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

Sr. No.	TITLE OF TECHNOLOGY
	RENEWABLE ENERGY
1.	SOLAR TREE
2.	WIND SOLAR HYBRID (WISH) SYSTEM
3.	BIOMASS GASIFIER BASED POWER GENERATION SYSTEM
4.	NATURAL GAS BASED POT AND MUFFLE FURNACES FOR GLASS INDUSTRY
5.	BIOGAS FROM MUNICIPAL SOLID WASTE
6.	CO -DIGESTION OF TANNERY SOLID WASTE FOR BIOGAS GENERATION
7.	HIGH SOLID TREATING COMPACT DIGESTER CUM BIOGAS PLANT
8.	BIOHYDROGEN PRODUCTION FROM BIOGENIC WASTE (SOLID /LIQUID)
9.	SOLAR BIODIESEL HYBRID MINIGRID OF 50KW PEAK CAPACITY
10.	SOLAR HYDROGEN GENERATION TECHNOLOGY
11.	RENEWABLE BIOHYDROGEN (H_2) AND PLATFORM CHEMICAL FROM BIOGENIC (SOLID /LIQUID) WASTE
12.	SUSTAINABLE INTEGRATION OF IRON REDOX FLOW BATTERY WITH A RENEWABLE ENERGY SOURCE
	ENVIRONMENT MANAGEMENT & WASTE MANAGEMENT
13.	GAS SENSOR FOR ENVIRONMENTAL MONITORING
14.	PLASTIC WASTE SORTING SYSTEM FOR FIVE TYPES OF PLASTICS
15.	COMPOSITE BOARD FROM AGRO-WASTE
16.	PROCESS TECHNOLOGY FOR SEPARATION OF GLASS AND PHOSPHUR FROM WASTE CFLs
17.	FLY ASH SOIL AMENDMENT TECHNOLOGY (FASAT)
18.	GASIFICATION OF POWDERY BIOMASS/COAL/INDUSTRIAL WASTES
19.	HYBRID WOOD SUBSTITUTE COMPOSITE
20.	HIGH STRENGTH PLASTER FROM FLUORO-GYPSUM
21.	UTILISATION OF MUNICIPAL SOLID WASTES (MSW) FROM LANDFILL FOR ROAD EMBANKMENT CONSTRUCTION
22.	PROCESS FOR THE PREPARATION OF WASTE PVC (POLY VINYL CHLORIDE) MODIFIED BITUMEN-USEFUL FOR PAVING APPLICATIONS
23.	PROCESS OF USING THERMOCOL (EXPANDED POLYSTYRENE) WASTE IN HOT BITUMINOUS MIXES FOR ROAD CONSTRUCTION
24.	GEOPOLYMER CEMENT
25.	RAPID COMPOSTING OF MUNICIPAL SOLID WASTE
26.	VALUE-ADDED PRODUCTS FROM FLY ASH
27.	PLASMA DISPOSAL OF PLASTIC WASTE AND GENERATION OF SYNGAS FOR POWER GENERATION
28.	RECYCLING OF PLASTIC WASTES INTO TILES FOR STRUCTURE DESIGNING FOR SOCIETAL USAGE
29.	WASTE PLASTICS TO FUEL AND PETROCHEMICALS
	OCEAN TECHNOLOGY
30.	AUTONOMOUS UNDERWATER VEHICLE
31.	REMOTELY OPERATED VEHICLE
32.	ROBO COASTAL OBSERVER
33.	AUTONOMOUS UNDERWATER PROFILING DRIFTER
34.	COASTAL OBSERVER AND LIFE SAVER
35.	DRIFTING BUOY SYSTEM
36.	WIRELESS EXPENDABLE CONDUCTIVITY, TEMPERATURE AND DEPTH PROFILER SYSTEM TECHNOLOGY
37.	SUB BOTTOM PROFILER SYSTEM
38.	DRISTI
39.	MARINE OIL SPILL BIOREMEDIATION TECHNOLOGY (MARESOL)
40.	DEVELOPMENT OF 'C'-PROFILER FOR OCEAN OBSERVATION
41.	SALINE WATER LANTERN
42.	RECOMBINANT ECTOINE FROM DEEP SEA BACTERIA

1.	PROCESS FOR THE PRODUCTION OF LUTEIN
2.	BIOSURFACTANT FROM MARINE BACTERIA
3.	C-PHYCOCYANIN FROM MARINE SPIRULINA TECHNOLOGY
4.	PHARMACOACTIVE NUTRIENT FROM MARINE ALGAE
5.	*E. FAECALIS* MULTIPLEX PCR KIT
6.	RECOMBINANT GLUTAMINASE FREE L-ASPARAGINASE FROM MARINE ACTINO BACTERIA *Nocardiopsis alba*: A PROMISING THERAPEUTIC AGENT FOR LEUKAEMIA CHEMOTHERAPY
	AGRO & AGRICULTURE SECTOR
7.	CASHEW NUT PROCESSING PLANT
8.	CONSULTANCY FOR ESTABLISHMENT OF MODEL/DEMONSTRATION CASSAVA FARM
9.	MOBILE DISTILLATION UNIT FOR ESSENTIAL OILS FROM MINTS, VETIVER, PATCHOULI, LEMON, GRASS, BASIL, PALMAROSA, CITRONELLA, MAGARMOTHA ETC.
10.	COTTON PRODUCTION AND PROCESSING TECHNOLOGIES
11.	PALM OILEXTRACTION TECHNOLOGY
12.	BIOGAS AND BIO-MANNURE FROM POULTRY LITTER
13.	AGRO-TECHNOLOGY FOR EDIBLE MUSHROOM
14.	LOW COST JUTE BASED DISPOSABLE SANITARY NAPKIN FOR RURAL WOMEN
15.	A PROCESS FOR MANUFACTURING JUTE FIBRE REINFORCED LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) COMPOSITE PRODUCT
16.	ROT RESISTANT NATURAL DURABLE JUTE GEO-TEXTILES
17.	CLEAN EXTRACTION OF BANANA FIBRE FROM PSEUDO STEM AND EMPTY BUNCHES
18.	COIRRET- INNOCULANT FOR RETTING COCONUT
19.	MOBILE FIBRE EXTRACTION MACHINE
20.	ANIMAL DRAWN SIX-IN-ONE TILLAGE OUTFIT / ASSEMBLY
21.	PITHPLUS
22.	COCOLAWNTM: A READYMADE LAWN
23.	BIOPESTICIDAL NEMA GEL
24.	A DEEP SOIL VOLUME LOOSENER-CUM-FERTILIZER APPLICATOR
25.	ANKUSH- A NEW SILKWORM BED DISINFECTANT
26.	MANUFACTURE OF POTASSIUM HUMATE FROM LIGNITE
27.	POSHAN: A MULTI-NUTRIENT FORMULATION FOR CORRECTING THE NUTRIENT DEFICIENCIES IN MULBERRY
	FOOD & BEVERAGES SECTOR
28.	READY TO SERVE FISH CURRY IN FLEXIBLE POUCHES
29.	BATTERED AND BREADED PRODUCTS FROM FISH
30.	COATED FISH PRODUCTS
31.	FISH KURE
32.	FISH PICKLE
33.	FISH WAFERS
34.	THERMAL FISH BASED PROCESSED PRODUCTS
35.	SHELF STABLE DEHYDRATED EGG PANEER/CUBES AND EGG CRUNCHY BITES
36.	MUTTON PICKLE
37.	READY TO EAT MEAT WAFERS
38.	SAUSAGES: MEAT/FISH/CHICKEN/PORK
39.	JACKFRUIT PROCESSING
40.	OSMO AIR-DRIED JACKFRUIT
41.	VALUE ADDED PRODUCTS FROM BANANA
42.	VALUE ADDED PRODUCTS FROM CUSTARD APPLE
43.	PRODUCTION AND PROCESSING OF OYSTER MUSHROOMS
44.	JAMS, JELLIES AND MARMALADES
45.	NUTRI-JAM:AN HERBAL JAM RICH IN NUTRITION

1.	AMLA (*Embilica officinalis*) PASTE
2.	AMLA *(Embilica officinalis*) SPREAD
3.	OSMO AIR-DRIED AMLA (*Embilica officinalis*)- SWEET & SALT
4.	MODIFIED ATMOSPHERE PACKAGING OF MINIMALLY PROCESSED VEGETABLES
5.	TOMATO PROCESSING
6.	INSTANT PICKLES
7.	DEHYDRATED VEGETABLE CURRY MIXES
8.	VIRGIN COCONUT OIL
9.	BAMBOO PRODUCTS FROM EDIBLE SHOOTS (CANDY, SNACKS & JUICE)
10.	VALUE ADDED PRODUCTS FROM TURMERIC
11.	VALUE ADDED PRODUCTS FROM CHILLI
12.	FRESH GINGER PRODUCTS
13.	FRUIT SQUASHES & SYRUPS
14.	BEVERAGES FROM BANANA PSEUDO STEM
15.	PASTEURIZED BOTTLED JUICE FROM ROSELLE (BISSAP)
16.	BOTTLING OF SUGARCANE JUICE
17.	COCONUT BEVERAGE FROM TENDER COCONUT
18.	PRODUCTION OF RTS FRUIT JUICE & BEVERAGES
19.	FRUIT BASED HERBAL DRINK (ALCOHOL 2-5%)
20.	CARROT JUICE BEVERAGE & RTS BEVERAGE FORMULATION
21.	GINGER BEVERAGE
22.	LITCHI PRODUCTS- CANNED & SQUASH
23.	COFEE CONCENTRATE
24.	PROCESS OF COCOA BEANS TO COCOA MASS, BUTTER & POWDER
25.	PEARL MILLET FOR VALUE ADDITION
26.	PAPADS
27.	NUTRITIOUS FLOUR
28.	MALTED WEANING FOOD
29.	ONLINE FORTIFICATION OF WHOLE WHEAT FLOUR/REFINED WHEAT FLOUR
30.	SPIRULINA ALGAE
	CHEMICAL SECTOR
31.	SULPHATE OF POTASH AND REFRACTORY GRADE MAGNESIA FROM SEA BITTERN
32.	SEAWEED LIQUID FERTILISER FROM BROWN SEAWEED
33.	SUPER-ABSORBENT HYDROGEL
34.	EXTRACTION OF AZADIRACHTIN FROM NEEM SEEDS KERNELS
35.	PONGAMIA SOAP FOR AGRICULTURE USE
36.	NEEM SOAP FOR AGRICULTURE USE
37.	A MERCAPTAN FREE PROCESS FOR PROFENOFOS
38.	PROCESS FOR PREPARATION OF ARKA MANGO FOLIAR SPRAY FORMULATION
39.	PROCESS FOR PREPARATION OF BANANA FOLIAR SPRAY FORMULATION
40.	PROCESS FOR PREPARATION OF VEGETABLE FOLIAR SPRAY FORMULATION
41.	PROCESS FOR FOLIAR MICRONUTRIENT FORMULATIONS FOR SPICE CROPS
42.	ALKALINE PROTEASE PRODUCTION
43.	THEAFLAVINS
44.	ENZYMATIC RAPID FIBRE OPENING
45.	GENETICALLY ENGINEERED AND STABLE LIPASE VARIANTS
46.	HIGLY EFFICIENT SOLAR ABSORBER FOR WATER HEATING
47.	HIGH TEMPERATURE SOLAR SELECTIVE COATING FOR SOLAR THERMAL POWER GENERATION
48.	MANUFACTURING TECHNOLOGY FOR CARBON FIBRES
49.	TECHNOLOGY FOR LUBE OIL RECLAMATION

1.	LIQUID DEODORANT CLEANER
2.	A COST-EFFECTIVE PROCESS FOR RECOVERY OF LOW SODIUM SALT FROM BITTERN
3.	FREE FLOWING IODIZED SALT
4.	CHROME-MELAMINE SYNTAN
5.	GLUE/GELATIN FROM TANNERY WASTES
6.	COLLAGEN SHEET FOR WOUND DRESSING (FROM BOVINE SOURCE)
7.	TECHNOLOGY FOR THE PRODUCTION OF BIODIESEL FROM JATROPHA SEED
8.	MANAFACTURE OF POROUS CONDUCTING PAPER FOR FUEL CELL APPLICATION
9.	Tp-16 BIOFERTILIZER
	DIAGNOSTICS SECTOR
10.	INTEGRATED CORROSION MONITORING SENSOR (ICMS) GADGET
11.	NOVEL METHOD FOR SIMULTANEOUS DETECTION AND DISCRIMINATION OF BACTERIAL, FUNGAL, PARASITIC AND VIRAL INFECTIONS OF EYE AND CENTRAL NERVOUS SYSTEM
12.	MOISTURE SENSOR AND MOISTURE METER
13.	PORTABLE MAGNIFYING INSTRUMENT USEFUL FOR COLPOSCOPY
14.	SALIVARY FLUORIDE DETECTION KIT
15.	SURGICAL MICROSCOPE FOR EYE SURGERY
16.	MYOMETER
17.	PULMOSCAN: AN AFFORDABLE FORCED OSCILLATION TECHNIQUE BASED DEVICE FOR BETTER POINT OF CARE SCREENING OF LUNG DISEASE
18.	CIRCULAR ELECTROPHORESIS
19.	WATER TESTING KIT
20.	THERMO-STABLE ELISA KIT
21.	SOIL MOISTURE INDICATOR
22.	ACOUSTIC MILK ANALYSER
23.	IODINE VALUE METER
24.	RISK ASSESSMENT OF WATER BORNE PATHOGENS, DETECTIONS BY BACTERIOLOGICAL WATER TESTING KIT (BWTK)
25.	TEST KIT FOR MICROBIOLOGICAL QUALITY OF DRINKING WATER
	WATER TREATMENT SECTOR
26.	MANUFACTURING THIN FILM COMPOSITE REVERSE OSMOSIS MEMBRANE FOR DESALINATION AND WATER PURIFICATION
27.	LOW COST TERAFIL WATER PURIFICATION SYSTEM
28.	INSTANT WATER FILTER
29.	HOLLOW FIBER MICROFILTRATION AND ULTRAFILTRATION MEMBRANE MANUFACTURING TECHNOLOGY
30.	HAND PUMP ATTACHABLE IRON REMOVAL PLANT FOR COMMUNITY WATER SUPPLY.
31.	A PROCESS FOR REMOVAL OF ARSENIC, CHROMIUM, CYANIDE AND PESTICIDES FOR IMPROVING WATER QUALITY
32.	ARSENIC REMOVAL FROM GROUNDWATER
33.	COAL MINE WATER RECLAMATION
34.	DOMESTIC FILTER FOR DEFLUORIDATION OF WATER
35.	ELECTROLYTIC DEFLUORIDATION PROCESS
36.	CERAMIC MEMBRANE BASED TECHNOLOGY FOR REMOVAL OF ARSENIC AND IRON FROM GROUND WATER
37.	H2S STRIP MICROBIAL WATER TESTING KIT
38.	IMPROVED IRON REMOVAL
39.	WATER FILTER FOR ARSENIC REMOVAL
	HERBAL SECTOR
40.	A HERBAL CHOLESTROL LOWERING FORMULATION
41.	HERBAL AYUSH ANTIDIABETIC 82
42.	ANTI COUGH HERBAL FORMULATION
43.	ANTI-ARTHRITIS: A HERBAL FORMULATION

