the eye from the ionizing effect of blue light. Lutein is present in higher plants andother photoautotrophic organisms like algae. NIOT isolated a fast growing, high biomass andlutein producing microalgal strain, C-Chlorella sorokiniana, optimized a custom designedculture media, culture methodology, harvesting technique and the purification of lutein to 90-95% purity and production of "Lutein" from marine Chlorella sorokiniana.

PRODUCT DESCRIPTION:

The present process relates to a production of lutein from marine Chlorophyceae microalgae.

The process includes

- Cultivating a marine Chlorophyceae microalgae Chlorella sorokiniana under cultivation conditions suitable for the production of lutein in a raceway or bubble columnphotobioreactor under phototrophic/ mixotrophic condition.
- Harvesting the cultivated microalgae using electroflocculation (patented).
- Rinsing the cultivated biomass free of salts with distilled water in centrifuge.
- Spray drying of algal biomass.
- Cell disruption prior to extraction of lutein.
- Alkaline treatment of algal biomass at 40ºC for 30 min.
- Solvent extraction of crude lutein in percolators.
- Solvent removal using rotary evaporator and reuse of the solvent.
- HPLC quantification of the lutein content.
- Purification of lutein
- Re-dissolving in olive oil for storage of lutein
- Re-extraction in acetone and nitrogen purging

Scale of Development: Technology demonstrated and commercialized.

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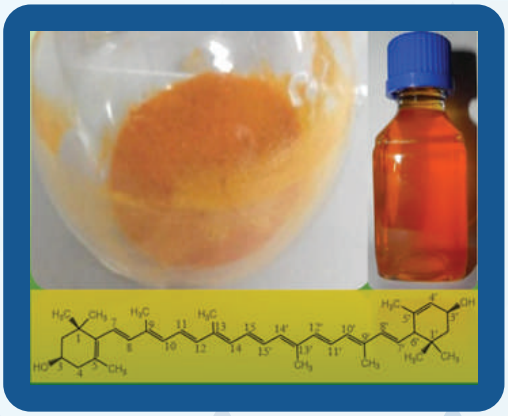


BIOSURFACTANT FROM MARINE BACTERIA

BRIEF DESCRIPTION:

The existing conventional methods to reduce, degrade and remove the toxic substances in the environment introduced by human activities are associated with some risk. In recent years, microorganisms have proved a unique role in the degradation and detoxification of polluted water environments. Surfactants are synthetic chemicals used to separate/remove oil by emulsification process. The major disadvantages of chemical surfactants are their persistent nature, non-biodegradability and environmental toxicity. Biosurfactant is made up of a hydrophobic and hydrophilic component. The application of biosurfactants can enhance the processes of bioremediation by means of emulsification, solubilization and mobilization. Biosurfactant are environmental friendly, effective and stable compounds

PRODUCT DESCRIPTION:
Biosurfactant from marine bacteria for environmental clean-up and waste management

PROCESS:

Biosurfactants produced by microbes are amphiphilic compounds possess both hydrophobic and hydrophilic moieties that decrease the surface and interfacial tension. The present invention major process steps include.

1. Microbial strain: Biosurfactant producing bacteria Brevibacterium sp. COD27 isolated from the deep-sea sediment.
2. Optimization culture conditions: Optimized culture conditions (pH, temperature and salinity) for high growth and biomass yields.
3. Enrichment media: Optimized production medium (Carbon, Phosphate and Nitrogen source) in specific proportion to enhance the production rate of biosurfactant.
4. Working range: The biosurfactant is highly stable and work efficiently in wide range of physicochemical conditions.

Temperature 0-120°C; Salinity 0-10%; pH 0-14; Pressure 0-10 MPa.

5. Biosurfactant Production: Brevibacterium sp. COD27 novel non-GMO strain produce biosurfactant 2.2 g/l in a period of 36 hrs.
6. Storage: High barrier plastic bags filled under vacuum condition.
7. Shelf life: Retain activity up to 14 months at 4O C

SALIENT FEATURES

- Microbe derived biosurfactants have advantages over their synthetic counterparts such as biodegradable, non-toxic, highly selective, active at variable pH, temperature and salinity.
- They find wide application in industrial, agricultural, food and pharmaceutical industry.

•Efficiency:

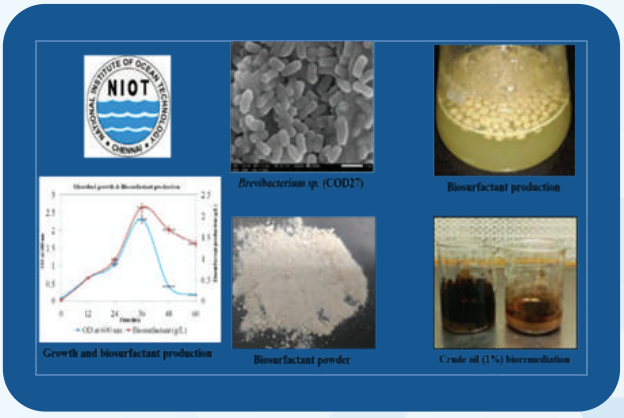
The biosurfactant works efficiently at a low concentration of 0.1% and degrade 87% of crude oil in period of 30 days. Biodegrade wide range of aromatic compounds and mineralize the toxic compounds into nontoxic form.

•Safety:

The biosurfactant is nontoxic, biodegradable and environmentally friendly.

.

Emulsifying activity of product		
S.No	**Oil**	**E24 (%)**
1	Coconut oil	88.63
2	Palm oil	95.42
3	Sunflower oil	91.38
4	Olive oil	89.26
5	Clove oil	71.42
6	Cedar wood oil	72.50
7	Kerosene	82.50
8	Petrol	80.00
9	Diesel	82.50
10	Benzene	93.33
11	Toluene	88.75
12	Xylene	96.67
13	Phenanthrene	21.00
14	Spent engine oil	93.33
15	Crude oil	76.76



Scale of Development: Technology demonstrated and commercialized.

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C-PHYCOCYANIN FROM MARINE SPIRULINA TECHNOLOGY

BRIEF DESCRIPTION:

The food industry is experiencing a shift in consumer preference, from artificial ingredients to natural ingredients. This changing trend has triggered the production of phycocyanic, which acts as a nutritious protein-pigment complex in several food and beverage applications. Its characteristic antioxidant, anti-aging, hepatoprotective and anti-inflammatory properties are increasingly gaining consumer attention in food, pharmaceutical and cosmetic industry. The market of C-PC has expanded several folds after its recognition by European Union as a permitted secondary coloring agent for foods. The cyanobacteria, namely, Spirulina (renamed as Arthrospira), has been commercialized in several countries for its use as health food and for therapeutic purposes due to its valuable constituents particularly proteins and vitamins. It is also a rich and inexpensive source of the pigment like phycocyanin. C-phycocyanin (C-PC), a phycobiliprotein, is one of the key pigments of Spirulina, a microalgae used in many countries as a dietary supplement. The bright blue colored C-Phycocyanin (C-PC) is an accessory photosynthetic pigment belonging to the phycobiliprotein family. C-PC has found applications in food coloring and cosmetics due its unique blue color, which indeed has few natural replacements.

SALIENT FEATURES AND APPLICATIONS:

- The developed Technology standardized the marine Spirulina culture in 2 ton FRP raceway ponds with proven production of biomass (2.3 g/L) and C-PC under outdoor conditions. Further, testing of large-scale culture in 25 tons capacity raceway ponds at seafront facility is in progress.

- The Institute has 50 tonne capacity paddle wheel operated raceway pond for pilot scale testing, electro flocculation system for large scale harvesting and continuous flow high volume centrifuge for dewatering and the necessary technical expertise to provide technical assistance and guidance for setting up the project and implementation.

Technical Specification:

Microalgal strain	*Spirulina sp.NIOT-155*
Culture medium	Modified organic media
Water source	Natural seawater
Biomass production	2.3 g/L
Extraction process	Modified green extraction method
C-phycocyanin yield	130-150 mg/g
Purity ratio	2.5 to > 4.0 after purification
Energy consumption	Low due to short extraction time

Marine Spirulina cultured in 300L photobioreactors

Marine Spirulina cultured in open 2 ton raceway

Scale of Development: Technology demonstrated and commercialized.

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PHARMACOACTIVE NUTRIENT FROM MARINE ALGAE

BRIEF DESCRIPTION:

Chlorella sp. finds wide application as a food supplement owing to its high nutritive value and medicinal properties. The present invention relates to the process for the production of “Pharmacoactive Growth Promoter” from live (wet) biomass of marine microalgae Chlorella vulgaris by modified hot water extraction method. Beneficial properties of “Pharmacoactive Growth Promoter” include anti inflammatory activity and wound healing property, detoxification, constipation relief and growth stimulation. The process involves isolating a fast growing, high biomass and lipid producing microalgal strain, C. vulgaris, optimized the culture media, culture methodology, harvesting technique and the production of “Pharmacoactive Growth Promoter” from Chlorella vulgaris of marine origin.

SALIENT FEATURES AND APPLICATIONS:

- A nutritionally and pharmaceutically valuable hot water extract “Pharmacoactive Growth Promoter (PGP)” from the live biomass of C. vulgaris cultured in seawater, where in the extract has been prepared by gradual heating.
- The marine C. vulgaris, wet biomass hot water extract “PGP” contains 27.45 % of protein, 39.21 % of carbohydrate and 0.75 % of crude fat.
- Mineral such as calcium, phosphorous, potassium, sodium, magnesium and iron were observed.
- Significantly higher level of vitamins such as vitamin B3 (Niacin-0.29 mg/100 g), vitamin B5 (Pantothenic acid- 2.26 mg/100 g) and vitamin B12 (Cobalamin- 34.42 µg/kg) were recorded.
- Pharmaceutically vital proteins such as thioredoxin, S-adenosylmethionine synthase 1, putative pleiotrophic drug resistance protein 3, dihydrolipoyl dehydrogenase, Brix-domain containing protein, Inositol monophosphatase 2, bearing significant activities such as cell growth, cell cycle regulation, defense, antioxidant, anti-cancer and proteins that are widely used in the treatment of depression, dementia, vacuolar myelopathy, liver injury, migraine,osteoarthritis, bipoar disorder, etc. were recorded in the protein fractions of PGP.
- PGP also documented various biologically important enzymes and proteins. Apart from the aforementioned proteins about 32 uncharacterized proteins were also observed.

Scale of Development: Technology demonstrated and commercialized.

Bio-pharmacological analysis of PGP from the live biomass of marine microalgae, C. vulgaris

Parameters	Standard	CGF
Anti-diabetic α-glucosidase α-amylase	Acarbose IC_{50} – 1.8 mg/mL IC_{50} – 1.1 mg/mL	IC_{50} –2.4 mg/mL IC_{50} – 6.1 mg/mL
Anti-inflammatory Caspase-3 apoptotic-inflammatory assay	Methotrexate IC_{50} – 0.9mg/mL	IC_{50} – 0.65 mg/mL
Wound healing *In vitro* scratch assay	Nitrofurazone IC_{50} – 0.13 mg/mL	IC_{50} – 4 mg/mL
Neuropharmacological effect- Role of CGF on central nervous system depression	Chlorpromazine (5 mg/kg)	25 mg/kg 50 mg/kg
1. Sleeping test 2. Locomoter activity 3. Muscle relaxant activity 4. Body weight	29 % increase in sleep 53.91 % reduction 37.33 % reduction 3.73 % decrease	11 % increase in sleep 67.61 % reduction 26.36 % reduction 10.83 % increase

RECOMBINANT GLUTAMINASE FREE L-ASPARAGINASE FROM MARINE ACTINOBACTERIANOCARDIOPSIS ALBA: A PROMISING THERAPEUTIC AGENT FOR LEUKAEMIA CHEMOTHERAPY

BRIEF DESCRIPTION:

The present invention relates to the construction and optimization of biosynthetic genes from the Nocardiopsis albaL-asparaginase gene, the method for cloning same and expression thereof in Escherichia coli. The purpose of the production of said enzyme is for producing high levels of a recombinant novel L-asparaginase that can be used in L-asparaginase-based pharmaceutical compositions for treating cancer, tumours and diseases involving cell proliferation, as well as for other medical applications.

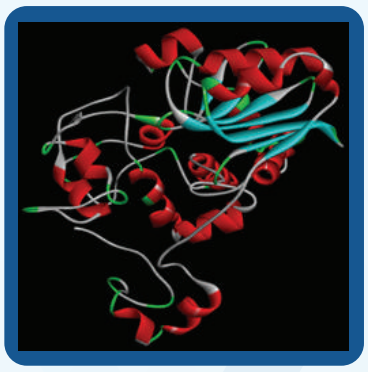
Application:

The development of this recombinant enzyme aim for its use in pharmaceutical compositions intended for use in medical applications, such as in the treatment of cancer, tumors and diseases in which cell proliferation is involved, providing an alternative to existing drugs.

The products developed in this invention represent a new way to treat cancer, tumors and diseases in which cell proliferation is involved. In addition, the developed techniques provide a high production output and productivity, which is reflected in lower cost of the final product.

SALIENT FEATURES:

- N. alba NIOT-VKKMA08 was isolated from the marine sediments of Phoenix Bay in Port Blair, Andaman and Nicobar Islands (A & N), India and was grown aerobically in starch casein agar (SCA) supplemented with 25 µg/mL nalidixic acid (Hi-Media, Mumbai, India) to inhibit the fast-growingGram-negative bacteria.



3D model prediction of ansAprotein from Nocardiopsis alba NIOT-VKKMA08.

Scale of Development: Technology demonstrated and commercialized

Technologies in

AGRO & AGRICULTURE SECTOR

MOBILE DISTILLATION UNIT FOR ESSENTIAL OILS FROM MINTS, VETIVER, PATCHOULI, LEMON GRASS, BASIL, PALMAROSA, CITRONELLA, NAGARMOTHA, ETC.

Salient Features

Mobile distillation unit can be attached to any tractor and can be transported directly to the farmer's field for distillation of the aromatic crops aromatic crops like mentha, lemongrass, basil, vetiver etc.

Advantages:

- Mounted on a specially designed & fabricated heavy duty four wheel trolley and can be attached to any tractor.
- Easily transportable to the farmers fields which shall save time & money of taking the crops to the distillation tanks.
- Capacity 400-500 Kg / batch semi dried; Useful for distillation of all types of essential oils bearing aromatic crops including mints, lemongrass, palmarosa, citronella, basil, patchouli, vetiver etc.Shall be using spent distilled biomass waste as fuel which shall minimize cost of firewood.
- Designed with inbuilt calandria for utilizing the heat energy of the flue gases thus decreasing the time required for boiling and also increasing the steam generation rate, which in turn enhances the distillation efficiency & oil recovery.
- Distillation unit constructed of Stainless Steel grade-304 having excellent corrosion resistance properties for high quality essential conforming to organic processing requirements.
- Furnace made of Stainless Steel grade-310 specially designed for high temperature operations thus giving a longer life to the unit.
- Provided with an inbuilt MS chimney for better air draft to the furnace and preventing pollution at work place
- Unit designed having double walled air insulation system to prevent heating of the trolley and with baffle plates to prevent heat damage to the trolley tires.

Scale of Development: Already commercialized**.**

COTTON PRODUCTION AND PROCESSING TECHNOLOGIE

Cotton after production in the field is to undergo a number of downstream processing both mechanical and chemical to yield yarn for manufacture of fabrics. During the removal of cotton from the plant either by mechanical or by hand picking often gets contaminated with leaves, bracts, boll rinds and other plant parts along-with many heavier particles like dust and sand. These impurities are removed prior to ginning of cotton wherein the seeds are separated from the fibre. The cotton after ginning is also subject to post cleaning for removing the contaminants like trash and oil etc. The ginned cotton then pressed to bales for marketing to the spinning mills wherein it is subject to mechanical processing to produce cotton yarn. The spinning operation includes several steps like cleaning, opening, blending, carding, aligning in draw, speed frame, combing and yarn formation. The yarn or the textile then go for chemical treatment and finishing processes for imparting desired properties. In addition the by products from the cotton fields as well as from the textile mills are judiciously utilised to make the cotton production and its utilisation more economic.

Cotton Farming Practices

- General Breeding methods and special breeding methods.
- Hybrid Seeds to suit various climates and soils

Seed Processing

Soil Management

- Management of soil for cotton production according to the soil properties.
- Soil fertility management for augmenting the cotton production
- Methods for cotton production in problem soils.