1.	AYUSH GHUTTI -"A HERBO-MINERAL FORMULATION" FOR COUGH AND COLD
2.	AYUSH-56 – PROCESS FOR PREPARATION OF THERAPEUTICALLY ACTIVE ANTI-EPILEPTIC PREPARATION
3.	HERBAL CCRAS MOSQUITO REPELLENT
4.	BAL RASAYAN - A PROCESS FOR THE PREPARATION OF A HERBOMINERAL PREPARATION FOR GENERAL IMMUNITY AND STRENGTHENING OF CHILDREN
5.	CIMAP ASVIKA PORTABLE MINI DISTILLATION UNIT
6.	DRY POWDER INHALATION OF PARTICLES CONTAINING ANTI-TUBERCULOSIS DRUGS
7.	FLOMOP - FLOOR MOPPING EMULSION
8.	GERANIUM OIL BASED SHAMPOO
9.	HANKOOL - HAND DISINFECTANT
10.	HERBAL COLOURS FOR COSMACEUTICALS
11.	HERBAL OINTMENT FOR WOUNDS
12.	HERBICHEW - TOBACCO & CHEMICAL FREE HERBAL MIXTURE
13.	MEMORY ENHANCER: A HERBAL FORMULATION
14.	MOSAWAY - NATURAL MOSQUITO REPELLENT CREAM
15.	TECHNOLOGY FOR MANUFACTURING OF NATURAL COLOURS
16.	NAARI (SANITARY NAPKINS) TECHNOLOGY
	MINERALS & METALS SECTOR
17.	BATTERY GRADE MATERIALS FROM SPENT CATALYSTS, SLUDGES, SECONDARIES, EFFLUENTS, PRIMARY AND LOW-GRADE ORES.
18.	COLUMN THICKENER AND A PROCESS THEREOF FOR DEWATERING OF IRON ORE SLURRY.
19.	EYE-ON-PELLET ONLINE PELLET SIZE ANALYZER FOR IRON ORE PELLETIZATION INDUSTRIES
20.	HIGH PURE METALS FROM SPENT CATALYSTS, SLUDGES, SECONDARIES, EFFLUENTS, PRIMARY AND LOW-GRADE ORES
21.	HIGH PURE TELLURIUM POWDER FROM ANODE SLIME
22.	INDUSTRIAL COATINGS BY ELECTROPHORETIC DEPOSITION
23.	LOW ASH COAL PRODUCTION FOR UTILISATION IN METALLURGICAL INDUSTRIES
24.	MAXIMIZING THE RECOVERY OF FLAKY GRAPHITE IN BENEFICIATION PROCESS.
25.	PROCESS DEVELOPMENT FOR PRODUCTION OF GRAPHENE OXIDE (GO) FROM NATURAL GRAPHITE
26.	PROCESS DEVELOPMENT FOR PRODUCTION OF HIGH PURITY GRAPHITE FROM NATURAL GRAPHITE
27.	PROCESS TO BENEFICIATE LOW GRADE BAUXITE
28.	RECOVERY OF IRON VALUES FROM RED MUD
29.	SCREW SCRUBBER EQUIPMENT FOR MINERAL PROCESSING
30.	HYDRAULIC TRANSPORTATION OF MINERALS/ORES/INDUSTRIAL WASTES
31.	BEACH SAND HEAVY MINERALS
32.	BRIQUETTING OF ORE FINES
33.	COLD BONDED CARBON COMPOSITE PELLETS FOR UTILIZATION OF IRON ORE MICRO- FINES AND CARBON BEARING FINES
34.	COLUMN FLOTATION TECHNOLOGY
35.	SYNTHETIC FLUX AND PROCESS FOR DE-PHOSPHORIZATION OF STEEL IN INDUCTION FURNACE
36.	FLUXED SINTER THROUGH MICRO-PELLETIZATION
37.	HIGHLY METALLISED LOW SULPHUR DIRECTLY REDUCED IRON (DRI) FROM IRON ORE SLIME AND REJECTED/MIDDLING COAL
38.	PELLET-SINTER COMPOSITE AGGLOMERATE (PSCA)OF IRON OXIDE FINES FOR USE IN BLAST FURNACE
39.	PRODUCTION OF DIRECTLY REDUCED IRON
40.	SPECIFIC, SELECTIVE & GREEN REAGENTS FOR THE BENEFICIATION OF ORES, MINERALS & COAL
	MECHANICAL ENGINEERING SECTOR
41.	KRISHI SHAKTI (10 HP TRACTOR)
42.	CABINET DRYER FOR GINGER AND TURMERIC
43.	COCONUT DEHUSKING MACHINE
44.	COTTON PICKING HEAD

1.	FLUIDIZED BED DRYER FOR AGRO CROPS
2.	INTER-ROW ROTARY CULTIVATOR FOR WIDE-ROW CROPS
3.	OFFSET ROTAVETOR FOR ORCHARDS
4.	PNEUMATIC PRECISION PLANTER FOR VEGETABLES
5.	ROTARY DRUM WASHER FOR GINGER AND TURMERIC
6.	AUTO DIPPER
	ELECTRICAL & ELECTRONICS SECTOR
7.	ELECTRONIC WEIGHING BASED FRUIT SORTING SYSTEM
8.	SYSTEM FOR DETECTION OF ADULTERATIONS IN MILK
9.	X RAY IMAGING BASED MANGO SORTING SYSTEM
10.	HANDHELD MILK QUALITY ANALYZER
11.	ON-LINE MONITORING OF FREE FATTY ACID (FFA) IN EDIBLE OIL
12.	SMART CAMERA BASED SYSTEM SORTING FOR BISCUIT
13.	1KW GRID TIED /STAND-ALONE SOLAR INVERTER
	ELECTROCHEMICAL AND CORROSION SECTOR
14.	PEM ELECTROLYSER
15.	AMORPHOUS ALLOY COATINGS BY SPUTTERING FOR SURGICAL TOOLS AND BIOIMPLANTS
16.	MULTICOAT PROTECTIVE SCHEME FOR CONCRETE STRUCTURES AND BRIDGES
17.	3-CHLOROMETHYL AZETIDINONE ESTER (CEPHALOSPORIN ANTIBIOTIC)
18.	ELECTROCHEMICAL DYEING OF COTTON FABRICS
19.	ELECTROCHEMICAL CONVERSION OF DL-HOMOCYSTINE TO DL-HOMOCYSTEINE
20.	1,4-NAPHTHOQUINONE
21.	SMART SELF HEALING COATING OF CONDUCTING POLYMERS FOR CORROSION PROTECTION
22.	BIODEGRADABLE INHIBITOR FOR PREVENTING SCALE AND CORROSION DEPOSITS OF STEEL PIPELINE IN COOLING WATER SYSTEM AND PROCESS THEREOF
23.	TRIBOLUMINESCENT (TL) PAINT TRIGGERED LUMINESCENCE SIGNAL IDENTIFYING SMART CAMERA FOR CRACK DETECTION OF STRUCTURAL COMPONENTS
24.	SIMULTANEOUS DETECTION AND INHIBITION OF CORRODING STEEL STRUCTURES IMINE FUNCTIONALIZED SILICA AEROGELS AND ITS PROCESS THEREOF
25.	3-KW LT-PEMFC FOR STATIONARY POWER APPLICATION
26.	DEVELOPMENT OF MODIFIED POLYMER ELECTROLYTE MEMBRANES FUEL CELL (PEMFC) STACKS FOR HYDROGEN REMOVAL
27.	ELECTROPLATING OF GOLD
28.	CORROSION RESISTANT INHIBITIVE ADMIXTURE FOR PORTLAND POZZOLANA CEMENT
29.	INTEGRATED CORROSION MONITORING SENSOR (ICMS) GADGET
30.	INDIGENOUS Li-ion BATTERY
31.	CORROSION RESISTANCE THERMAL COATING FOR HYDROCLAVES
32.	METAL OXIDE IMPREGNATED FABRICS FOR SURGICAL MESH
33.	COLLOIDAL MULTI-COMPONENT CZTSSE INKS FOR SOLAR CELLS
34.	MICRO FUEL CELL
35.	CARBON COMPOSITES BIPOLAR PLATES FOR HYDROGEN-BASED FUEL CELL APPLICATIONS
36.	DEVELOPMENT OF FREE STANDING AND FLEXIBLE CARBON NANOTUBE PAPER
37.	A COST-EFFECTIVE PROCESS FOR THE PRODUCTION OF HIGH-PURITY SOLAR SALT IN SOLAR SALT WORKS
38.	WEARABLE METHANOL FUEL CELL POWER PACK FOR SOLDIERS
39.	SCALED -UP SYNTHESIS OF HIGH POWER LI -ION BATTERY MATERIALS - INDIGENOUS TECHNOLOGY DEVELOP MENT


Technologies in
RENEWABLE ENERGY SECTOR

SOLAR TREE

INTRODUCTION

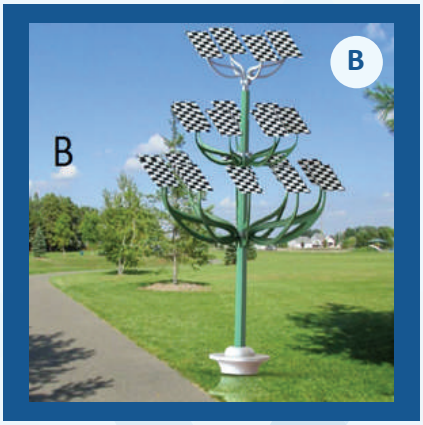
Solar tree is a fusion of art and technological which can harvest 100 times more solar power by utilizing just 1% of land compared to conventional SPV layout. It plays major role in electrification of rural areas and national highways. It holds the panels at a higher height – gets more sun and it can 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.

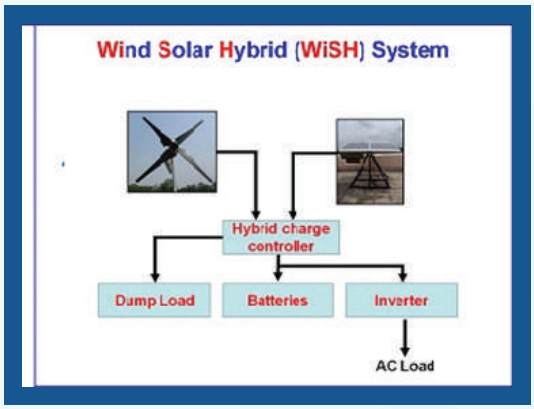
APPLICATIONS

- 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

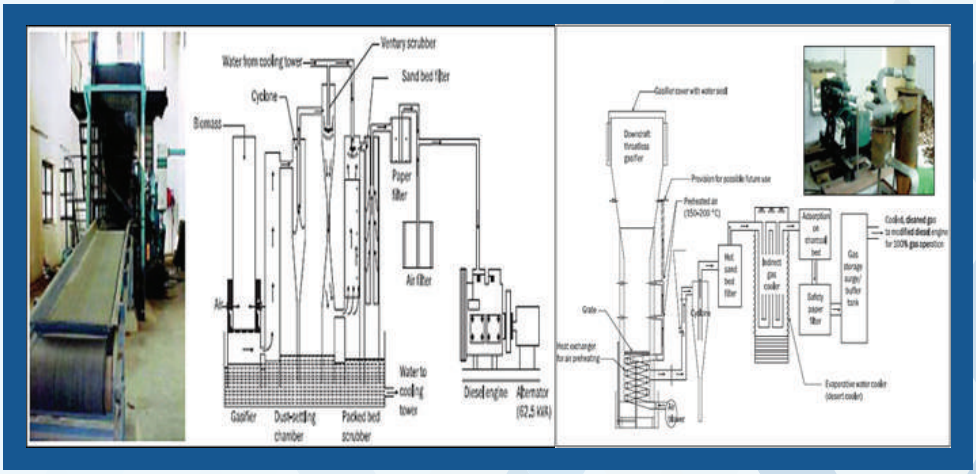
- Effectively make up for the absence of grid electricity supply in many remote areas

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

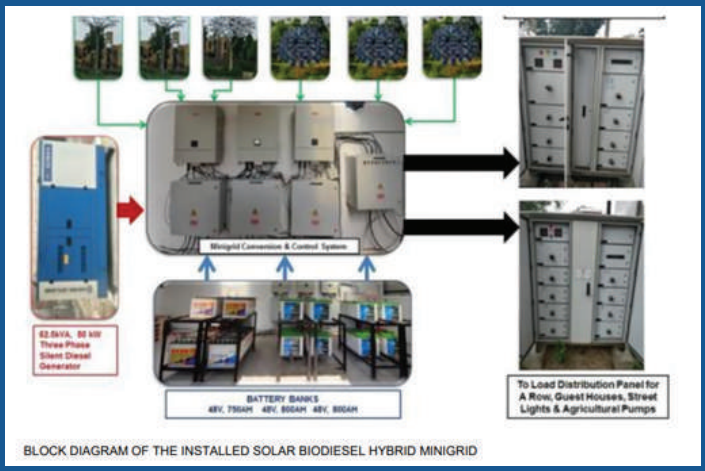
IINTRODUCTION

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.

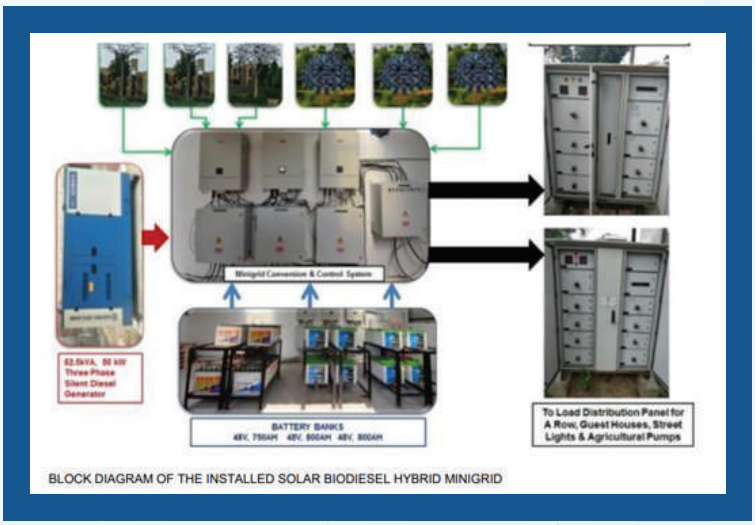
SALIENT FEATURES

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



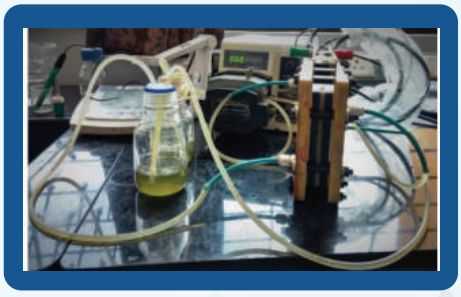
SUSTAINABLE INTEGRATION OF IRON REDOX FLOW BATTERY WITH A RENEWABLE ENERGY SOURCE

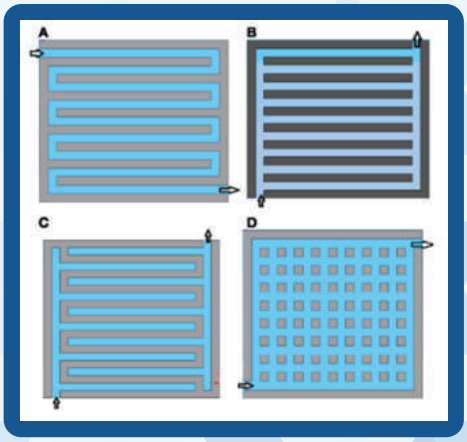
INTRODUCTION

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.

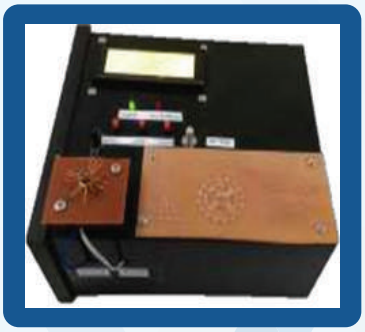
APPLICATIONS

- 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.





FLY ASH SOIL AMENDMENT TECHNOLOGY (FASAT)

INTRODUCTION

Brief Description: Production of fertilizer from waste fly ash with synergistic combination involving mixing of fly ash with grounded phosphatic rock, potassium chloride, etc. is developed. Fly ash based soil conditioner cum fertilizer is produced which comprises fly ash, grounded phosphatic rock, potassium chloride, urea and humic acid are added in the mixture to obtain urea-humic acid. The final obtained mixture is slow release type of formulation. Bio fertilizer is further added and discharging the resulting mixture at room temperature to obtain fly ash based soil conditioner cum fertilizer.

The developed technology covers the following area

- Waste land reclamation.
- Reclamation of Mine Spoil/OB Dumps.
- Bio-restoration of abandoned Ash Pond/low lying area.

Comparative Advantage:

- Improvement in physico-chemical properties of soil.
- Significant increase in crop yield (15-60%).
- Higher nutritional value of crop produce.
- Early Maturity of crops.
- Less incidence of pests.
- Beneficial residual effect (4-5 years).
- No carry over of trace/heavy metals/radioactivity beyond permissible limits.
- Encouraging growth performance of various plant species (timber, oil yielding, fruit bearing, ornamental, medicinal).

Scale of Development: Technology demonstration completed.



Fig: waste land management by using FASAT



Fig: Reclamation of low lying area filled with FBC ash



Fig: Paddy cultivation in mine Spoil at NCL Neyveli

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





HYBRID WOOD SUBSTITUTE COMPOSITE

Industrial wastes such as red mud, flyash, jarosite, marble slurry dust, copper tailings, and natural fibres like sisal and jute have been used as fillers for developing a variety of polymer composites. The materials have been subjected to a characterization such as resistance to weathering and fire, mechanical, chemical, wear etc. A comparison of features shows higher strength, greater resistance to corrosion and weathering for the developed materials than that of the conventional ones (wood). They are also insensitive to attack by termite, rodent, rot etc unlike wood. Display of their self extinguishing nature helps to reduce the severity of damage to the residents and buildings in the event of fire hazards. The developed door shutters were thoroughly tested by the Central Public Works Department (CPWD), Bharat Heavy Electricals Limited (BHEL) and Central Building Research Institute (CBRI) and finally approved by CPWD for public use.

SALIENT FEATURES

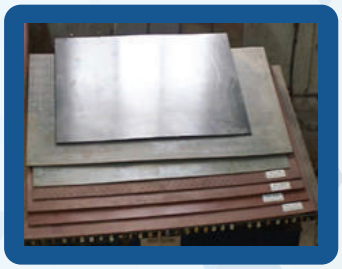
- Applications in building products like doors, false ceiling, flooring, roofing, partition, and furniture
- Building construction industries, automobile, locomotive and transport system

COMPARATIVE ADVANTAGES

- Stronger (flexural, impact strength) than wood.
- Weather resistant and durable.
- Resistance to attacks by termite, rodents, rots, moisture etc.
- Increased fire protection and self-extinguishing nature in the events of fire.
- Less basic cost than teak wood, GRP and similar products.
- Maintenance free.

SCALE OF DEVELOPMENT: Commercial





HIGH STRENGTH PLASTER FROM FLUORO-GYPSUMt

Fluorogypsum is generated during the production of hydrofluoric acid from fluorspar (a mineral composed of calcium fluoride) and sulphuric acid. Fluorogypsum is discharged in slurry form and gradually solidifies into a dry residue after the liquid has been allowed to evaporate in holding ponds. When removed from the holding ponds (if it is to be used), the dried material must be crushed and screened. This produces a sulphate-rich, well-graded sandy silt material with some gravel-size particles.

The high strength plaster is developed by beneficiation and fine grinding of fluorogypsum and admixing it with suitable chemical activators. Plaster possesses high compressive strength (30-35 MPa) and low water absorption (< 8 %) and porosity (<10 %) and complies with requirement as given in ASTM C-61-50.

SALIENT FEATURES

- Suitable for use in plastering Finish coat & Base coat
- Plaster showed high compressive strength (30-35 MPa) and low water absorption and porosity.

COMPARATIVE ADVANTAGES

- The technology for formulation of high strength plaster is simple and no heavy machinery is involved.
- The plaster is fire resistant, possess good acoustic properties, self strengthening with time and helps in conservation of cement.

SCALE OF DEVELOPMENT

Ready for 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.

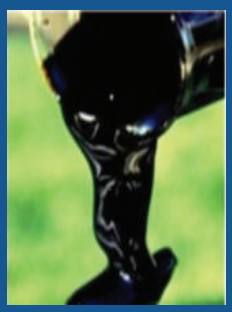
SALIENT FEATURES

- 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


PROCESS OF USING THERMOCOL (EXPANDED POLYSTYRENE) WASTE IN HOT BITUMINOUS MIXES FOR ROAD CONSTRUCTION

Thermocol is Expanded Polystyrene, a petrochemical based plastic. As a result of their versatile and highly desirable properties as well as the ease and low cost of manufacture, Thermocol is extensively utilized. However, disposal of Thermocol like other plastics which are all non-biodegradable pose major waste management problems due to their recalcitrance. Hence, the conversion of waste polystyrene (a dead end product) into a useful commodity is desirable. As a result of its widespread use and poor rate of recycling, polystyrene is viewed as a major post-consumer waste product. The use of plastic waste Like Polyethylene, High Density Polyethylene, Polyvinyl Chloride, Low density Polyethylene in hot bituminous mixes for road construction globally has paved the way for the use of Thermocol waste.

SALIENT FEATURES

- Optimization of the dose of Thermocol waste has been done for a particular source of aggregate with conventional bitumen.
- Detailed studies have been conducted to determine the physical, empirical, mechanical and rheological properties of bituminous mixes.
- Improved mechanical properties of bituminous mix samples having Thermocol waste have been found in comparison with conventional asphalt viz. Stability increased by 50% to 100%, Retained Stability increased by 20% to 50%, Flow Value within limits as per MoRTH specification and Bulk Density decreased by 10% to 20% and resilient modulus increased by 10%.
- By the addition of Thermocol waste in the hot bituminous mix, reduction in the use of asphalt has been found viz. Binder content reduction by 0.5-1.5%.

COMPARATIVE ADVANTAGES

- Eco-friendly and Economical.
- Potential replacement of costly imported additives like SBS and EVA.
- Reduction in the amount of bitumen in hot bituminous mixes making construction of bituminous layers more economical.

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

VALUE-ADDED PRODUCTS FROM FLY ASH

BRIEF DESCRIPTION:

The new developed process is used for the manufacture of building bodies such as bricks, roofing tiles and construction building blocks. Major material used are Fly ash, bottom ash, lime, sand, chemical accelerator. The products like bricks obtained by this proces have better machine finish, requires 25% less mortar.

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

- Uniform pleasing colour
- Uniform in shape and smooth in finish
- Lighter in weight
- Less porous
- Less water absorption

Comparative advantage:

- Better machine finish-about 25% less requirements of mortar.
- Very high crushing strength & low porosity, Lighter in weight.
- High durability, No efflorescence.
- Fly ash having maximum 10% carbon can be utilized.
- Cost competitive.

Scale of development: Commercialized





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



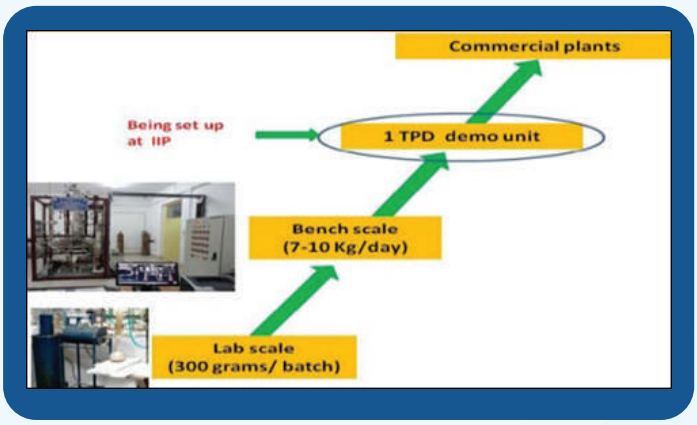
WASTE PLASTICS TO FUEL AND PETROCHEMICALS

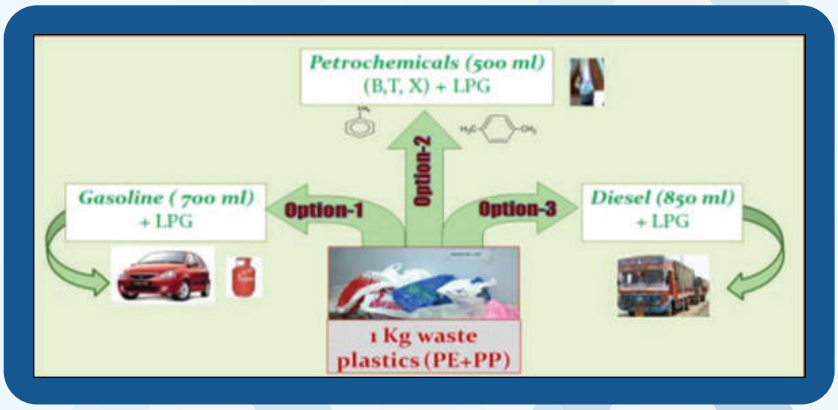
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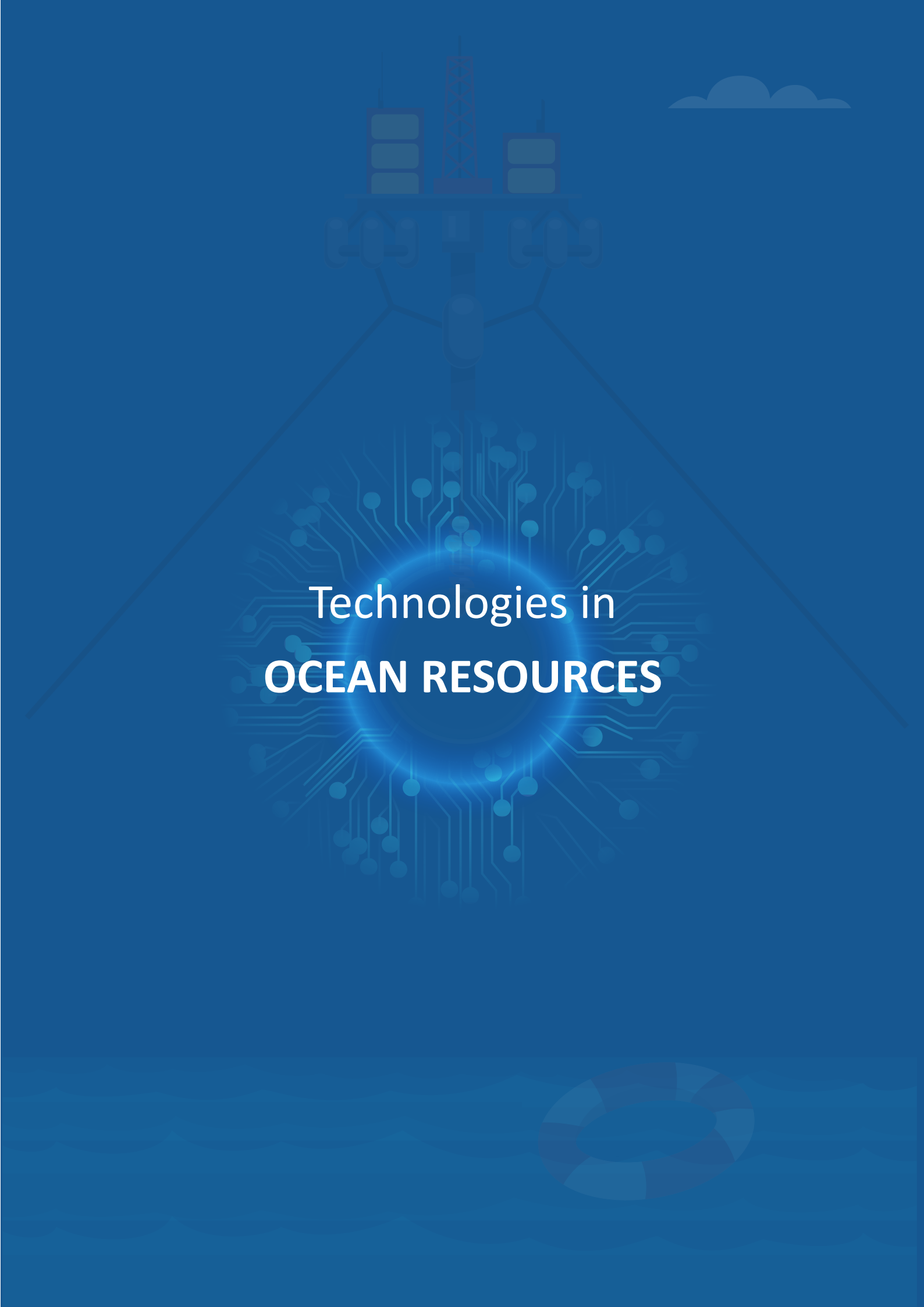
This technology is for the conversion of waste plastics (polyethylene and polypropylene) to exclusively any one of the products viz. gasoline, diesel or aromatics. The gasoline and diesel meet most of the BS IV/VI specifications while the petrochemicals are rich in toluene and xylenes. Conversion of 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

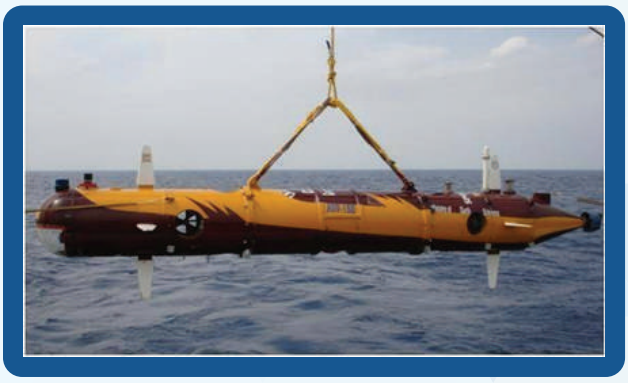
BRIEF DESCRIPTION:

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



ROBO COASTAL OBSERVER

BRIEF DESCRIPTION:

A low cost buoyant apparatus was developed for remote data collection in water bodies such as river, lake, pond and coast. The proposed equipment could be equipped with sensors for ocean data collection with camera. The equipment can be controlled by a radio controlled remote and the data collected are stored and can be transmitted using RF/GPRS/4G/Satellite telemetry. This equipment can also be used in Polar Regions for ocean data collection very close to the ice bergs without risking life of persons.

Unlike a fixed mooring this equipment has a flexibility of rapid data collection over an area of interest. The data collected from various oceanographic sensors could help researchers by providing valuable data on coastal discharge, salinity variation, pollution monitoring. This equipment can also be used for coastal surveillance.

ADVANTAGE:

- SOLAS and IRS/equivalent approved Life Saving Appliance
- Easily operable using remote control, Life of sight: 2 Nautical Miles in fair weather
- Ease of visibility: fluorescent stickers attached
- Speed of 4knots. Rechargeable battery. 5 hours of endurance, Camera for visual surveillance, Flash light for low light condition, GPS module for position indication
- RCO can be used for remote data collection in coastal waters by oceanographic institutions, universities, private industries involved in R&D. The advantage of aiding in rescue/assisting of swimmers in coastal waters will attract persons engaged in coastal fishing; coastal surveillance using the camera fitted with RCO. It can also be used in coastal patrolling covering a limited area.

Scale of Development: Ready for licensing of Technology



AUTONOMOUS UNDERWATER PROFILING DRIFTER

BRIEF DESCRIPTION:

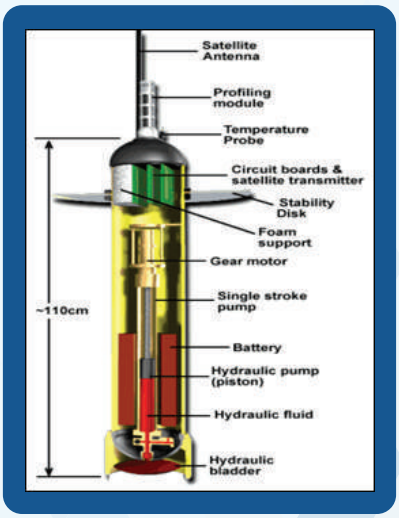
The AUPD is common underwater platform which carries CTD (Conductivity, Temperature and Depth) sensor and profile the sea water measurement at pre-determined depth. These floats drift freely at a predetermined depth, then periodically ascend to the sea surface, report to satellite and descend again back 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.





COASTAL OBSERVER AND LIFE SAVER

BRIEF DESCRIPTION:

During emergency or accidental situation if the person falls in water, it is often difficult to locate and approach him for recovery. More than half of the persons who fall in water are not recovered alive, mainly due to the delay in rescue operation. The rescue operation is also greatly biased by the agility of the rescuer, harsh weather condition etc.