Water Management

Integrated Nutrient Management

Integrated Pest Management (IPM) and Insecticide Resistance Management (IRM)

Cotton Diseases and their control

Farm Machinery for Cotton Cultivation

Ginning and Pressing

Mechanical Processing of Cotton (Spinning)

Chemical processing of Cotton fabrics

Cotton By-Product Utilisation

- Cottonseed Meal
- Particle Boards from Cotton Plant Stalks
- Binder-less Hard Boards from Cotton Plant Stalks
- Pulp & Paper from Cotton Plant Stalks
- Corrugated Boards from Cotton Plant Stalks
- Bio pulping of Cotton Plant Stalks
- Micro Crystalline Cellulose from Cotton Plant Stalks
- Edible cultivation on Cotton Plant Stalks
- Biogas and Bio-manure from textile mill waste

PALM OIL EXTRACTION TECHNOLOGY

Brief Techno Economic Profile:

Oil palm is a new crop to our country and is the highest oil yielding crop, gives about 20 tonnes of oil per hectare. Unlike other oils, palm oil is taken from the fresh fruit and hence the extraction process involves many unit operations. Moreover the fruits have to be processed within 24 hours from hasrvest and during harvest the damage to the fruit has to be minimal otherwise the oil quality will be bad. This necessitates captive process unit for oil palm plantation. Considering these requirements and the land holding pattern, we had designed a 2.5 ton expandable to 5.0 ton and 5.0 ton expandable to 10.0 ton FFB/hr processing plant and commercialized the technology through project engineering companies. The process efficiency and product quality are comparable with international standards. 2.5 ton mill can cater to the need of 500 hectares and other capacity plants can cater the needs accordingly.

Scale of Validation:

Commercial plants have been established based on this technology. Our process efficiency and product quality was same as the competitors and our plant and machinery & utilities package was comparatively better but 2/3rd of the competitor's cost. We are trying to improve the package still better.

Impact of the technology:

This was a major successful programme supported by Technology Mission on Oil seeds (TMOP). The objective of TMOP was to promote high yielding oil crops to bridge the gap between demand and supply of edible oil. Oil palm was identified as the potential crop. Since oil palm is not a saleable commodity and palm oil is the primary saleable product, there was need to have palm oil extraction technology to promote oil palm cultivation in the country. CSIR, through NIIST, Trivandrum had developed the palm oil extraction technology and commercialized the same and demonstrated to the farmers at field level, which catalysed the oil palm development in the country.

PALM OIL MILL

BIOGAS AND BIO-MANURE FROM POULTRY LITTER

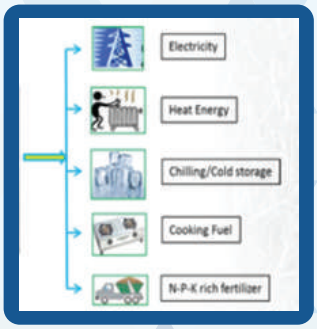
Brief Description:

Untreated poultry litter is mainly utilized for growing crops which may result in air, land and water pollution apart from spreading pathogenic organisms like Salmonella and E.coli. The technology is meant for scientific treatment and disposal of poultry litter through the generation of renewable energy in the form of biogas and bio-manure. “Anaerobic Gas Lift Reactor (AGR).” is specially designed for treating poultry litter generated from Indian poultry farms having grit, sand and low C/N ratio. This technology is superior in terms of biogas and bio-manure production. The technology incorporates novel grit removal system and ammonia inhibition mechanism. Installation of biogas power plants based on “AGR” would ensure a cleaner environment and provide sustainable financial dividends to farm owners by offsetting their power requirements. Safe & timely waste disposal through the AGR, coupled with the biogas energy generation, will improve the profitability of the poultry industry.

Comparative advantage:

- Biogas and Bio-manure generation from Poultry Litter
- AGR Technology is economically viable solution with in the farm.
- Replacement of conventional electricity board power with renewable power generated from biogas
- Bio-manure is a salable by product.
- Hygiene in the poultry farm could be improved thereby sanitation could be avoided.
- Helath of the bird will improve and egg production could be increased.
- Mortality of the birds could be reduced

Scale of Development: Commercial plant working



LOW COST JUTE BASED DISPOSABLE SANITARY NAPKIN FOR RURAL WOMEN

Jute being a natural lingo-cellulosic bast fibre is mostly used in manufacturing packaging materials. As a part of jute product diversification, the present development is targeted at production of sanitary napkins which can be obtained from jute, a readily available renewable natural sources . The use of sanitary napkin (SN) being a basic necessity, yet due to cost it is always not affordable for use in all sections of the society. Thus, cost has been a barrier to reach sanitary napkins to most of the people such as its use is low in India as 83% women cannot afford the product. At present the sanitary napkin available in market is made of wood pulp. Use of wood pulp causes deforestation and has a negative impact on environment. In near future supply of wood pulp may be stopped and supply chain of core material will be affected. Keeping this environmental issue in mind and to keep the supply chain alive a core material has been developed for sanitary napkin from jute.

Salient Features:

The production of sanitary napkin advantageously and selectively involves jute fibre and jute sticks as the low cost absorbent core material without the incorporation of any synthetic super-absorbent polymer. The manufacturing processes of the jute based core material is simple and chemical free, have no adverse effects on the environment. Advantageously, this simple process of making SNs can be easily adopted even by the non-skilled / semi-skilled persons for manufacturing safe and cheaper jute based sanitary napkins.

Advantages:

- A stable, low cost sanitary napkin
- The core absorbent material made from readily available and natural renewable sources such as jute;
- The core material formed without incorporation of any synthetic super-absorbent polymer;
- The biodegradable core with good water retention value (comparable to commercial counterpart)
- Involving an eco friendly manufacturing process without any chemical processing steps
- Cost effective and economical sanitary napkins

Scale of Development: Technology ready for commercialisation

JUTE FIBRE REINFORCED LINEAR LOW DENSITY POLYETHYLENE (LLDPE) COMPOSITE PRODUCT

This development relates to a process for manufacturing Jute fibre reinforced Linear Low Density Polyethylene (LLDPE) composite product. The melt compounding process of plastic with bio-based material is cost intensive process due to involvement of costly machinery namely, Twin Screw Extruder. The current invention is the cost effective mixing process of Jute fibre (bio-based natural fibre) with polyolefin using a Kneader –extruder system in a batch process.

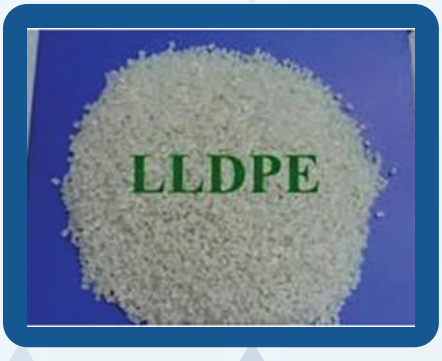
SALIENT FEATURES:

The Jute fibres used are either in the form of chopped fibre and the length of the same are kept ≈ 30mm, or loom waste material from jute industry where the fibre length usually kept within 10 – 50 mm. Pre-drying of the fibre to keep it relatively moisture free is optional. To increase more reaction sites for fibre-matrix adhesion, small percentage of compatibilizer (2-5% on the batch weight) has also been added. The granules / pellets, formed by the extrusion of the dough coming out of the Kneader are then used as the raw material to make natural fibre reinforced moulded products through suitable moulding processes namely, Roto-moulding. Jute fiber to the extent of 20 % by weight is incorporated in LLDPE by this process.

ADVANTAGES:

- Comparative characterization study of the virgin LLDPE based Roto-moulded water storage tank and jute fibre reinforced Roto-moulded water storage tank shows market improvement in impact strength.
- Noted 20% increase in Charpy impact strength.
- Functional property like exposure to UV Rays has improved

Scale of Development: Technology integration



ROT RESISTANT NATURAL DURABLE JUTE GEO-TEXTILES

The synthetic Geo-textiles, manufactured from by-products of petroleum, are becoming costlier and moreover, ecological considerations do raise doubts about the long term effect of indiscriminate application of such synthetic materials. Whereas, Natural Geo-textiles are ecologically safe as they are biodegradable and leaves no residue to environment. Out of several available natural Geo-textiles, Jute Geo-textiles is of prime importance due to the properties like hydraulic, tensile strength, Trapezoidal tear strength, porosity and permeability etc. which are more or less comparable with synthetic textiles. But there are some very important Geo-technical applications where the functional requirement of JGT cannot be adequately met due to the short life of the jute geo-textiles than its actual requirement for such application.