The present way of using life buoy for rescue requires the ship/boat to be very close to the drowning person. The drowning person may be required to traverse towards the life buoy and if the person is non swimmer then this could be even fatal. The patent filed apparatus can be commercialised which could result in minimization of fatalities due to drowning victims.The need for life saver was conceived from the idea of moving life buoy.

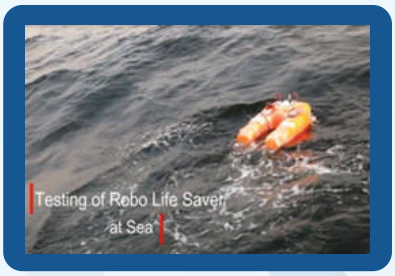
ADVANTAGE:

- Rapid approach towards drowning person.
- Ability to perform rescue in harsh environmental condition.
- The life of rescuer is safe as he needs to operate the equipment only.
- Ergonomic handling. Can be easily thrown from ship/boat (any orientation) or from beach for rescue.
- Easily operable
- Operational range of 5 nautical miles.
- Top speed of 8 knots.
- More than 5 hours of power autonomy

Scale of Development: Ready for licensing of Technology

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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

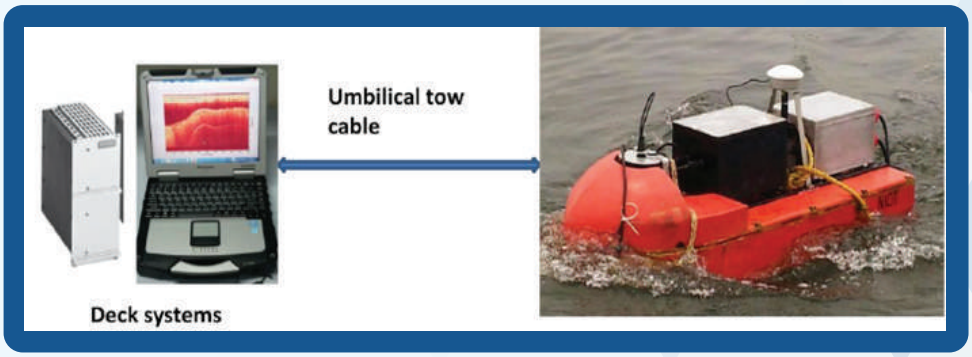
BRIEF DESCRIPTION:

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:

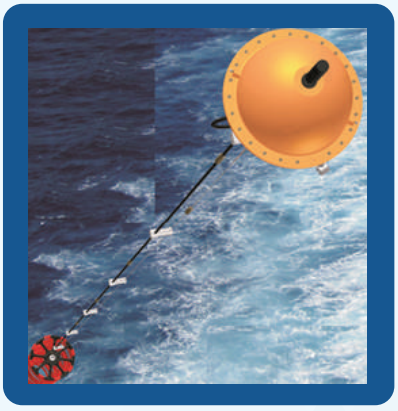
Drifting buoys are widely deployed to measure near surface ocean currents and temperature. Drifting buoy was indigenized in India with geostationary satellite communication (INSAT communication) to have near real-time data at every hour. The measurement scheme in the drifting buoys is capable to measure 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

.





DRISHTI

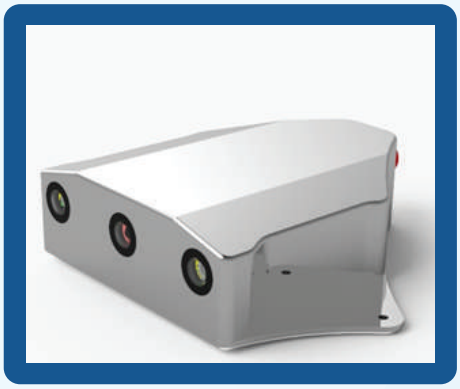
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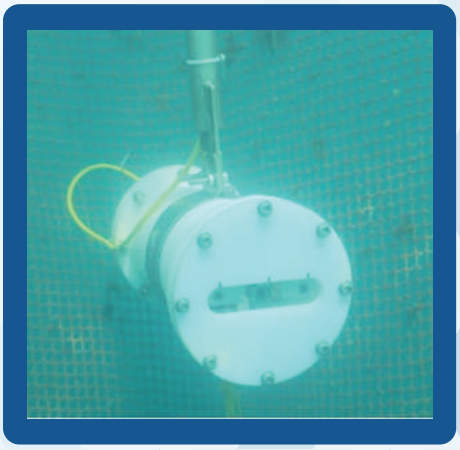
दrishti is an IOT device for fish farmers that provide real-time fish weight estimate, supports in fish feed control and timely harvest. It provides insights direct from the field through SMS, assists in farm management, reduces feed wastage and input costs, while supporting grid and off-grid power modes. 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:

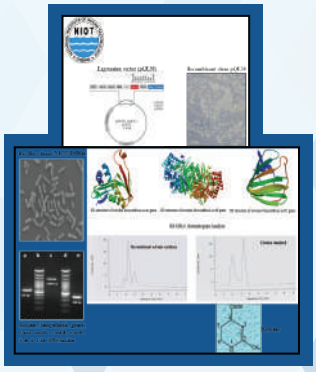
A recombinant E.coli M15 bearing the ectoine biosynthesis genes from deep sea Bacillus clausii and optimized methodology for production and purification of recombinant ectoine in laboratory conditions.

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:

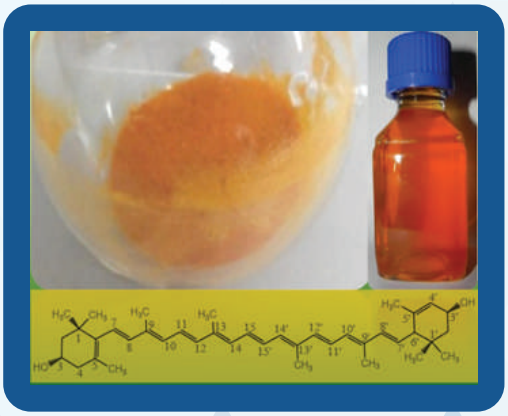
The present process relates to a production of lutein from marine Chlorophyceae microalgae.

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:

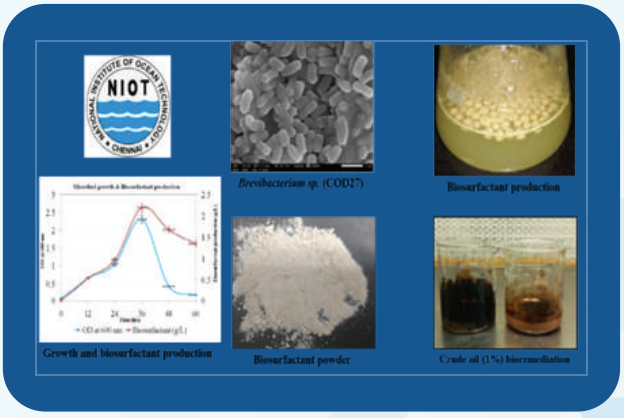
The biosurfactant works efficiently at a low concentration of 0.1% and degrade 87% of crude oil in period of 30 days. Biodegrade wide range of aromatic compounds and mineralize the toxic compounds into nontoxic form.

•Safety:

The biosurfactant is nontoxic, biodegradable and environmentally friendly.

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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



PROCESS FOR THE PRODUCTION OF LUTEIN

BRIEF DESCRIPTION:

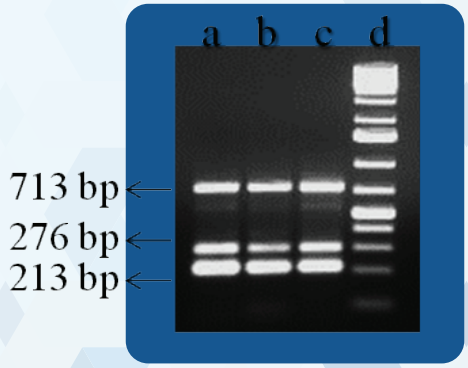
Multiplex PCR is a widespread molecular biology technique for amplification of multiple targets in a single PCR experiment. E. faecalis is found in most healthy individuals, but can cause endocarditis and septicaemia, urinary tract infections (UTIs), meningitis, and other infections in humans. Several virulence factors such asaggregation substance (asa1), gelatinase (gelE) and hyaluronidase (hyl) are the major virulent genes and determines the pathogenicity of E. Faecalis are thought to contribute to E. Faecal is infections.

SALIENT FEATURES AND APPLICATIONS:

Product	Volume
NIOT-EF enrichment medium (Broth)	100 g (dry powder)
DNA extraction buffer	3 mL/vial
PCR master mix	450 µL/vial
Buffer I (MgCl2)	15 µL (2.5 mM)
Taq DNA polymerase	375 µL (3 U/µL)
Nuclease free water	0.5 mL/vial
Positive control	25 µL/vial
Negative control	25 µL/vial

Components	Volume/Reaction
E. faecalis Multip lex PCR master mix	15.0 µL
Nuclease-free water	7.0 µL
Taq DNA polymerase	1.0 µL
Sample DNA	2.0 µL
Total volume	25 µL





Scale of development: Technology demonstrated and commercialized

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.

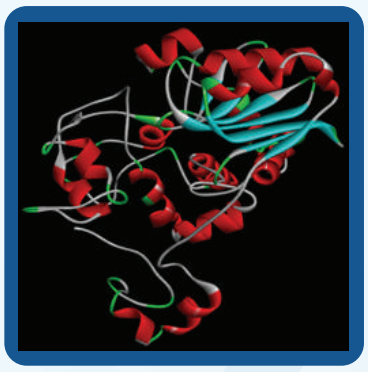
Application:

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

CASHEW NUT PROCESSING PLANT

Introduction:

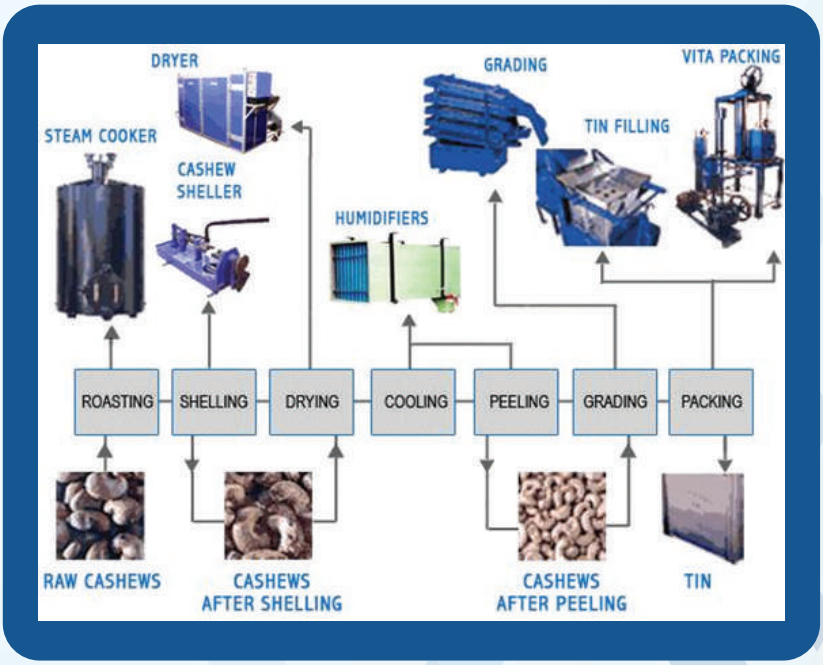
The cashew apple is an edible false fruit, attached to the externally born nut by a stem. In its raw state, the shell of the nut is leathery, not brittle. It contains the thick vesicant oil, CNSL, within a sponge-like interior. A thin testa skin surrounds the kernel and keeps it separated from the inside of the shell. The primary products of cashew nuts are the kernels which have value as confectionery nuts. Cashew nut shell liquid (CNSL) is an important industrial raw material for resin manufacture and the shells can be burned to provide heat for the decorticating operation.

NRDC is in possession of the technical know-how to provide complete range of operation for processing of cashew nut.

Process: The steps involved in commercial processing of cashew nuts are:

Roasting: drum roasting, oil bath roasting and steam roasting
Shelling: foot operated shell cutters (mechanical device)
Drying: drying kernels in hot chambers at 70-80 C in perforated trays for about 6-8 hr
Peeling: removal of testa (seed coat) from the kernel
Grading: Kernels are graded according to the size manually
Packaging: eco-friendlypackaging material, recyclable and hermetically sealed

Scale of Development: Commercial



CONSULTANCY FOR ESTABLISHMENT OF MODEL/DEMONSTRATION CASSAVA FARM

1) Area of farm required- 20 hectare
2) Innovative/New technologies offered

Production

1. Land preparation
2. Planting materials preparation/methods
3. Mechanization
4. Interculture
5. Micro irrigation/water use efficiency
6. Integrated Nutrient Management
7. Integrated pest & disease management
8. Harvesting
9. Storage of planting materials

Processing

1. Chipping and drying
2. Flour preparation
3. Starch
4. Value added snack food

3) Pre and Post-Harvest Machineries/equipment required

1. Tractor and accessories (plough/ridges etc)
2. Bund former
3. Power Transplanter
4. Power weeder
5. Drip Irrigation
6. Sprayer
7. Harvester
8. Chipping machine
9. Peeling machine
10. Starch extraction unit
11. Powdering mill
12. Wagon, JCB etc.

4) Infrastructure requirement

1. Farm office
2. Storage shed
3. Workshop
4. Drying yard
5. Starch extraction plant
6. Tank and wells
7. Bore well

Extent of Mechanization: 70%

Organic Cultivation: Technology available

Seeds/varieties: Varieties available/modalities to be worked out

5) Crops per year- one

Different varieties- Various local cultivars to be tested

6) Value added products of Cassava

1. Chips
2. Flour
3. Starch
4. Minimal Processing
5. Fermented flour

7) Capacity Building

1. Model farm persons
2. Extension agents
3. Farmers

8) Cassava Starch Technology : Washer, peeler, crusher, sievers, milling, packaging

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.

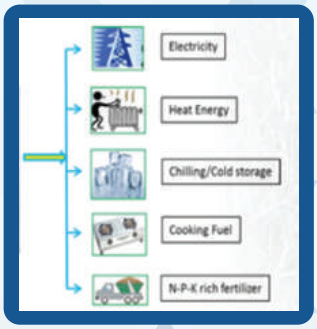
Comparative advantage:

- 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







AGRO-TECHNOLOGY FOR EDIBLE MUSHROOM

BRIEF DESCRIPTION:

Mushroom is a nutritious food rich in protein, amino-acids, minerals, vitamin B12, vitamin D, folic acid, minerals and fibre.

SALIENT FEATURES:

Oyster mushroom cultivation: Mushroom is a nutritious food rich in protein, amino-acids, minerals, vitamin B12, vitamin D, folic acid, minerals and fibre. Also called as 'White vegetable', Mushroom is the fruiting body of fungus. It is considered ideal food for patients with hypertension, obesity and diabetics. Mushroom growing is relatively simple and can be taken up as individual home based activity or on small and large scale. Propagated through spawns, it can be cultivated in cool and humid climate. The cultivation is done on specially prepared compost made out of paddy straw and other agricultural wastes. There are two seasonal varieties. Winter varieties grow during the month of November to April and summer varieties can be cultivated in the month of June to August. Mushroom varieties include Oyster Mushroom, European White Button Mushroom, Paddy Straw Mushroom and Medicinal Mushroom.

ADVANTAGES:

Several NGOs, entrepreneurs and rural women are engaged in commercial cultivation with CSIR-NEIST's efforts. To promote mushroom cultivation, the institute also works along with NGOs, SHGs, etc. in order to reach out to large sections of people. Under societal activities, the Institute organizes training and awareness programs to encourage mushroom cultivation among marginal farmers, unemployed youth and rural women.

SCALE OF DEVELOPMENT: Technology Integration



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.