SALIENT FEATURES:

The present invention advantageously gives selective natural fibrerute fabric treated with treatment media which does not involve the use of environmentally hazardous chemicals such as copper based salts and bitumen used in the known art. Preferably, the treatment media includes selective textile friendly, anti-microbial both leachable and non-teachable type adapted in natural fibres especially jute. Non-leachable type of anti-microbial is preferred as they are expected to impart durable rot- resistant property to Jute Geo-textile

ADVANTAGES:

- These geo-textiles are eco-friendly.
- Retain the desired characteristic of a natural fibre based geo-textiles such as permeability, flexibility.
- Light-weight and cost-effective.
- These do not possess any hormonal properties

Scale of Development: Technology integration

CLEAN EXTRACTION OF BANANA FIBRE FROM PSEUDO STEM AND EMPTY BUNCHES

BRIEF DESCRIPTION:

There is a good demand for the banana fibre, which is used in making a wide range of goods as cordage, yarns, paper and paper cups, tea cups and tea bags, attractively patterned cloth, hand-bags/purses and shoes. Traditionally the patu sari was also made from banana fibre, but it is discontinued now. The most difficult part of this business today is the extraction of the fibre both manual and mechanical.

SALIENT FEATURES:

- It is an anaerobic process mediated through microbial action and completed in 6 days of water soaking.
- The in-situ production of enzymes is responsible for the separation of the fibres, which is in turn facilitated in the system by circulating liquid from an anaerobic reactor treating fibreless wastes and juice of the pseudo stem.
- In this treatment the organic wastes are converted to biogas and pollution free.
- The process water is used repeatedly.
- The fibre obtained from anaerobic processing of banana pseudo stem and bunches is brilliant white, has little pith residues.

ADVANTAGES:

- Simple method to produce banana fibres
- Obtains good quality fibres
- Inexpensive
- Pollution free
- Zero damage or loss of fibres
- Biogas generated and collected
- Higher earnings to farmers
- Means of new employment

COIRRET- INNOCULANT FOR RETTING COCONUT

BRIEF DESCRIPTION:

Traditionally coir fibre is extracted from coconut husk by a process known as retting. Retting by the conventional methods takes 6 to 11 months. The new process developed relates to reducing the period of retting of coconut husks and upgrading the quality of un-retted green husk coir fibre treatment by treatment with a combination of bacterial cultures.

SALIENT FEATURES:

By applying developed a bacterial consortium “COIRRET” the retting period is reduced from 11 months to 3 months and improve the quality of green husk fibre within 72 hrs.

ADVANTAGES:

- Reduces the cost of production
- Maximum utilisation of the husk potential
- It is an environment friendly process.
- The bacterial consortia can be treated on coir fibre bales extracted by mechanical means
- The treatment can be carried out in RCC tanks

SCALE OF DEVELOPMENT: Ready for licence.

MOBILE FIBRE EXTRACTION MACHINE

BRIEF DESCRIPTION:

It is estimated that out of total production of coconuts in the country 10% are plucked as Tender Coconuts. Tender Coconuts provide a healthy drink. Tender Coconuts are sold in most of the cities by road side vendors. The husk is thrown away near the road side or in the streets. The husks containing about 80-85% moisture are a source of mosquitoes, flies etc. In cities it adds to the garbage problems. Further, The industry feels that there is an untapped stock of husks in the rural areas from where collection is difficult as on-site de-fibering is not possible. Therefore there was a need to develop a mobile fibre extraction machine which could be taken to the remote villages so that vast untapped potential for utilization of husks from such areas could be tapped.

SALIENT FEATURES:

- The extraction of fibre also requires several machines resulting long time and high cost.
- The newly developed machine separates directly the coir fibre and pith from coconut husk and eliminates the number of steps and combination of machines required in traditional ways.
- The cost of the machine is very low about one tenth as compared to old set up and therefore very much affordable.
- The new development also eliminates the pollution problems encounteredin traditional methods.

ADVANTAGES:

- The weight of newly developed machine is only 250 kg against 1500Kgs of conventional machine.
- The machine is also very compact and portable and provides hygienic working environment to about half million workers in coir industry.
- The machine is also suitable for other coir processing countries.

SCALE OF DEVELOPMENT: Ready for licence.

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PITHPLUS

BRIEF DESCRIPTION:

The coir processing is one of the important industries in coconut producing countries. Coconut coir dust is the major waste material that is produced by industries processing coconut husk for extracting coconut fibre and poses disposal problem besides making the land unfit for any other uses/activities. With environmental pollution becoming more stringent, processing of coir dust has become very essential.

Coir dust consists of short fibbers (2 mm or less) and pith (dust), which are left behind after processing of coconut husk. Coir dust accumulates in large dumps outside the mills, which process the husk for extraction of industrially valuable long fibres. It is estimated that there is accumulation of one million ton of coir pith in the coconut growing states in India. The high lignin and cellulose content in the pith makes it non-biodegradable. When burnt, it smoulders, emitting large quantity of smoke for several days causing air pollution.
Indian scientists developed a technology named as Pithplus for the bio-conversion of coir dust in to a very useful organic manure which has application in agriculture and horticulture industry. The product obtained after bio-conversion has excellent properties of being used as growing medium especially in soilless containers for growing high value horticulture crops.

The global agro-industry has been facing a serious crisis due to steady built up of biological resistance resulting from an over application of chemical fertilizers and pesticides. It is here that organic amendments become useful. While synthetic fertilizers are generally more available, less expensive, and have quicker results, they have played havoc with our ecosystem. Factors like salinity and less water holding capacity make soil unsuitable for cultivation.
Coir pith manure, under such situation offers to be an ideal soil re-conditioner, soil structure improver and soil substrate with excellent water holding capacity. Therefore the coir dust generated from the coir fibre processing industries needs to be processed to a form suitable for agricultural and horticultural use especially for the floriculture production and landscaping. The coir dust could also be an excellent substitute for various peat products since it also has high water holding capacity and ability to last long in the soil.

SALIENT FEATURES & ADVANTAGES:

- The bio-conversion technology so developed offers an excellent opportunity for converting the coir waste which is otherwise an environmental problem, to a very useful organic manure (soil conditioner),
- It is found to be perfect organic growing medium for fruits and vegetables.
- The bio-converted organic manure from coir pith, therefore, found to be most popular soil conditioner throughout the world

COCOLAWNTM: A READYMADE LAWNt

BRIEF DESCRIPTION:

Coir dust or coir pith is a by- product that we get during extraction of coir fibre from coconut husk. It is purely a natural organic product. This natural, unique, spongy cellulose organic plant growing media is useable in garden centre, horticulture nurseries. It has a high water retention capacity to plant growth. Scientists developed a know-how 'coco-lawnTM' for constructing a ready to use lawn by using coir pith etc. It is a natural, eco-friendly lawn and a better substitute of synthetic lawn presently made. It has vast potential in tourist resort, hotels and playgrounds and even roof-top plantation/lawn etc.
A ready-made lawn of natural grass consists of:

- A layer of netting material made of coir
- A single or plurality of non worm layers
- A layer of fertilizer of treated coir pith and natural grass on the coir pith layer.

The netting can be placed on a sheet made of plastic material such as polyvinyl chloride or polythene. Non woven layers provide thickness to the lawn and allows grass roots to get entangled in the non woven material. The layer of coir pith gives a support base for layer coir pith layer can be treated with other nutrients such as mushroom seeds and urea etc., and allowed to mature till the weight is substantially reduced as ligmin is consumed by fungi or mushroom seeds. Ready-made lawn can be made in the form of rollable blankets, which can be laid on any surface.

BIOPESTICIDAL NEMA GEL

BRIEF DESCRIPTION:

A major constraint for practical use of nematode based bioagent for pest control has been its poor shelf life at temperatures higher than 300C, prevailing in tropical and sub-tropical regions of the world.

The newly developed technology has utilized highly mobile nematode entrapped in the matrix of a special kind of hydrogel maintained at a specific moisture level, thus overcomes the constraints of high temperature and stability with high efficacy for controlling wide range of insect pests. The technology has been developed by Indian Agricultural Research Institute (New Delhi),

The Nema Gel contains an indigenous insect-killer nematode, which has been isolated in the laboratory. This nematode species is heat tolerant and can kill a broad range of soil and foliar insect pests of various crops such as cereals, pulses, oilseeds, vegetables, fruit trees etc.