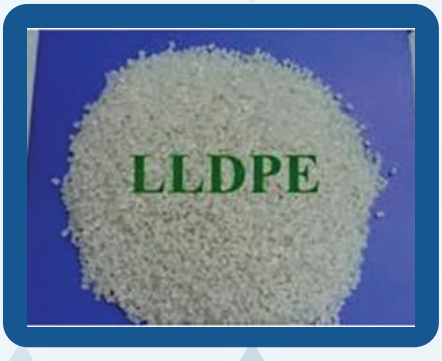
ADVANTAGES:

- 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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ANIMAL DRAWN SIX-IN-ONE TILLAGE OUTFIT / ASSEMBLY

BRIEF DESCRIPTION:

In India, the use of mechanical power sources and the existing draft animal power complement each other for accomplishing the mechanization needs in agriculture. According to an estimate about 50% of the total cultivated area of the country is still managed by draft animals with 1.5-2.0 ha command area. Although the draft animals population is declining (63 million in 2003 to 56 million in 2009-10), they will be in the business for another 20-25 years or so due to non-availability of adequate farm power in the country. Even with the introduction of mechanical power in future, draft animal power would cover over 25% areas in the hilly regions and other difficult terrains. While great strides have been made towards agricultural mechanization in the country, the hill regions have not been able to catch-up with mechanization because of terrain, farming systems in practice, weak R & D efforts on mechanization, weak extension and promotional efforts and so on. In India, about 20% of cultivated land is under hill agriculture with very meager amount of power availability (0.4-0.6 kW/ha) as against national power availability of about 1.70 kW/ha and projected availability of about 2.4 kW/ha by 2025.

Efforts have been made to improve upon the local tools and implements made of wood especially by changing the wooden components with metal and accordingly, the equipment for tillage, sowing, intercultural etc. have been developed and are being introduced. However, for each operation a particular type of implement is required, therefore, a farmer has to purchase 5-6 implements and pay a higher price for acquiring a set of implements. The hill equipment developed with interchangeable components and modular type for performing various farm operations will not only reduce the cost but would also help in transportation of individual components by the family members which could be reassembled before use.

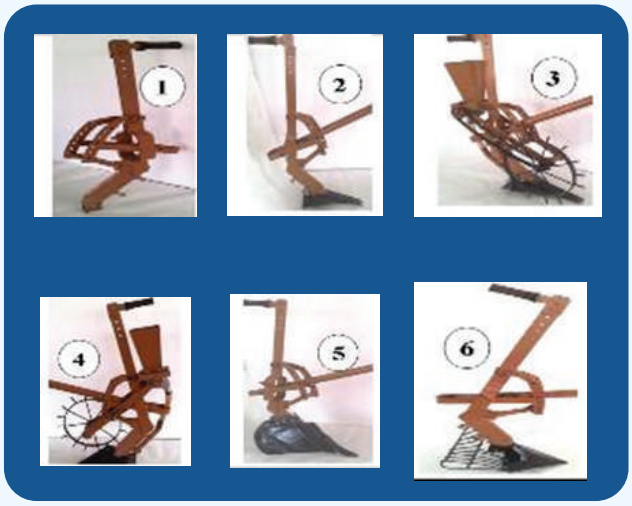
SALIENT FEATURES & ADVANTAGES:

- Easy to mount and dismount different units on the main frame of tillage outfit with a pair of nuts and bolts to construct six different implements
- Absence of wood in any of the components of tillage outfit reduces the expenditures on repair and maintenance and provides protection again deforestation.
- Easy to transport and handle in difficult terrain due to less weight of about 9-10 kg when working as jet plough, ridger, potato digger and interculture tool, and about 20-22 kg when working as a seed drill or fertilizer applicator and that's too on the day of sowing only.
- Telescopic two piece mild steel beam with lighter weight of about 5.6 kg for hitching with different sizes of draft animals
- Ploughing of fields without soil inversion and retention of crop residues at the field surface with jet plough for promotion of conservation agriculture with reduced soil erosion and enhanced moisture retention.
- Less wear of the share point of jet plough due to hardened tip with tool steel and easy to replace different components after wear.
- Placement of fertilizers in a band at 100-150 mm depth in the root zone of crops before sowing enhances nutrient use efficiency and crop yield.

- Easy to adjust seed / fertilizer application rates simply by adjusting the hopper axially on the metering unit.
- Low draft of about 35-60 kgf for different implements of the outfit makes it suitable for small and medium size draft animals each weighing about 200-300 kg.
- Primarily designed for soil cultivation in hill region but equally suitable for small and marginal farmers of plain regions who use draft animals as the power source

SCALE OF DEVELOPMENT: Ready for licence.

Animal Drawn Six-in-One Tillage Outfit / Assembly



Design Details of Tillage Outfit and Associated Implements`

1. Tillage Outfit
2. Jet Plough
3. Fertilizer Applicator
4. Seed Drill
5. Ridger/ Furrower
6. Interculture Implement

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



A DEEP SOIL VOLUME LOOSENER-CUM-FERTILIZER APPLICATOR (Sugarcane Ratoon Manager)

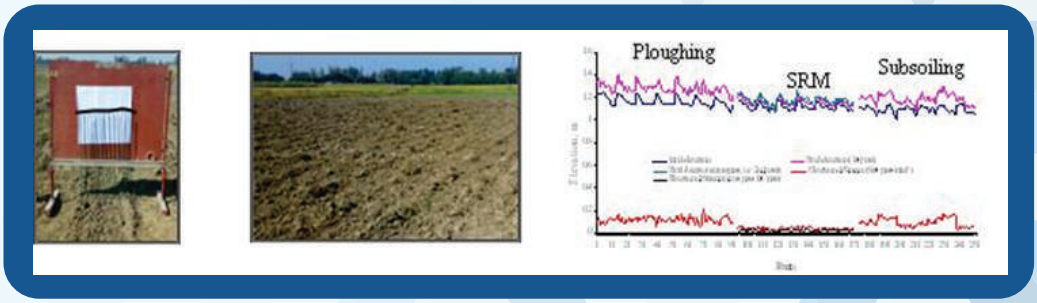
The mechanized agriculture in India has led to adoption of many heavy farm machineries such as combine harvesters (6-7 t), field sprayers, higher H. P. tractors with heavy equipment, sugarcane harvesters (>10 tonne) and other specialized machines. Indiscriminate use of these machines has not only influenced the cultivated top soil layers but also has caused gradual deterioration of subsoil (>25 cm) structure at a number of locations in the country which has ultimately affected the soil workability, crop growth and yield. Most of the farmers have adopted shallow cultivation practices with disc harrows or cultivators irrespective of the tractor size. Some of the farmers cultivate soil while it is still wet due to agronomical and other management reasons leading to compaction of soil to greater depths of soil profile. The Indian soils have not been cultivated deeply since time immemorial because of non-availability of high h.p. tractors in the past. During 70's, animal farming was dominant on Indian farms, thus the soil cultivation was limited to 10-12 cm depths only. At a later stage, lower h.p. tractors upto 35 h.p. were introduced with soil cultivation at around 15-20 cm depths with mould board or disc ploughs. However, the last decade has witnessed a definite shift towards high h.p. tractors with 8-10% are being produced in 50 plus h.p. range. The tractors up to 80 h.p. are available in India. Thus, it is now possible to cultivate soils deeply upto 50 cm or so. A breakthrough in Indian agriculture is possible by adopting the good soil management practices, modifying the subsoil structure by breaking the compacted layers, if present and improving the nutrient status of not only the top soil but also the subsoil. With this in view, an innovative machine named as Pant-ICAR Subsoiler-cum-Differential Rate Fertilizer Applicator was developed and is being patented through NRDC. This machine has been recently commercialized. Its contribution in increasing the productivity of sugarcane has been substantial with 30-35% increase in yield as compared to conventional practices.

Sugarcane is the main sugar producing crop that contributes nearly 75% to the total sugar pool at the global level. In India, sugarcane is the prime source of sugar as commercial cash crop which occupied about 4.41 Mha (2008-2009) with an average productivity of about 67 t/ha. In major cane growing countries of the world, cultivation of two or more ratoon crops is a common practice. In Hawaii, Mauritius, Philippines and Cuba 4 to 6 ratoons are quite common. In India, however, one ratoon crop is generally taken. In U.P., Maharastra, Gujarat and Haryana ratoon occupies more than 55% of the total area under sugarcane, whereas in some of the States such as Assam, ratoon accounts for more than 80 % of the total area under sugarcane. The national average cane yield is, thus, greatly influenced by low ratoon yield, as its contribution is only 35% of the total cane production with 50-55% of total area under ratoon crop. The life style, increasing population and growing food industry would need more sugar production in future. Considering the shrinking land resources, the sugar production can not be increased by area expansion alone and therefore, increasing the productivity of ratoon crop is a major issue at present. For increasing the productivity of plant crop, a lot of research work has been done in respect of agronomical and mechanization aspects. In sugarcane plant crop, a cafeteria of machines such as power operated sett cutting machine, semi-automatic drop planter, semi-automatic rota-drum drop planter, automatic drop planter, raised bed– furrow planting system machine, slit type cutter planter, disc type cutter planter, ridger type cutter planter and sugarcane harvesters have been developed and are at different levels of adoption.



This machine, however, cannot be used for normal soil cultivation operations.
The sugarcane plant roots spread to either sidesupto about 2 m from the centre of a stool and upto 6 m deep, and decay in about 60 days after harvesting. The cutting of old roots (off-barring), inter-cultivation between rows for weed control, placement of fertilizers in the soil while off-barring have been recommended for increasing productivity of sugarcane ratoons. Inter-cultivation is being presently done with rigid tine cultivators which hardly penetrate beyond 12-15 cm and the fertilizer is applied invariably through broadcasting with very poor utilization efficiency. Therefore, there is a need to develop an efficient multipurpose equipment for the management of sugarcane ratoons, inter-row cultivation in cotton and maize as well as soil cultivation in laser levelled fields.

A precisely levelled field is a pre-requisite for an efficient surface irrigation system, in-situ conservation of rain water and introduction of resource conservation technologies such as zero tillage, raised bed planting etc. The laser aided precision shaping / smoothening equipment which have been used for decades in many countries were imported to India in the year 2002. According to an estimate over 3500 units of laser land levellers are now available in the country which have levelled over 1.0 Mha area mainly in the States of Punjab, Haryana, U.P. and Uttarakhand. The results of several hundreds participatory field trials in these States have brought out several benefits of this technology which include water saving of 15-30%, increased nutrient utilization efficiency by 10-15%, increased field efficiency of farm equipment by over 10%, increased net cultivable area by reduction in bunds/ridges and irrigation channels by 2-5% and yield advantages of 15 to 30% in different crops. The area under laser levelling is increasing at an exponential rate. It is pertinent to note that on one hand a very precise laser land leveller has been introduced while on the other hand, the same old technology of soil manipulation with mouldboard /disc ploughs, harrows and cultivators are being used with frequent changes in the level of fields. In fact, there is a need to develop such conservation tillage equipment which could cultivate not only the top soil but also the subsoil without soil inversion so that the biomass is maintained in the same zone or at the surface and at the same time, level of the field is disturbed to a bare minimum.



Soil Cultivation in laser levelled field at 30 cm depth : No change in field surface level is clearly visible

Thus, keeping in view all the above issues, a new machine named as Pant-ICAR Deep Soil Volume Loosener-cum-Fertilizer Applicator, also known as Sugarcane Ratoon Manager (SRM) has been designed and developed under the ICAR National Professor Scheme of the G. B. Pant University of Agriculture and Technology, Pantnagar. The technology has been protected by filing patent application (2267/DEL/2009) dated 04.11.2009.

This tillage machine has been developed for deep soil volume loosening upto 30 cm depth for subsoil structure modification, minimum re-compaction of disturbed soil due to mounting of main V-shaped tines behind the tractor rear wheels and simultaneous application of chemical fertilizers at different depths of 20±5 cm in the root zone of crops. This machine is most appropriate for cutting of old roots of sugarcane ratoons (off-barring) with two pairs of Inverted-T openers tines and intercultural operations when used as Sugarcane Ratoon Manager. It can also be used for inter-row soil cultivation for weeds management in row crops such as cotton and maize as well as for normal soil cultivation in laser levelled fields with minimum alternation of field surface configuration after its operation.



Row spacing: 75 cm | 90 x 30 cm paired row | Third ration at Pantnagar

Developed machine working as Sugarcane Ratoon Manager (SRM)

This machine consists of three main units i.e. (i) deep soil volume loosening unit, (ii) fertilizer metering and placement unit and (iii) clod crushing unit. The deep soil volume loosening unit consists of scientifically designed V-shaped tines with replaceable blades on each leg of tine for cutting of soil/ roots, side plates and a share, all of which are mounted together as a unit and clamped at the front of the rectangular frame and positioned exactly behind the rear wheels of the tractor. The tip/point of the chisel share is welded with a replaceable and wear resistant tool steel plate. The share is mounted over a pair of side plates at a rake angle of 220 for ease of penetration and minimum draft. The clearance angle of foot has been kept at 80 with the horizontal plane for reduced sliding friction and wear. The fertilizer metering and placement unit consists of two main fertilizer boxes of pyramidal section to accommodate about 100 kg of fertilizers in each box. The bottom of each box is provided with two openings for delivery of fertilizers into metering device housings. The discharge rates of fertilizers can be varied by vertical adjustment of the box with the help of levers provided at the sides of each box. Four metering device housings (two for each box) have been provided at the bottom of the fertilizer box and are equipped with grooved metering rollers mounted on independent shafts. The power to the metering rollers is supplied from a floating type lugged ground drive wheel through sprockets and chains for obtaining the application rates of 250 to 1000 kg/ha. A fertilizer metering device delivers fertilizer at the rear of inverted-T opener tine on to a deflector plate for its uniform distribution in bands. A pair of inverted-T opener's tines is mounted on the rear beam of the frame behind each V-shaped main tines at proper spacing which can place fertilizer at the depth of 20±5 cm.

The clod crushing unit consists of spiked rollers with sufficient weight and mounted on the rear beam of the frame with floating arms and positioned exactly behind the V-shaped main tines for soil pulverization and its consolidation so as to conserve soil moisture and leave the field surface completely level. The present design of the machine is suitable for ratoon management of sugarcane planted at 75 cm as well as 90 x 30 cm paired row spacing and is operated with a 50-55 h.p. tractor. The machine has been



Wheat grown successfully in sugarcane ratoon (Ratoon yield : 74 t/ha, wheat yield : 3.8 t/ha)

extensively used over an area of about 200 ha for sugarcane ratoon management by many farmer's groups, commercial farms and research stations in the State of Uttarakhand and U.P. The results have indicated an increase in ratoon yield by 25 to 35% at different locations and is in great demand during each season. Agro-techniques for growing of crops in sugarcane plant crop is available but no technique is available at present for raising crops in sugarcane ratoon. However, the Deep Soil Volume Loosener-cum-Fertilizer Applicator has been used successfully for tilling of soil in sugarcane ratoon (120 cm row spacing) and sowing of wheat crop. Therefore, this machine could be adopted for tilling and fertilizer placement in sugarcane ratoon crop and subsequently planting of many crops such as moong bean, urd, cow pea etc. during summer.

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

READY TO SERVE FISH CURRY IN FLEXIBLE POUCHES

Value addition and diversification to satisfy the ever changing and diverse demands from the importing countries as well as urban consumers at home are some of the major challenges faced by food processing industry.One such value added product developed is fish curry processed in flexible retortable pouches.

SALIENT FEATURES:

- The flexible pouches manufactured indigenously employing the configuration of a three ply laminated material- polyester/aluminum foil/cast poly propylene.
- Fish curry in reportable pouch is heat sealed and subjected to retort sterilization at 121oC for a specified time.
- The product can be kept in room temperature more than one year in acceptable condition.
- Standardized various type of fish curry in flexible retort pouch include Kerala style sardine curry, Punjabi style catla curry, Manipur style Rohu curry, Mughlai style Rohu curry, Goan style Mackerel curry, Ready -to-eat mussel meat etc.
- Retort pouch technology finds application in the preservation of fish curry, fish sausage, fish paste, chicken curry, coconut masala curry, coconut beverage, kheer /payasam, mushroom curry etc.

ADVANTAGES:

- Eliminates undesirable taste generated in metal cans
- More cost effective
- All metal cans are not suitable and
- Eliminates leakage through seams
- The three layer flexible pouches offers shelf-life over one year at room temperature
- More convenient to use by the consumers

The technology is ready to be licensed.





BATTERED AND BREADED PRODUCTS FROM FISH

Value added product is preferred by the consumer for its convenience and it's ready to use nature. It also provides better return and increased profits to the entrepreneurs. The battered and breaded products from the meat of commercially less important fishes provide a competitive edge over otherwise expensive products from fish. Some of the major coated products are Fish fingers, Fish balls and Fish cutlets which require much less financial requirement and affordable to low time traders.

Fish fingers

- Fish meat free of bones, skin and adipose fat is used for this purpose.
- Minced fish meat can be conveniently used for the preparation of fish fingers.

Fish cutlets

- The basic raw material required for preparation of this product is cooked fish or 'fish kheema' (fish meat picked from whole fish by means of a meat picking machine) Fish balls
- There are several varieties of fish which do not command a ready market as fresh fish, but are comparable to many table fish in nativities value and other attributes, are effective utilized to process ready-to-serve or ready-to-cook value added 'convenience' products
- Fish ball is one such product prepared using fish mince and starch that can be processed a a coated product or as a heat-processed as a coated product or as a heat-processed product in a suitable fluid medium.

Advantages:

- Convenience products
- Less preparation time
- User friendly packaging



COATED FISH PRODUCTS

Coated product is one, which is coated with another foodstuff. Two types of coatings are in common use. They are batter and breadcrumbs. Seafood specialties, fish portions (raw and precooked), shrimp, fish fingers, scallops, fish balls, fillets etc are the principal seafood products which are bettered and/or breaded. Most of these items are ready-to-cook and are processed frozen, although some may be processed fresh.

Breaded shrimps

Breaded shrimp can be prepared from both wild and farmed shrimp in different styles, viz. peeled and deveined, butterfly, round tail- on, cooked and peeled nobashi etc. These are coated with batter and breadcrumbs, flash fried and packed as IQF preferably in thermoformed trays.

Fish fingers and fish portions

Fish fingers or portions or sticks are regular sized portions cut from rectangular frozen blocks of fish flesh. They are normally coated with batter and breadcrumbs before being flash fried and frozen. Some fish blocks, particularly those used for catering products are made with high proportion of mince, even up to 100%.

Coated Squid rings

Cleaned squid tubes are cut in the form of rings, cooked in brine, cooled, battered and breaded. These are then flash fried, cooled, packed and frozen.

Coated Fish Fillets

Skinless and bone less fillets preferably of white meat fish are cold blanched in dilute brine and drained. These are then battered, breaded flash fried and frozen in IQF form preferably in thermoformed containers.

Coated Fish Balls

Fish balls are generally prepared from mince of low cost fish. The simplest method is by mixing the fish mince with starch, salt and spices. This mix is then made into balls and cooked in boiling 1% brine. The cooked balls are then battered and breaded.

Advantages:

Convenience and variety of fish based products
Technology ready to license







FISH KURE

Fish Kure is a fish based extruded food product and have application as snack food. Usually, extruded products are prepared using cereal flour, which have less protein content and are limited in some essential amino acid. By incorporating protein-rich fish mince instead of cereal, the product is protein enriched snack food.

Salient Features:

- The production process involves fish meat is mixed with cereal flours, spices and salt and extruded using a twin screw extruder.
- The dried and coated products are then packed in metalized polyester polyethylene pouches using nitrogen gas filling
- The product is acceptable up to 3 months at ambient temperature.

Advantages:

- Innovative and nutritious product
- Longer shelf life

The technology is available for license.





FISH PICKLE

Like vegetable pickles, fish pickle has also gained popularity in the recent past. Fish/Prawn pickle, when carefully prepared under most hygienic conditions with addition of required quantity of salt, preservatives and spices will have generally an average shelf life of one year.

Salient features:

- Most of the sea fish like Prawn, Tuna, Pomfret, Mackerel, etc. Are ideally suitable for making fish pickles.
- Standardized spices and condiments

Advantages:

- They are equally spicy, pungent traditional pickles made of vegetables like lime, gooseberry, ginger, garlic, etc.
- Considered to be very good appetizer





FISH WAFERS

Value addition and diversification to satisfy the ever changing and diverse demands from the importing countries as well as urban consumers at home are some of the major challenges faced by food processing industry. One such value added product developed is fish wafers. The product has excellent market potential since product contains sufficient quantity of carbohydrate, protein and mineral content.

SALIENT FEATURES:

- Fish wafers are to be used as a snack food.
- The product can be readily fried in any cooking oil or the dehydrated product can be used as ready to fry.
- Fish wafers can be introduced in school feeding programmes.
- Product can be prepared in shape with 1.5 to 2 mm thickness.

ADVANTAGES:

- It contains more energy material.
- It can be fried under normal condition.
- Product may be packed in flexible pouches at low moisture and oxygen transmission.
- More cost effective

The technology is ready to be licensed.



Before and after frying

THERMAL FISH BASED PROCESSED PRODUCTS

Thermal fish based products are developed and packed into convenient packaging for ease of consumers. These products have good market potential.

SALIENT FEATURES:

Canned fish products

Mackerel, tuna, sardine, crab, shrimps etc can be packed in oil, brine, curry & sauce and heat processed in aluminium tin cans. These have a shelf life of more than one year at ambient temperatures.

Ready to serve fried mussel

Ready to serve fried mussel can be processed in three layer laminate flexible pouches and can be stored for more than one year at ambient temperatures.

Ready to serve fish moilee

Fish Moilee which is a traditional Kerala preparation are packed in a three layer laminate flexible pouches and can be stored for more than one year at ambient temperatures.

Fish curry in retort pouch

Ready to serve fish curry can be processed in three layer laminate flexible pouches and can be stored for more than one year at ambient temperatures.

ADVANTAGES:

- Easy storage
- Taste and convenience
- Longer storage life
- Less preparation time

The technology is ready to license






SHELF STABLE DEHYDRATED EGG PANEER/CUBES AND EGG CRUNCHY BITES

BRIEF DESCRIPTION:

Egg paneer is prepared from egg albumin or egg yolk either separately or in combination i.e. whole egg, stabilizers and binders. The mix is processed under optimized conditions and made in to cubes. Further, the cube pieces are dried and packed under metalized pouches. This product can be used in curry preparation. During curry preparation, the cubes are rehydrated and appear like paneer. The product can also be used under various nutritional programmes as high protein foods.

SALIENT FEATURES:

This product made from egg albumin or egg yolk either separately or in combination, is first of its kind. Egg crunchy bites can be used as ready-to-eat nutritious snack item. It provides convenience of use and can be made available in different flavours like onion, garlic, and pepper. The product has a good shelf-life of six months at ambient temperature.

ADVANTAGES:

The process is simple and can easily be adopted on a cottage scale. Product can be popularized under shelf stable ready-to use food and can be marketed in supermarket and fast food restaurants. As this product is free from chemicals or synthetic preservative and rich in high quality protein it can have niche market.

SCALE OF DEVELOPMENT:

Technology integration



MUTTON PICKLE

BRIEF DESCRIPTION:

Mutton pickle is to be used as food adjunct, along with bland foods like roti, rice, chapati bread etc. Mutton Pickles can be introduced in Hotels, Restaurants and Students Mess.

SALIENT FEATURES:

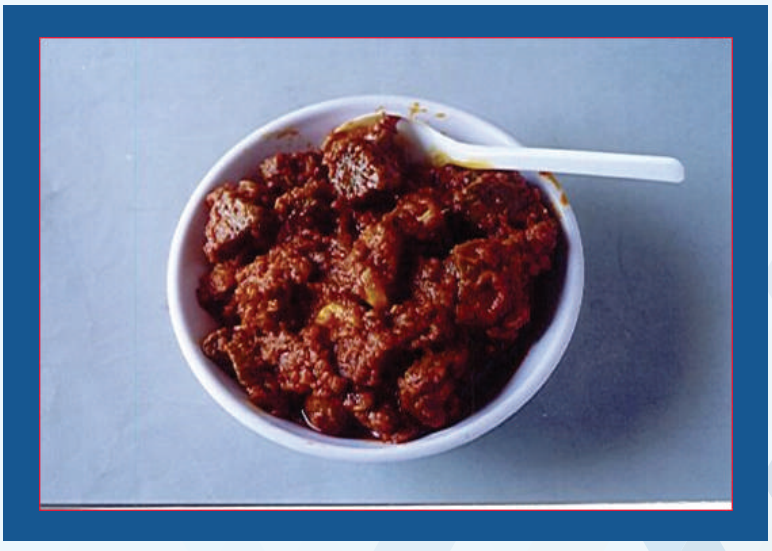
Since product has acidic pH (4.2) low moisture content with salty and spicy taste, no external preservatives has been used.

ADVANTAGES:

- The pickles have a tested self-life of over one year at room temperature
- The product has excellent market potential as the product contains sufficient quantities of protein and mineral content.

SCALE OF DEVELOPMENT:

Market launch



READY TO EAT MEAT WAFERS

BRIEF DESCRIPTION:

Wafers are the convenience snack food liked by people of all age groups. Varieties of potato wafers are available in the market. Chicken wafers or egg wafers or wafers from any source of meat including fish or prawn will be a delicacy. The ready-to eat wafers can also be produced without deep fat frying using latest techniques**.**

SALIENT FEATURES:

- RTE wafers are to be used as a snack food.
- The product can be readily fried in any cooking oil or the dehydrated product can be used as ready to fry.
- Chicken wafers can be introduced in school feeding programmes. Product can be prepared in shape with 1.5 to 2 mm thickness.
- It contains more energy material.
- It can be fried under normal condition.
- Product may be packed in flexible pouches at low moisture and oxygen transmission.

ADVANTAGES:

- This product has edge over other ready-to-eat snacks and will have potential market as its nutritive value is higher.
- The wafers can be made available either in ready-to-eat (fried) or ready-to use (without frying) forms.
- Products with different flavour and reasonably high shelf-life (up to 6 months) could boost its market potential.

SCALE OF DEVELOPMENT: Technology integration



SAUSAGES : MEAT/FISH/CHICKEN/PORK

BRIEF DESCRIPTION:

Meat sausages are prepared from minced meat mixed with minced fat, spices, green curry stuff, binders, salt, fillers, etc. The sausage mix is stuffed into casings and linked into sausages of desired length. This could be sold fresh or after smoking and cooking. When the mix is filled into moulds and processed, it is known as meat loaf.

SALIENT FEATURES:

There is an encouraging trend in the production of meat products like ham, bacon, sausages and poultry. The product can also be exported under frozen condition.

ADVANTAGES:

Depending upon the fineness of the grinding they are known as fine or coarse ground comminuted products. Luncheon meat also is a comminuted product. The products could be prepared from any type of meat-fish-chicken-pork and by using any animal fat.

SCALE OF DEVELOPMENT:

Technology integration



JACKFRUIT PROCESSING

Brief Description:

Jackfruit (Artocarpus heterophyllus) is a tropical fruit. It has a very short harvest season (2-3 months) and all consumed fresh. During harvest in June to August it is over consumed and sold at a throw away prices. The scope of processing will be increased many fold with increase of yield per hectare. Jackfruit bulbs are a rich source of vitamins and mineral constituents especially calcium. Variety of products such as fruit bars, jam, candy etc. can be prepared from this fruit. However, it has not so far been fully exploited by the fruit preservation industry.

Products from raw tender jackfruit

- Jackfruit chips
- Jackfruit papad
- Brine cured
- Pickles



Products from Raw matured Jackfruit

- Canned jackfruit
- Dehydrated jackfruit slices
- Minimally processed jackfruit slices/ cubes
- Deep fat fried jackfruit chips

Products from Ripe Jackfruit

- Canned bulbs in syrup
- Bulk preservation of pulp
- Bar/Leather (Sun drying or Cabinet drying
- Jam
- Fruit spread
- Osmo-air dried jackfruit
- Candy

Advantages:

- Value addition reduces post harvest losses
- Increases shelf life of the fruit
- Add value and increases income
- Local demand for jackfruit will increase
- Generates employment and income in rural areas
- Makes the product available throughout the year

Scale of development: Technology ready to be licensed



OSMO AIR-DRIED JACKFRUIT

BRIEF DESCRIPTION:

Jackfruit bulbs are a rich source of vitamins and mineral constituents especially calcium. Much of the raw jackfruit is consumed locally for curry preparation and after ripening the bulbs are relished as such in India as it is considered to be a good appetizer. Products such as fruit bars, jam, candy etc. can be prepared from this fruit. However, it has not so far been fully exploited by the fruit preservation industry. Jackfruit bulbs are a rich source of vitamins and mineral constituents especially calcium. Much of the raw jackfruit is consumed locally for curry preparation and after ripening the bulbs are relished as such in India as it is considered to be a good appetizer. Products such as fruit bars, jam, candy etc. can be prepared from this fruit. However, it has not so far been fully exploited by the fruit preservation industry.

SALIENT FEATURES:

The osmo-air dried fruit products can be used in ready to eat type of foods, ice-creams, fruit salad, kheer, cakes and bakery products.

ADVANTAGES:

- The osmo-air dried product prepared from jack fruit bulbs may be consumed as snack.
- It can also find use in military rations in suitable packing.
- Convenience product

SCALE OF DEVELOPMENT:

Market Integration



VALUE ADDED PRODUCTS FROM BANANA

BRIEF DESCRIPTION:

Banana is a fast growing and high biomass-yielding plant. The fruit averages 125 grams (0.28 lb), of which approximately 75% is water and 25% dry matter. Each individual fruit (known as a banana or 'finger') has a protective outer layer (a peel or skin) with a fleshy, edible inner portion. Both skin and inner part can be eaten raw or cooked.Banana has many uses. The ripe fruit is pureed, candied, and preserved in various forms when not eaten fresh. Its extract is used in the manufacture of catsup, vinegar, and wine. The unripe fruit is powdered and chipped.

- Banana Juice Concentrate
- Clarified banana juice
- Banana Fruit Bar
- Banana Chips
- Banana Candy
- Banana toffee
- Banana Dried
- Banana cereal Flakes
- Banana pseudo stem juice

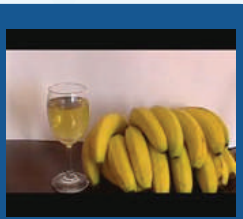
SALIENT FEATURES:

- Variety of value added products
- Low cost technologies
- Highly acceptable and palatable products

ADVANTAGES: Microbiologically safe products with longer shelf life

SCALE OF DEVELOPMENT: Technology development





VALUE ADDED PRODUCTS FROM CUSTARD APPLE

BRIEF DESCRIPTION:

Custard Apple (Sitaphal) is a tropical fruit grown mainly in the tropical climate. The fruits are well known for their delicious taste and are heart shaped with light green skin, a soft creamy white flesh. Nutritionally, the fruit is rich in carbohydrates, minerals and excellent source of vitamin C. It is said to contain the qualities of the rejuvenating drugs. Technology and general methods for preparation of value added products from custard apple – shelf stable pulp, micro – filtered beverage and jelly.

SALIENT FEATURES:

This processing technology provides information about quality control, packaging and packaging material specifications and equipment details.

ADVANTAGES:

It has been found to be very useful to the brain and the nervous system. It also enhances muscular strength and tones up the heart.

SCALE OF DEVELOPMENT:

Technology integration





PRODUCTION AND PROCESSING OF OYSTER MUSHROOMS

BRIEF DESCRIPTION:

A technology for the Large scale production and processing of Oyster (Pleurotus species) Mushrooms has been developed and transferred to entrepreneurs, which involves

- Culture & Spawn
- Large scale production (Urban & Rural Models)
- Mushroom dehydration
- Pickle & Sweet Chutney
- Canning
- Instant mushroom soup mix

SALIENT FEATURES:

Plantation crop wastes like fresh coffee pulp and coir fibre waste are also used substrate and yields are at par with that on rice straw (more than 100% BCE).

ADVANTAGES: Mushroom produced without any fungicide/pesticide and hence, can be regarded as “Organic Food”.