SALIENT FEATURES

- Employs an indigenous strain of the nematode.
- Safe for the plants, farm-animals, non-target pests, human health and the environment.
- High reproductive potential of the nematode favors its recycling in the environment.
- No special equipments needed for application
- Application in the soil not only manages the soil pests but also increase the water holding capacity of the soil.
- Eco-friendly, water absorbing and microbe resistant.
- Besides being heat tolerant, this bioagent can effectively kill the insect pests at a wide range of soil moisture level (3-19%).
- It offers an effective two-in-one solution for management of insect pests and water in agriculture.
- Its efficacy in field is visible within 24-48 hours of its application.
- The technology leads to significant improvement in the shelf-life of the nematode (few hours to 36 months) over a wide range of temperature (5-500C).
- The formation overcomes contamination by not allowing growth of microorganisms, and does not require any chemical reagent for its application.

Field with termite attack before and after Nemagel application

ANKUSH- A NEW SILKWORM BED DISINFECTANT

BRIEF DESCRIPTION:

Silkworm diseases are the major constraint in achieving optimum productivity of silk cocoons by sericulturists in India. Among the various measures suggested to control diseases in silkworm is the use of bed disinfectant chemicals for disinfection of silkworm body and rearing seat. This process of silkworm body and rearing seat disinfection plays a significant role as a prophylactic measure to control the initiation and spread of diseases through the germicidal action during various stages of the silkworm rearing.

Ankush is an eco-friendly silkworm body and rearing seat disinfectant aimed at avoiding environmental deterioration and user friendly by eliminating the hazardous chemicals in the product. The product is not only eco-friendly and user friendly but also biodegradable, economical and as effective as most popular but hazardous bed disinfectants.

The product is a fine powder and this is dusted uniformly over the silkworm body and the rearing seat as per the schedule after the silkworm bed is cleaned. A total of 6 applications are recommended during silkworm rearing till cocooning. About 6 kg of powder is required for treatment of 100 disease-free laying.

SCALE OF DEVELOPMENT: Ready for licence.

MANUFACTURE OF POTASSIUM HUMATE FROM LIGNITE

BRIEF DESCRIPTION:

It is well-established fact that the humus in soil serves to stimulate the plant growth. Humic substances arise from chemical and biological degradation of plant and animal residues. Depending on the crops, dosage is fixed as soil application or as foliar application after suitable dilution. Humic acid or salts of humic acid have been shown to increase the availability and uptake of nitrogen, phosphorus, calcium, iron, and magnesium which increase the osmotic pressure; provide release of toxins and amino acids; and serves as quality substrate for microorganisms. Humic acid is found naturally in soils, but does not exist in all soils in quantities that will support optimal crop and tree growth. Adding potassium humate rich in humic acid to the soil is a positive, natural practice and promotes long term health of the soil. Potassium humate can be mixed with organic manures and fertilizers, applied during seed soaking treatment, root application, foliar application or used directly during fertigation. This patented process (Indian Patent No: 201577) invention provides an efficient method for extraction of humic acid in the form of potassium humate from lignite as raw material.

SALIENT FEATURES:

- Has favorable effects on plant tissue nutrient balance, fertilizer uptake, top and root growth, crop yield and quality for crops
- Increases soil N-utilization efficiency and also enhances the uptake of K, Ca, Mg, P and trace elements
- Increases the water holding capacity of soil
- Stimulates seed germination and viability, and root respiration, formation and growth
- Crop yields have increased from 10 to 30 per cent
- Improves drainage and increases aeration of the soil
- Establishes a desirable environment for development of rhizosphere microbes

SCALE OF DEVELOPMENT: Ready for licence.

POSHAN: A MULTI-NUTRIENT FORMULATION FOR CORRECTING THE NUTRIENT DEFICIENCIES IN MULBERRY

BRIEF DESCRIPTION:

POSHAN – a multi-nutrient formulation is a balanced nutrient formulation along with growth promoters for correcting nutrient deficiencies in mulberry. Foliar application of different formulations is particularly relevant for timely application of specific nutrients to the leaf during growth and development. In soils having high pH, the availability of nutrients is reduced as the absorption and translocation to shoot is affected, favouring fixation of nutrients in the soil. In such soils, foliar application of multi-nutrient formulations is more effective than soil amendment. This is the only solution for maintaining the quality and quantity of mulberry leaf.

SALIENT FEATURES:

- Has favourable effects on plant tissue nutrient balance, fertilizer uptake, top and root growth, crop yield and quality for crops
- POSHAN formulation contains all the required multi-nutrients for mulberry and is low cost.
- Technology is farmer friendly as only one spray is recommended for improving the quality of leaf thereby reducing the cost of cultivation.
- The cost of spraying works out to be minimal per acre per crop.
- The developed formulation corrects the physiological disorders caused by the deficiencies of both macro and micronutrients.

SCALE OF DEVELOPMENT: Ready for licence

Technologies in
FOOD AND BEVERAGES SECTOR

OSMO AIR DRIED AMLA (Emblica officinalis) (SWEET & SALT)

BRIEF DESCRIPTION:

Osmo air-dried amla (Emblica officinalis) is a ready-to-eat product wherein salt/sugar is incorporated into the amla pieces which makes the subsequent drying process less energy intensive and gives a good taste and texture to the finished product.

SALIENT FEATURES:

- It is a concentrated fruit product with a good nutritive value,
- It is in ready-to-eat form
- The product has a good shelf-life.
- The product has a ready internal market & promising export potential.

ADVANTAGES:

This product has shelf-life upto 8-10 months at ambient temperature and finds varied application as it can be used in place of fresh fruits.

SCALE OF DEVELOPMENT:

Technology Integration

MODIFIED ATMOSPHERE PACKAGING OF MINIMALLY PROCESSED VEGETABLES

BRIEF DESCRIPTION:

The demand for safe, fresh and hygienically packed vegetable for retailing its huge demand.

Salient Features:

- Uses hurdle technology for shelf-life extension.
- Technology ready for cutting vegetables.

Advantages:

- Generates employment
- Maintains freshness and quality
- Render vegetables in convenient and "Ready-to-cook form".
- Bulk reduction for better storage, easy transportation and packaging
- Extends shelf-life by 3-5 folds
- At rural and urban level
- Boosts export of vegetables
- Renders 60% value addition
- Low cost technology

Scale of development:

Market Launch

TOMATO PROCESSING

BRIEF DESCRIPTION:

Tomato is one of the most versatile fruit. The production of tomato products, though negligible has been showing arising trend during the last few years. From a mere 2,800 MT in 1976, the production shot up to around 30000 MT per annum. The surplus production during seasons could be suitably processed and preserved in bottles and cans in the form of tomato juice, paste or puree, ketchup/sauce, tomato chutney and tomato pickles - popular ready-to-serve products relished very much in local as well as export markets .With fast food sector expanding, the demand for tomato ketchup and sauces is estimated to have expanded as indicated by the trend.

SALIENT FEATURES:

The product mix of which includes besides tomato puree/paste, ketchup, sauces and soups. The products are mostly utilized in the domestic market. Service sectors like flight catering and hospital catering, armed rations etc. are the potential markets for tomato products.

ADVANTAGES:

- Reduction in post harvest losses
- Increased shelf life
- Highly palatable and acceptable products
- Increased variety

SCALE OF DEVELOPMENT: Market launch

VALUE ADDED PRODUCTS FROM TURMERIC

BRIEF DESCRIPTION:

Turmeric is an important tropical spice primarily valued for its color, aroma, antioxidant property and powder could be used in food, perfumery and pharmaceutical industries. This ground spice is used as a condiment. It is an essential ingredient of curry powders and is extensively used in traditional medicines. Traditional Indian medicine claims the use of its powder against biliary disorders, anorexia, coryza, and cough. Various value added turmeric products have been produced:

- Turmeric powder
- Turmeric oil
- Turmeric oleoresin
- Colourants -curcuminoids

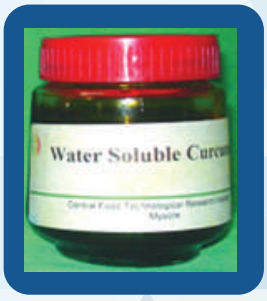
SALIENT FEATURES:

Many processing steps are involved in processing of turmeric by traditional methods. The heat treatment influences the colour and the aroma of the final product. Excess thermal treatment (cooking) spoils the colour of the final product while under-cooking renders the dried product brittle. The process developed by CSIR reduces processing steps especially the heat treatment of rhizomes; enhance the extractability of high colour and flavor of constituents.