SCALE OF DEVELOPMENT:

Technology integration



JAMS, JELLIES AND MARMALADES

BRIEF DESCRIPTION:

Among preserved fruits, jams, jellies, and marmalades form an important class of products. The popular varieties of jams are pineapple, Mango, Mixed fruit, Strawberry, Grape, Apricot and among jellies guava and papaya, and orange marmalades. The product is used as a spread on bread for sandwiching. It is very popular now-a-days to eat bread with jams/jellies or marmalades. Can also consumed along with chapathi, dosa or similar breakfast foods to make them more palatable. The packing ranges from 25g (single serve) to 4 Kg or even 7 Kg.

SALIENT FEATURES:

Jam: It is a product prepared by boiling the fruit pulp (sometimes whole fruit) with sufficient quantity of sugar to a moderately thick consistency, firm enough to hold the fruit tissues in position. It is commercially produced by using 45 parts of fruits pulp for every 55 parts of sugar. It should contain 68% soluble solids as determined by refractometer when cold and uncorrected for insoluble solids.

Jelly: It is a product prepared by boiling clear fruit extract (with or without) water with sugar and boiling the mixture to a stage at which it will set to a clear get.
Marmalade: is a fruit jelly in which the slices of the fruit or the peel are suspended. The term generally is associated with the products made from citrus fruits like oranges and lemons, in which shredded peel is included as suspended material.

ADVANTAGES:

- Preservation of fruits in different varieties
- Long shelf life
- Reduction in post harvest losses

SCALE OF DEVELOPMENT:

Market launch



NUTRI-JAM: AN HERBAL JAM RICH IN NUTRITION

BRIEF DESCRIPTION:

Production process of herbal jam rich in nutrition and excellent nutritional supplement for particularly for pregnant women, growing child and aged people.

SALIENT FEATURES:

A standardized, novel herbal health food fortified with essential nutrients and health promoting herbs, which provide instant energy, fight fatigue and also acts as antioxidant.

ADVANTAGES:

- A composition comprises of protein, essential amino acids and minerals rich fruits and medicinal herbs,
- Fruit juice/pulp is used as base material.
- It has attractive attributes- good taste, nutritive and refreshing property.
- An excellent nutritional supplement for all particularly for pregnant women, growing child and aged people.
- Fortified with medicinal plants having high antioxidant, hepato-protective, digestive, nervine, relaxant and good immuno-enhancing properties.

SCALE OF DEVELOPMENT:

Technology Demonstration





AMLA (Emblica officinalis) PASTE

BRIEF DESCRIPTION:

Emblica officinalis or Indian Goose-berry is highly valued for its medicinal properties. Amla paste is a rich source of vitamin including ascorbic acid, minerals, organic acids, polyphenols, crude fibre etc.

Salient Features:

Amla paste also known as amla pulp is an intermediate product which can be used for the preparations of chavanpras, jam, spread and other preparations.

Advantages:

It can also be used in different culinary preparations where sour taste is desired.

Scale of development:

Market Launch



AMLA (Eblica officinalis) SPREAD

BRIEF DESCRIPTION:

Bacterial or fungal spoilage may occur during post-harvest handling of Amla fruits. Processing of Amla not only results in curtailing the spoilage of fresh fruits but also results in value addition through new products with better nutritional properties.

SALIENT FEATURES:

i) Product packed in glass jar.
ii) Product can be stored under ambient temperature.
iii) The product is microbiologically stable.
iv) Product can be consumed as jam for bread spread.

ADVANTAGES:

Amla spread can be used in bread for sand witching. This product can also be taken along with Chapthi, dosa or similar breakfast foods to make the more appealing.

SCALE OF DEVELOPMENT:

Technology Development

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





INSTANT PICKLES

BRIEF DESCRIPTION:

Pickles are adequately spiced unfermented preparations of fruits and vegetables. Preservation of fruits and vegetables in the form of pickles is an old art. The process of making instant pickle mix, which can be converted to a palatable pickle at home without any difficulty by simple addition of water and oil has been standardized. The dry mix is a convenient product to pack, transport and handle in the trade channel. A variety of dry pickle mix can be developed by using dehydrated mango, lime (lemon), Green chillies, tomatoes, carrots, different type of leaves such as gongura, coriander, etc. However, the instant pickle (dry) mix is a new concept, yet to become popular.

SALIENT FEATURES:

Fruits and vegetables are available during different seasons, which vary from product to product, in abundance. The raw materials are to be processed during the season, prepared, cured, dehydrated and stored for the ready use all-round the year. Powdered spices are the other raw materials of importance in instant pickle preparation. Dry powdered salt is to be used. All the materials can be locally procured. Packaging materials also form an important input.

ADVANTAGES:

By virtue of its quality, convenience to handle this product may become popular and acceptable.

SCALE OF DEVELOPMENT: Technology development



DEHYDRATED VEGETABLE CURRY MIXESS

BRIEF DESCRIPTION:

Cauliflower, cabbage, beans and carrot are some of the most popular but seasonal vegetables which are used to make curry, as such or in combination with other vegetables. An attempt has been made to dehydrate these vegetables and prepare instant curry mixes with spices such that the curry.

SALIENT FEATURES:

- It would be ready in 10 min. time by emptying a packet of curry mix into required quantity of boiling water.
- All the above curries go well with chapati, purri or can be adjuncts for rice.

ADVANTAGES:

- Convenience product
- Less preparation time

SCALE OF DEVELOPMENT: Market Launch



VIRGIN COCONUT OIL

BRIEF DESCRIPTION

This product has huge export market and the domestic usage is on rise.

Salient Features:

- Enzymatic process for Production of Virgin Coconut Oil (VCO).
- VCO is rich in Lauric fatty acid and has a long shelf life due to its antioxidant properties.

Advantages:

Used also as a functional food, has a great potential both in domestic & export market.

Scale of development: Market Launch



BAMBOO PRODUCTS FROM EDIBLE SHOOTS (CANDY, SNACKS & JUICE)

BRIEF DESCRIPTION:

Bamboo shoots have immense potential of being used as important health food as they contain high proteins, amino acids, carbohydrates, many important minerals, and vitamins. Freshly collected bamboo shoots have good amount of thiamine, niacin, vitamin A, vitamin B6, and vitamin E. Also the bamboo shoot based diets are rich source of dietary fibres and phytosterols and less cholesterol contents which make them one of the popular natural health foods.

SALIENT FEATURES:

- Low fat content
- High fiber
- Rich in minerals

ADVANTAGES:

- Convenience food products
- Utilization of bamboo and its popularization in different parts of the country

SCALE OF DEVELOPMENT: Technology integration







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:

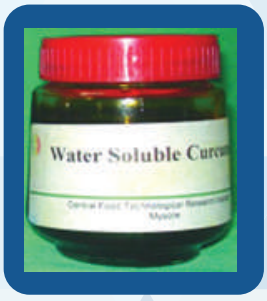
Many processing steps are involved in processing of turmeric by traditional methods. The heat treatment influences the colour and the aroma of the final product. Excess thermal treatment (cooking) spoils the colour of the final product while under-cooking renders the dried product brittle. The process 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





VALUE ADDED PRODUCTS FROM CHILLI

BRIEF DESCRIPTION:

Chillies are important sources of vitamin C (110 mg/ 100g), capsaicinoids, a source for pungency. They have presence of capsaicin as main capsaicinoids (69%) present in pericarp and placenta of fruits followed by dihydrocapsaicin (22%), nordihydrocapsiacin (7%), homodihydrocapsiacin (1%) and homocapsiacin (1%) Help in digestion by stimulating saliva and gastric juice flow. It is also suitable for the treatment of sensory nerve fiber disorders including pain, associated with arthritis and diabetic neuropathy. Value added products from chilli are developed are:

- Chilli powder
- Chilli oleoresin
- Chilli seed oil
- Chilli paste
- Chilli colour
- High pungency chilli oleoresin
- Capsaicin

SALIENT FEATURES:

- Harvesting at near ripe red stage
- Indoor heaping for full colour development
- Solar/ shade drying- 8-15 days
- Improvements in drying
- Processing of paprika

ADVANTAGES:

This processing technology provides information about quality control, packaging and packaging material specifications and equipment details.

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



FRUIT SQUASHES AND SYRUPS

BRIEF DESCRIPTION:

Fruit beverages are relished very much when served in chilled condition especially during summer, which are nutritious and healthy. Fruit squashes, crushes, cordials and syrups are popular class of fruit products, which are convenient to use. Squashes like orange squash, mango squash, lime squash, Pineapple squash, grape squash, etc., are very popular. Among syrups, sarasaparilla syrup, ginger-amla, roovaafsa" are well known. Lemon juice cordial is also popular. The demand for squashes and syrups goes up in summer and in winter it will be very less. Orange squash, mango squash, etc., will find a reasonably good market all-round the year for their nutritional quality.

SALIENT FEATURES:

- Simple unit operations
- Relishing beverages
- Utilization of different fruits

ADVANTAGES:

- Cost effective
- Large variety

SCALE OF DEVELOPMENT: Market launch









BEVERAGES FROM BANANA PSEUDO STEM

BRIEF DESCRIPTION:

The banana stem called the pseudo stem, is a juicy material rich in fiber. It is one of the various other common foods in some regions of India. It has great medicinal value too. It is available in India as any other vegetable in the markets. Juice from banana stem is a well-known remedy for urinary disorders. It improves the functional efficiency of kidney and liver thereby alleviating the discomforts and diseased condition in them. The product could be consumed or its medicinal value. Due to its high content of phenolics and tannins its consumption is limited. Its astringent taste could be masked by blending it with suitable fruit juices or spices to render the product palatable.

SALIENT FEATURES:

- In this process, banana pseudo stem juice is extracted overcoming the problem of browning.
- The juice is made palatable by blending it with other fruit juices, fruit juice concentrates.
- The product has a good shelf life and higher export potential

ADVANTAGES:

- Useful in kidney related diseases
- Longer shelf life
- High in nutritive value

SCALE OF DEVELOPMENT: Technology integration



PASTEURISED BOTTELED JUICE OF ROSELLE (BISSAP)

Bissap (Hibiscussabdariffa Linn.), also called Roselle,Guinea Sorrel or Jamaica sorrel is a nature to the old world tropics. It is widely grown in Africa, many countries in the Carribbean, Latin America and Asia. A refreshing and very popular beverage is made by boiling the calyx, sweetening it with sugar and adding ginger, lime juice and flavouring herbs.

SALIENT FEATURES:

- The fresh calyces are harvested while they are still tender and juicy, about 10 days after flowering.
- It is a brilliant red tart juice with pleasant lemon like flavour.

ADVANTAGES:

Roselle juice is similar to cranberry juice but not bitter.



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.







FRUIT BASED HERBAL DRINK (ALCOHOL 2-5%)

BRIEF DESCRIPTION:

Antioxidant Fruit based Herbal Drink (Alcohol 2-5%) which is cardio-tonic diuretic, digestive, choleretic, nervine relaxant, and immunomodulant.

SALIENT FEATURES:

Herbal drink having characteristic taste of a beer with no adverse effect and contributing a several medicinal properties e.g., antioxidant, cardio-tonic diuretic, digestive, choleretic, nervine relaxant, and immunomodulant.

ADVANTAGES:

- Based on nutraceutical concept to provide better nutrition and has reputed Ayurvedic ingredients, provide instant energy fights fatigue.
- It has self-generated alcohol (1.8-2.5), antioxidant diuretic.
- This drink is fortified with herbs reported in Ayurveda to have health protective and promotive attributed such as hepatoprotective, antioxidant and immunoenhancing besides providing instant energy and vitality.

SCALE OF DEVELOPMENT: Lab validation



CARROT JUICE BEVERAGE & RTS BEVERAGE FORMULATION

BRIEF DESCRIPTION:

Carrots are highly nutritious vegetable. It is a good source of vitamin A. Several carrot based formulations such as carrot juice beverage, carrot juice beverage blends with suitable fruit juices and flavours and spiced carrot juice beverages are available. The carrots are sorted to remove damaged portions and cleaned with water to remove soil. The prepared carrot pieces are crushed after proper treatment and then disintegrated. The same is further ground to a fine pulp and the juice expressed. Method of preparation of various products is standardized.

SALIENT FEATURES:

- Packed in 200 ml bottles can be sold to health conscious customers.
- Plain and blended juices can be consumed as a good drink for energy and strength.

ADVANTAGES:

The products are cloud stable and acceptable.

SCALE OF DEVELOPMENT: Market Launch



CARROT JUICE BEVERAGE & RTS BEVERAGE FORMULATION

BRIEF DESCRIPTION:

Ginger is a very important and highly valuable crop in some countries like Nigeria, Sierra-Leone, India, Japan, and China. This, perhaps is because ginger and its derivations (e.g. ginger oil, ginger powder, ginger syrup or juice and ginger flakes) have a lot of applications which include confectionaries, pharmaceuticals and beverages production . Ginger is composed of water, protein, fat, starch, fiber, ash, volatile oil and resinous matter. Some biologically active components are: asparaginase, borneol, chavicol, citral, cumene, cymene, geraniol, gingerdiorie, gingerol, limonene, myrecene, neral, piriene, shogal and zingerone.

SALIENT FEATURES:

Shelf life of the product is about 4 months.

ADVANTAGES:

Natural Ginger beverage/concentrate is a good product, which possesses several combined qualities of refreshing, thirst quenching, nutritious as well as carminative and tonic beverage

SCALE OF DEVELOPMENT:

Technology integration



LITCHI PRODUCTS – CANNED & SQUASH

BRIEF DESCRIPTION:

The lychee (litchi) industry in South Africa is well-established with a gradual rise in new plantings and output. Due to its characteristic pleasant flavour and soft texture, the fruit is in great demand. Unfortunately, the season of this fruit is hardly for 30 days and requires proper processing for future use.

SALIENT FEATURES:

Litchi squash/syrup is an easy to prepare beverage based and ready for use by dilution, pack, store and consume. The product is packed in 700 ml net (840g) bottles.
Canned litchi in sugar syrup is a delicacy which can be prepared in factory scale by adopting canning methods as in case of other fruits.

ADVANTAGES:

- Reduction in post harvest losses
- Utilization into variety of cost effective products
- Commercial production can be taken up to manufacture large quantity either as part of diversification of pulp making/ canning unit or as a new enterprise.

SCALE OF DEVELOPMENT: Technology integration





COFFEE CONCENTRATE

BRIEF DESCRIPTION:

It is one of the very innovative technology, which will be extremely beneficial to urban household.

SALIENT FEATURES:

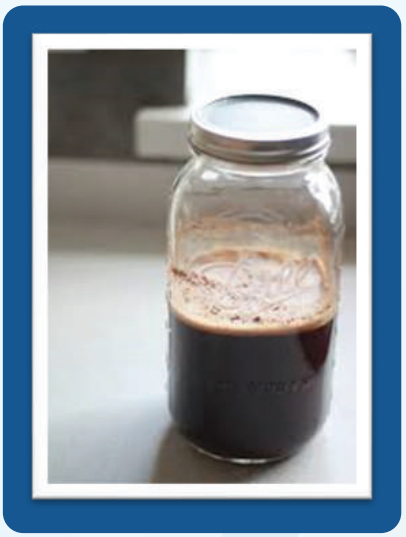
- Technology of making a coffee brew concentrate.
- Product has a shelf life of one year at room temperature.

ADVANTAGES:

Finds uses in normal coffee/cold coffee as well as a coffee flavourant.

SCALE OF DEVELOPMENT:

Market Launch



PROCESS OF COCOA BEANS TO COCOA MASS, BUTTER & POWDER

BRIEF DESCRIPTION:

COCOA MASS

Cocoa mass is used as main ingredients in manufacture of chocolate, chocolate coating, cocoa beverages, bakery goods and drinking chocolate.

COCOA BUTTER

Cocoa butter is generally used for the enhancement of organoleptic qualities of the chocolate. It is also used in preparation of pharmaceuticals and cosmetics.

COCOA POWDER

Cocoa power is used as flavouring ingredients in beverages, bakery products and confectioneries etc.

SALIENT FEATURES & ADVANTAGES:

- Standardized process
- High quality products
- Optimum recovery

SCALE OF DEVELOPMENT: Technology ready to be licensed







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.