ADVANTAGES:

- Premium products
- Improvement in colour
- Flavour enhancement

SCALE OF DEVELOPMENT: Market launch



FRESH GINGER PRODUCTS

BRIEF DESCRIPTION:

Ginger products such as preserve, candy, ginger amla syrup and beverage, ginger honey syrup and beverage, chips, pickle, paste, powder, in brine etc. can be made in very small quantities in village or rural sector by a group of trained village women entrepreneurs.

SALIENT FEATURES:

These products can be successfully marketed in urban areas where the convenience products are becoming popular.

ADVANTAGES:

Preserve candy and salted dry ginger chips can be used as mouth freshener and in confectionery products. Ginger in brine can be a replacement to fresh ginger. Ginger pickle and paste can be used as appetizers

SCALE OF DEVELOPMENT: Market Launch

BOTTLING OF SUGARCANE JUICE

BRIEF DESCRIPTION:

Help full for the preservation of sugarcane juice for months.

SALIENT FEATURES:

- Process for shelf stable natural sugarcane beverage.
- Beverage has a shelf life of 4 months.
- Provides a health, hygienic viable option for sugarcane processors.

ADVANTAGES:

Caters to the ever-increasing demand for natural soft beverages; can also be carbonated.

SCALE OF DEVELOPMENT:

Market Launch

COCONUT BEVERAGE FROM TENDER COCONUT

BRIEF DESCRIPTION:

Tender Coconut water refers to the liquid endosperm of a tender coconut at an age of approximately 9 months from time of pollination, the period before the solid endosperm or white meat forms. It is a pure and nutritious beverage in the natural state. The coconut husk is an excellent package for the water which contains sugars, minerals, amino acids and vitamins.

SALIENT FEATURES:

- Tender coconut water is a natural source of electrolytes, minerals, vitamins, complex carbohydrates, Amino acids and other nutrients.
- The natural carbohydrate content is between 4-5% of the liquid solution.
- This make coconut water particularly suitable for the burgeoning sports drink market.
- It's a natural isotonic beverage with the same level of electrolytic balance as we have in our blood. It's the fluid of life.

ADVANTAGES:

The tender coconut beverage can be packaged, distributed and sold commercially with high keeping quality due to the presence of natural electrolytes, refreshing and fresh taste of coconut.

Production of tender coconut beverage without any artificial flavouring agents has nice market to cater the consumers with high awareness who prefer least chemical additives.

SCALE OF DEVELOPMENT:

Market Launch

PRODUCTION OF RTS FRUIT JUICE & BEVERAGES

BRIEF DESCRIPTION:

A variety off soft drinks are being presently produced in the country such as sweetened carbonated (aerated) soft drinks, still beverages containing fruit juice/pulp and soda water falling under the category of RTS (ready-to-serve) beverages. Among these the share of fruit juice based beverages are very small compared to synthetic carbonated drinks/soda waters. However, the trend is slowly changing for the obvious advantages of nutritious beverages over the synthetic aerated waters. Manufacture of RTS fruit beverages based on fruit juices/pulps (pomegranate, mangosteen, guava, mango, jamun, papaya etc.) are considered here, as they are nutritious.

SALIENT FEATURES:

It is one of the most popular beverages prepared out of fruit juice. It contains 10 – 20% fruit juice with added sugar and water. It is a pasteurized product which remains preserved for a reasonable long time. It contains no chemical preservative. The beverage is chilled before direct consumption.

ADVANTAGES:

It is refreshing, palatable with thirst quenching properties.

SCALE OF DEVELOPMENT: Market launch.

PROCESSING OF PEARL MILLET FOR VALUE ADDITION

BRIEF DESCRIPTION:

Millet is relished mostly by the rural population in India for its nutritional value, being a rich source of carbohydrates and minerals, such as calcium, phosphorous and iron. The major millet varieties in India are: (a) sorghum (Sorghum bicolor); and (b) pearl millet(Pennisetum typhoides). Millets are rich source of nutrients. There are certain constraints like coarse skin, undesirable colour pigment presence of anti nutrients, poor keeping quality, etc. which hinder the utilisation of these millets. Various processing methods have been developed and standardised to over-come these constraints and improve the nutritive value of millets. These processing help to improve utilisation of millets for product developed.

SALIENT FEATURES:

- Increasing the shelf life of the processed pearl millets flour to 2-3 months from 5-8 days.
- The shelf life study indicates that the fat acidity, free fatty acids and lipase activity increased by almost four folds.
- Acceptability of colour and appearance in raw pearl millet flour is much lower as compared to processed pearl millet flour.

ADVANTAGES:

Various value added products were developed and standardised using pearl millet, finger millet, barnyard millet and sorghum.

- Preparation of Chapati mix, dhokla mix, idli mix- chapatti mix, dhokla mix, idli mix and pasta developed.
- Pasta - prepared using different proportions of bleached or unbleached pearl millet with Bengal gram seed coat.
- Development of supplementary foods like nankhatai, namkeen matar and popped ladoo, ladoo, Milk powder/soyabean/chickpea flour etc. were also added to improve its nutritive value of the supplements.
- Developed baked products such as - Cake, biscuits, Soup sticks, Rusk, Salt biscuits.
- All the products developed from various proportions of millets are found to be acceptable and nutritious.
- Cost of pearl millet based products is almost 50% of traditional products and are superior in nutrients

.

SCALE OF DEVELOPMENT: Ready for licence.

MALTED WEANING FOOD

BRIEF DESCRIPTION:

The formulation based on millets has its own market appeal for infants and geriatrics.

Salient Features:

- Ragi, the minor millet, has the uniqueness of being used for malting next only to barley
- Malted ragi is a good source of protein, carbohydrates & other nutrients besides hydrolytic enzymes.
- Used to reduce the dietary bulk of energy food & other supplementary foods.

Advantages:

- The product is based on malted ragi, which is a good source of amylase enzymes which brings down the viscosity of the product on cooking.
- Low viscosity of the product reduces the bulk of the diet and hence more food can be given per serving
- The product contains natural calcium present in ragi which has high biological value
- The product contains 12% protein and 70% carbohydrates and provides 347 Kcal per 100 g

Scale of development:

Market Launch

ONLINE FORTIFICATION OF WHOLE WHEAT FLOUR/REFINED WHEAT FLOUR

BRIEF DESCRIPTION:

The product has good demand in the growing food-to-food fortification market.

SALIENT FEATURES:

- Helps in improving the overall nutrition of the staple food
- Suitable for Atta (whole wheat flour) and Maida (refined wheat flour)

ADVANTAGES:

- Can be employed in the existing roller flour mills.

SCALE OF DEVELOPMENT: Market Launch

SPIRULINA ALGAE

BRIEF DESCRIPTION:

Spirulina Plankton is a blue-green vegetable micro-algae found in the highly alkaline lakes of Africa and Mexico. The natives of these places have been using Spirulina as part of their diet for centuries. Today, Spirulina cultivation is becoming a world-wide phenomena owing to its extraordinary nutritional qualities. The various features that highlight the importance of Spirulina under present day context are:

SALIENT FEATURES:

- The only single, natural source providing the highest amount of protein ever known to man is spirulina which contains 71% protein.
- Like all other microbial cells, Spirulina contains all natural vitamins including the 'B' complex range. It contains the highest amount.
- It is the only vegetable source of vitamin 'B12' containing two and half times that of liver.
- The other micro organisms including those pathogenic to humans and other animals are eliminated in the production process of spirulina due to its requirement of a very high alkaline growth medium.
- Spirulina's preference for tropic and sub tropic climatic conditions offers a best land use in arid areas.

APPLICATIONS:

- Food Supplement -The World Health Organisation has found Spirulina to be an excellent food for human consumption and Spirulina has the approval of the Food & Drugs Authority of the United States for being sold as a natural food.
- Health And Medicine- Cholesterol control, Vitamin A, deficiency & malnutrition, Adjunct to cancer patients undergoing chemotherapy, Formulations with other natural products as a general health supplement, liver corrective for liver disorder, etc.
- In Pisiculture- Speciality feed for aquarium fish, Colour enhancement feed for Gold fish, Formulation with existing feeds for augmentation of vitamins, High protein feed for table variety fishes (fresh water), Special feed for shrimp farming.
- Cosmetics- Spirulina in pimple lotions, Facial asks, Hair oil, Shampoo, Mineral bath, Skin cleaner, Tooth paste.

Technologies in
WATER TREATMENT SECTOR

MANUFACTURING THIN FILM COMPOSITE REVERSE OSMOSIS MEMBRANE FOR DESALINATION AND WATER PURIFICATION

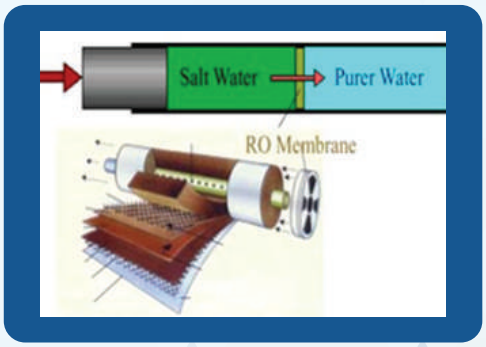
BRIEF DESCRIPTION:

The Technology covers the process for manufacturing low fouling thin film composite (TFC) reverse osmosis (RO) membrane in two steps using the semi-automated machinery which were designed and fabricated in the laboratory. The first step in the process is the preparation of poly-sulphone porous support having about 30-40 micron thickness on a non-woven polyester fabric according to wet-phase inversion method at a scale of 1m width x 100-500 length and at the rate of 2-10 meters/min. NaCl rejection with water flux of 50-65 liters/m2 h. Technology has also been developed for making spiral modules of different size from the flat sheet TFC membranes.

Comparative Advantages:

Fabrication of TFC membranes (100x100 m2) with indigenously designed and developed semi-automated polysulphone casting and TFC polyamide coating machines.
Cost Improvement of fouling resistance property of the TFC membranes by simple and robust post treatment method and thus improvement in the membrane life.
Improvement of chlorine stability by simple and robust post treatment of the TFC membranes.
Effective technology for preparation of TFC support membranes and polyamide TFC membranes thereof.
It has low fouling, high flux and high rejection thin film composite reverse osmosis membranes at commercial scale levels at the rate of 20-25 m/h using semi-automated machinery

Scale of Development: Already Commercialised



INSTANT WATER FILTER

BRIEF DESCRIPTION:

Instant Water Filter is the water purification system suitable for potable water supply particularly under emergency situation with a wide range of flood water quality. It meets drinking and cooking water requirements on emergency basis and serve as a disaster management tool for drinking water supply under flood affected situations. A typical unit, with two 100 L vessels, can serve about 20-30 persons, when operated for 10 hours a day, on the basis of 6-10 litres per capita/day for drinking and cooking purposes.

A typical unit comprises two plastic containers placed at elevation difference to manage gravity flow. The given oxidizing chemical solution is added into the raw water container. The filtered water from the tap is collected in the third container. The given disinfectant solution is added to this treated water container, once treated water starts accumulating in the container. The container is allowed to fill up to the capacity. Safe potable water is ready for use after half an hour. The filter needs periodical cleaning. The typical capacity of the unit is 20-30 L/hr. of treated water.

COMPARATIVE ADVANTAGES:

Produces potable water within few hours
Treatment without electric power supply
Operating cost Rs. 3 per 100 litre
Removes turbidity, organic matter and bacterial contamination
No change in dissolved salts in the water
Can be used as a domestic iron removal unit

Scale of Development: Commercialized

HOLLOW FIBRE MICROFILTRATION AND ULTRAFILTRATION MEMBRANE

BRIEF DESCRIPTION:

Water pollution is a very serious problem in the world. Most of the world's surface water and many of the groundwater reservoirs have been contaminated due to biological and industrial pollutants. In this context development of indigenous Hollow fibre membrane based water purification technology is the need of the hour.

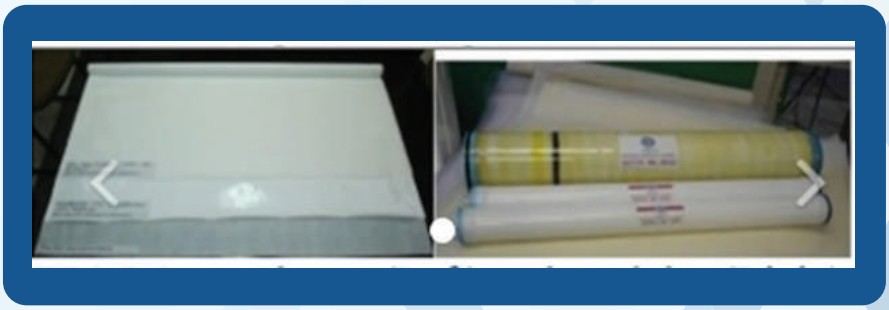
This technology has been successfully developed for manufacturing hollow fibre (HF) microfiltration (MF) and ultrafiltration (UF) membranes having discrete molecular weight cut off (MWCO) values from polymers like polysulphone, polyethersulphone polyvinylidene fluoride, polyacrylonitrile and blends of polysulphone and polyacrylonitrile. Hollow fibre membranes are made according to the wet phase inversion process under different conditions using the semi-automatic spinning unit. Fibres could be spun at a rate varying from 35-50 m/min.

The hollow fibres were found suitable for the removal of bacteria (6 log reduction), virus (4 log reduction), turbidity and colloidal materials (NTU reduction ≥ 99%) from contaminated water and thus produce safe drinking water. Hollow fibre modules of different sizes (60" X 4"; 40" X 4"; 20" X 4"; 20" X 2"; etc.,) were fabricated by potting both the ends of the bundle of fiber for practical applications.

COMPARATIVE ADVANTAGES:

The hollow fibre membranes exhibit solute cut off values in the range of 12000 to 91000 Da and are useful for the treatment of different types of solutions.
They exhibit 4-6 log bacterial rejections and are useful for disinfection of drinking water for the removal of harmful pathogens.
The presence of methacrylic acid functionality in the hollow fibres increases the negative charge as well as hydrophilicity of the membranes and thus imparts fouling resistance properties for the treatment of water and other contaminated water.
The fibres can be used in point of use domestic water purification units as well as large scale purification plants.

Scale of Development: Commercialised



HAND PUMP ATTACHABLE IRON REMOVAL PLANT FOR COMMUNITY WATER SUPPLY

BRIEF DESCRIPTION:

Excessive Iron in drinking water affects human health. Precipitation of soluble iron by oxidation with air followed by sedimentation and filtration is a relatively simple process used for removal iron from groundwater. Based on this process our associate lab has designed hand pump attachable iron removal plant with 1 m3/hr hydraulic loading. The plant is suitable for 250 persons with 40 lpcd and 10 hrs of operation. The dimensions of the plant are 135 cm diameter and 150 cm height.

COMPARATIVE ADVANTAGES:

Continuous operation system with 1 cu m/hour hydraulic loading
Oxidizes the dissolved iron : 1-30 mg/L
High Removal Efficiency and easy to operate
No need of chemical addition, skilled operator, electric power and mechanical parts
Minimum maintenance with negligible operational cost
Pre-fabricated FRP units can be installed quickly
The system treats the water with Iron content in the range of 1 – 30 mg//L.
The treated water is with iron content below the drinking water standard (BIS: 10550: 2012) of 0.3 mg/L.
The plant is either constructed of Reinforced Concrete (RCC) or prefabricated using Fiber-glass Reinforced Plastic (FRP) as per required situations.

Scale of Development: Technology is commercialized

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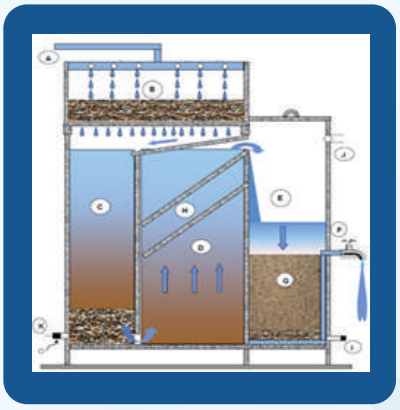
The technology is already commercialized



A PROCESS FOR REMOVAL OF ARSENIC, CHROMIUM, CYANIDE AND PESTICIDES FOR IMPROVING WATER QUALITY

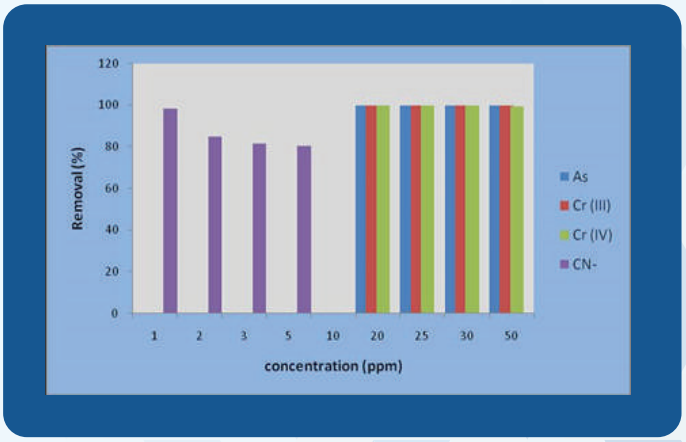
Presence of arsenic (As) and chromium metal ions in drinking water has become the issue of global concern. Long-term exposure to even low concentrations of arsenic in the drinking water may cause skin, lung or prostrate cancer and cardiovascular, pulmonary, immunological and neurological disorder. A process has been developed for the removal of arsenic and chromium from contaminated water using nanoparticles of zinc peroxide (ZnO2) capped with glycerol/tri-ethylamine (TEA)/poly vinyl pyrrolidone (PVP). The synthesized ZnO2 nanoparticles remove arsenic and chromium from the contaminated water from the level of 25 ppm to less than the detection limits of the AAS-HG and FAAS/GFAAS instruments used respectively, which is less than the USEPA prescribed limit 10 ppb for arsenic and 50 ppb for chromium for drinking water.

The ZnO2 nanoparticles were synthesised by dissolving zinc acetate ammonia solution and the resulting solution was diluted with using suitable solvent. Hydrogen peroxide was also added in the prepared solution at room temperature. The solution was stirred on magnetic stirrer for 1 hour after adding hydrogen peroxide solution. The precipitate was centrifuged washed several times with 1:1 water-solvent mixture and then with de-ionized water several times. Finally the precipitate was dried at 105 deg. C. in an oven up to complete dryness.

COMPARATIVE ADVANTAGES:

Low cost
Highly effective
Environment friendly

Technology is ready to be licensed



ARSENIC REMOVAL FROM GROUNDWATER

SUMMARY APPLICATION:

It is an adsorption technique. A naturally occurring ferruginous manganese ore (FMO) is used as adsorbent for iron and arsenic in contaminated groundwater and may be applied at both domestic and community level. A domestic three compartment filtration unit employing this technique has been developed at an associate laboratory of NRDC. It works for both As(lll) and As(V) without any pre-treatment. At domestic level the hardware does not require electricity. The process comes with a sludge management protocol.

COMPARATIVE ADVANTAGES:

The process can be used at domestic as well as community level.
The ferruginous manganese ore (FMO) used as adsorbent for iron and arsenic is non-toxic
The community level plant equipment and machinery can be designed as per the client requirement
It is a cost effective technique with filtered water cost at 3-5 paisa per litre covering all possible recurring expenditure and the hardware cost at Rs. 600/- per unit (one time).

Technology is ready to be licensed.

COAL MINE WATER RECLAMATION

This technology was developed with the objective to purify coal impacted water to be fit for drinking. Coalmine water reclamation process developed has three modules arranged sequentially, It separates suspended particulate matters using appropriate flocculants, negotiates dissolved contaminants including heavy metal ions with a nanometric aqueous suspension developed that kills harmful micro-organisms through ozonisation. The finished product is suitable for the purpose of drinking, the plant developed to perform on continuous mode @ 4000-5000 LPH that can operate for 20 hours per day.

ADVANTAGES:

- The process provides reclamation of coalmine water free of harmful micro-organisms suitable for the purpose of drinking.
- The purified water cost works out to be less than 20 paisa per litre.
- The process is environment friendly and does not involve any hazardous or toxic reagents.

Technology is ready to be licensed.

DOMESTIC FILTER FOR DE-FLUORIDATION OF WATER

The developed technology is domestic type adsorption based multi stage water filtration unit. The process comprised of activated alumina (AA), ferrite impregnated (FIA) active alumina and silver impregnated activated carbon (SIAC). The developed filtration unit could be promising for commercialization. The developed unit has a very potential application the region where fluoride concentration is higher in the ground or surface water. Approximate cost of the defluoridation unit: $32/- (SS make); $20/- (Polypropylene make).

SUMMARY APPLICATION:

Various School, Colleges
Govt Offices
Health Centre in Rural fluoride affected areas

COMPARATIVE ADVANTAGES:

Effective reduction of Fluoride concentration from ~ 5 ppm to below permissible limit (~1.5 ppm)
Simultaneously useful for bacterial remediation since standard SIAC is used
No electricity
Flow rate: ~ 5-6 L / hour
Adsorbent life (average): ~2000 L
Storage capacity: ~15 L
Adsorbent replacement cost: ~ Rs. 10/-
Cost of filtered water is cent 0.06/ day which is very less compared to a daily labour's wage

Technology is ready to be licensed.

ELECTROLYTIC DE-FLUORIDATION PROCESS

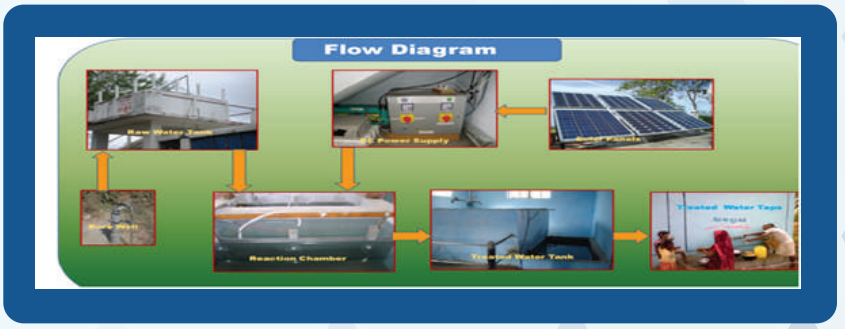
Electrolytic de-fluoridation process is a water purification system suitable for fluoride affected area with water containing excess fluoride. The defluoridation process is based on the principle of electrolysis, using aluminium plate electrodes placed in the raw water containing excess fluoride. During the electrolysis, anode gets ionized and fluoride is removed by complex formation, adsorption, precipitation, coagulation and settling.

Electrolytic defluoridation (EDF) system uses totally new concept for treatment of safe potable water supply in fluoride affected areas, particularly in the villages which have no electric supply and do not have alternate safe water source for potable water supply.

ADVANTAGES/SALIENT FEATURES:

Simple to fabricate, easy to operate with minimum maintenance
Suitable for treatment of raw water with fluoride concentration up to 10 mg/L
Produces potable water with palatable taste as against the other available chemical treatment methods
Quantity of sludge produced is much less (60-70%) than conventional treatment methods
Simultaneous reduction in hardness and bacterial contamination in treated water
Treatment cost up to 40 cent per 1000 L
Can be operated using Solar Energy
Can be configured to any design capacity
Operation and maintenance by unskilled operator
Successfully implemented in the field and nearly 100 plants being operated in fluorosis endemic areas supplying safe drinking water to nearly 2 lakh people

Technology is ready to be licensed.



H2S STRIP MICROBIAL WATER TESTING KIT

Testing water sources is a critical step for anyone within or affected by the water industry — from government organizations looking to regulate waters to safeguard against environmental and health risks, to homeowners wanting to ensure their water is safe for consumption. Water, whether for a pubic municipality, water facility or business/home, must be tested regularly to keep the source safe and free of potential health/environmental risks. Contamination of food/water in quantity as low as 1 g makes it unfit for consumption and must be tested to avoid any health issues. Further getting this test done in the laboratory is expensive.

Salient Features:

- The process is based on the detection of H2S producing organisms in drinking water, which are present along with Coliforms.
- The kit encompasses screw cap bottles with test media and suitable indicator. Small amount of test sample is put in the bottle and left at 30 ±5C overnight.
- Change in colour depicts the presence of coliforms.

Advantages:

- Low in cost, all other segments and materials can be found easily.
- Simple for non skilled people to understand as a clear change of colour is observed.
- Easy to use in the field as it consists of only prepared testing vial.
- Samples can be incubated at room temperature.
-

The technology is ready to be licensed.