PAPADS

BRIEF DESCRIPTION:

Papad is a thin wafer-like snack food particularly popular in South and South-East Asian countries. It is made from dough containing legume flours such as blackgram, horsegram or cereal flours such as rice, ragi etc. along with salt, khar and spices. It is either toasted or deep fat fried to an attractive crispy wafer like product that is commonly used as an adjunct to a full meal. Currently papad production and sale are carried out at home level or as a tiny scale industry, which is mostly in the unorganized sector.

SALIENT FEATURES:

This process involves grinding of black gram, mixing with ingredients, kneading the dough in a kneader, shaping in pedal/hand operated presses, drying at room temperature and packing in suitable packaging material.

ADVANTAGES:

This processing technology provides information about quality control, packaging and packaging material specifications and equipment details.

SCALE OF DEVELOPMENT:

Market launch



NUTRITIOUS FLOUR

BRIEF DESCRIPTION:

Nutritious flour (Paushtik atta) is a nutritive product prepared by blending wheat flour and soy flour fortified with vitamins and minerals to meet the nutritional requirements. Common salt is added to improve the taste of the product. Paushtik atta is acceptable as whole wheat flour for common food preparation.

SALIENT FEATURES:

The process involves very simple steps and does not require expensive equipment. The production units can be set up even in small towns with low capital. The equipments required to process Paushtik atta are cleaner, destoner, impact pulversier, mixer, roaster and heat sealer. All the raw materials and equipments are available in India

ADVANTAGES:

- It contains higher amount of proteins 14% as compared to whole wheat flour (12%).
- It can be used for the preparation of puris and chapathis in the same way as ordinary atta.

SCALE OF DEVELOPMENT:

Technology Integration



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:

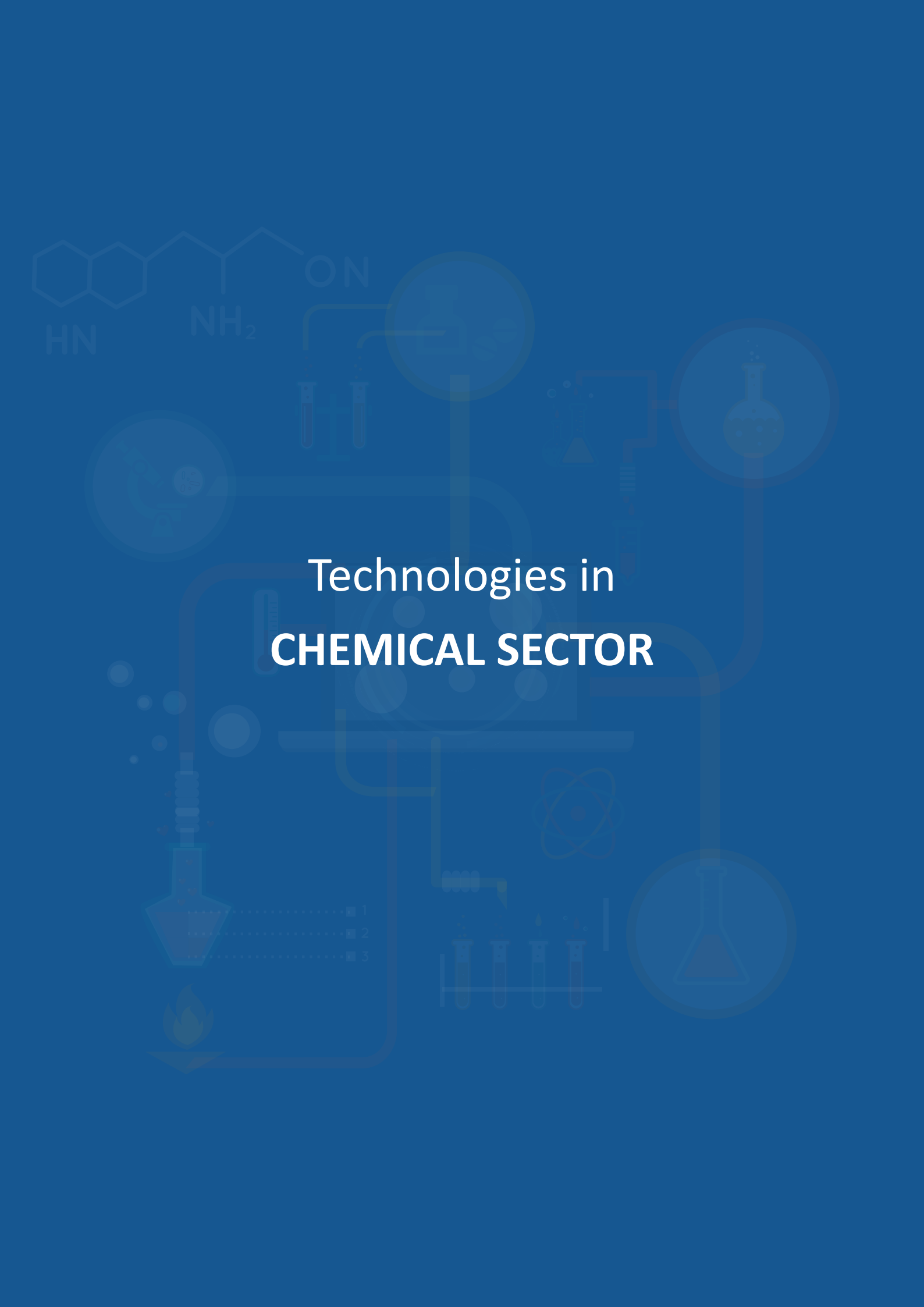
SALIENT FEATURES:

- 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
CHEMICAL SECTOR

SULPHATE OF POTASH AND REFRACTORY GRADE MAGNESIA FROM SEA BITTERN

BRIEF DESCRIPTION:

Sulphate of Potash (SOP) is excellent non-chlorine Sulphur containing Potassic fertilizer widely used in agriculture, especially suitable for crops that are sensitive to chloride. It is also basic raw material for useful industries like potassium chlorate, nitrate, sulphate, hydroxide, carbonate, etc. It is specially recommend for crops such as tobacco, potato, tomato, coffee, citrus fruits, nursery plants and oil seed. Besides these, there are smaller requirements of Potash for production of Caustic potash, Potassium Carbonate, Potassium Sulphate, etc.

SALIENT FEATURES:

SOP is a premium two nutrient fertilizer (50% K2O and 18% S) with the highest total nutrient value (68%) and the lowest salt index (46.1) which lowers osmotic effect and there by reduces the dehydration of plants.

SOP (K_2SO_4) offers an advantage over MOP (KCl) currently used by farmers with special focus on Chloride sensitive crops, Dryland agriculture, Sulphur responsive crops, Drip irrigation and areas deficient in K & S.

Low cost than the present import price to promote its use for better soil and crop management

Conversion of liquid effluent into value added products such as low sodium salt and magnesia.

No floatation is used for NaCl separation and recycle system designed leaches away NaCl with simultaneous increase in potash recovery.

The sea bittern and many of subsoil bitterns in the country are sulphate rich and hence the potash is recovered in form of SOP which is agronomically better fertilizer

The recovery/yield of potash is high because of integration and recycle of inter-mediate streams

The unit operations used are simple and most of the operations are carried out at ambient temperature except drying and calcinations of magnesium hydroxide to form MgO

The technology developed is environmentally benign.

Suitable for implementation in low humidity area.

Scale of Development: Commercialized



SEAWEED LIQUID FERTILIZER FROM BROWN SEAWEED

BRIEF DESCRIPTION:

An integrated method has been developed to utilize to a maximum extent the fresh biomass of seaweeds such as Kappaphycus alvarezii. The fresh seaweed as harvested from sea coast is liquefied to produce a seaweed liquid fertilizer which proven to be a promising low cost bio fertilizer (foliar spray as well as soil applications) and residue processed for recovery of cellulosic and carbon materials which may be used for suitable applications. Seaweed is harvested from sea and extraneous matters are removed. Seaweed is homogenized to obtain slurry, the slurry is filtered to obtain residue and sap separately. Slurry is dried to reduce moisture content. A suitable preservative is added in sap and sap is concentrated to reduce volume. For foliar spray application suitable wetting agent is added.

Africa emerging as agricultural continent, there is considerable demand for developing low cost bio fertilizer. The residue generated while producing liquid fertilizer can be used as a feedstock for making a commercially important products such as cellulose, carbon materials, for desired applications etc. Brown seaweeds are utilized as raw material and it is abundant in nature and easy to harvest.

COMPARATIVE ADVANTAGES:

Production of low cost bio fertilizer affordable even by marginal farmers.
The residue generated while producing liquid fertilizer can be used as a feedstock for making a commercially important products such as cellulose, carbon materials, for desired applications etc.
Reduce drying time and drying area required
Reduced Transportation cost due to its lesser bulk
Easier handling due to its free flowing granular nature
It can be directly used for gel preparation in certain application

Scale of Development: Commercialised





SUPER-ABSORBENT HYDROGEL

BRIEF DESCRIPTION:

The Hydrogels have been extensively reported worldwide in diverse applications, including agriculture. There have been efforts to utilize these materials as water economy aid in agriculture. However, their serious constraints like fragile structure of hydrogels particularly at higher temperatures, high rate of biodegradability, reduced water absorption capacity under practical use situations, purely synthetic origin, etc have restricted in their promotion and use in agriculture. A process has been developed for preparation of new type of hydrogel which overcomes such limitations. Hydrogel remains stable under high temperature conditions (50-60°C), possesses water absorption potential upto 35000% and remains stable in soil for long period.

Salient Features:

Less affected by the presence of salts in its immediate environment
Improves seed germination and the rate of seedling emergence
Improves root growth and density
Helps plants withstand prolonged moisture stress
Reduces nursery establishment period
Reduces irrigation and fertilization requirements of crops with improved input use efficiency
No undesirable effect on the crops raised in the fields treated with hydrogel has ever been observed or reported by the experimenters or the end users, the farmers

Advantages:

50-75% enhancement of water use efficiency in chrysanthemum and mung bean
High reduction (32%) in the frequency of fertigation
Reduction in the nursery raising period of plants (18 days as compared to 28 days in control).

Scale of development: Commercialised



Figure: Without Hydrogel



Figure: Field trial with Hydrogel

EXTRACTION OF AZADIRACHTIN FROM NEEM SEEDS KERNELS

BRIEF DESCRIPTION:

Azadirachtin is one of the most interesting constituents of Neem because of its influence on insect feeding behaviour and insect developments. Azadirachtin works as anti-feedant and insect growth for a variety of insect pests. Azadirachtin has also been reported to be non mutagenic and it appears to have no apparent mammalian toxicity. As a result of the above studies, Azadirachtin has been considered to be a promising environmentally compatible insect pest control device for plant protection. The process of extraction of azadirachtin from the neem seeds kernels involves the following major steps:

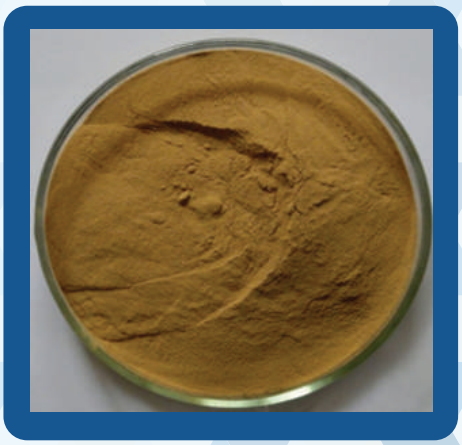
Cleaning and decortication of neem seeds
Powdering/crushing the kernel
Deoiling / defatting of kernel
Isolation of azadirachtin
Storage of final product

COMPARATIVE ADVANTAGES:

Low capital investment
High employment potential
Maximum use of local raw materials and manpower resources
Adaptable levels of sophistication
Non-hazardous to humans
Control formulations for use in Agriculture, Veterinary and Public Health from neem
Azadirachtin is separated out by precipitation instead of concentrating the solution by evaporation and recovery of the solvent.

Scale of Development: Commercialized





PONGAMIA SOAP FOR AGRICULTURE USE

BRIEF DESCRIPTION:

To reduce the adverse effect of pesticides on environment and food efforts are being made to develop eco-friendly and safe pesticide throughout the world. Scientists from a premier institute in India have developed a simple product from an Indian plant, pongamia. It is easily soluble in water and is very effective in controlling many insects pest. The solution of the pongamia soap is sprayed thoroughly to cover the plant surface. The droplet of the spray should fall on the insects for controlling them. One hectare requires approx 8-10 kg of spray per spray. Precaution should be take of ambient temperature condition for better efficient and yield. Pongamia soap is prepared by adding alkali to oil and pH is neutralized by adding sulphuric acid. Potassium hydroxide is utilized for soap preparation because it does not impart any harmful effect on plants.

Yield: By spraying pongamia soap, the damage due to insects pests like diamondback moth in cabbage and cauliflower, fruit borer and leaf miner in tomato, fruit fly and leaf miner in cucurbits can be reduced. The potential yield in each crop according to variety will be realized when it is accompanied by integrated crop management. In tomato and cabbage yields of more than 70 t can be realized in hybrids**.**

Comparative Advantages:

Soaps are easily soluble in water
If contact with insects properly it knocks down insects with 24 hour
Shelf life is upto 3 months at temperature below 30°C.
Production cost for pongamia soap is approx $0.65/kg
It does not require frequent spraying.
It reduces leaf miner, red spider mite and fruit borer pests present in tomato crop.
It destroys all fruit fly infested fruit completely to avoid further damage.

Scale of Development: Commercialized



Figure: Pongamia fruit and seed



Figure: Oil extracted from

NEEM SOAP

To reduce the adverse effect of pesticides on environment and food efforts are being made to develop eco-friendly and safe pesticide throughout the world. Scientists from a premier institute of India have developed a simple product from an Indian plant, Neem. This is in the form of pest and easily soluble in water and is very effective in controlling many insects pest. The solution of the Neem soap is sprayed thoroughly to cover the plant surface. The droplet of the spray should fall on the insects for controlling them. Spraying must be taken up in the evening or early morning hours so that the spray droplets do not dry out quickly, following this step also improves the effectiveness application. One hectare requires approx 8-10 kg of spray per spray. Precaution should be take of ambient temperature condition for better efficient and yield. Neem soap is prepared by adding alkali to oil and pH is neutralized by adding sulphuric acid. Potassium hydroxide is utilized for soap preparation because it does not impart any harmful effect on plants.

SALIENT FEATURES:

Yield: By spraying neem soap, the damage due to insects pests like diamondback month in cabbage and cauliflower, fruit borer and leaf miner in tomato, fruit fly and leaf miner in cucurbits can be reduced. The potential yield in each crop according to variety will be realized when it is accompanied by integrated crop management. In tomato and cabbage yields of more than 70 t can be realized in hybrids.

COMPARATIVE ADVANTAGES:

- Soaps are easily soluble in water
- If contact with insects properly it knocks down insects with 24 hour
- Shelf life is upto 3 months at temperature below 30 °C.
- Production cost for neem soap is approx $0.615/kg
- It reduces leaf miner, red spider mite and fruit borer pests present in tomato crop.
- It destroys all fruit fly infested fruit completely to avoid further damage.

Technology is ready to be licensed.



A MERCAPTAN FREE PROCESS FOR PROFENOFOS

BRIEF DESCRIPTION:

Profenofos an important member of the Organothiophosphate class of insecticides is a cholinesterase inhibitor, non-systemic insecticide and acaricide with contact and stomach poison. With a view to overcome the pollution problem and to provide a better quality product, an innovative clean, green and cost effective technology was worked out avoiding mercaptan release. The developed process for manufacture of profenofos involves 4 steps.

Major Raw Materials to be utilized are 2-Chlorophenol, Bromine, inorganic and organic bases, n-Propyl bromide, DETC etc. PROFENOFOS has efficacy equivalent to Monocrotofos but has higher degree of safety to mammals.

SALIENT FEATURES:

The product is odourless and has a better impurity profile
Readily availability of raw material
Mercaptan free route, so overcomes a major effluent and pollution problem
It is an environmentally benign and cost effective technology
Higher degree of safety to mammals

ADVANTAGES:

Profenofos is very effective on cotton pests especially white fly menace and controls Lepidoptera insects and Mites in cotton, tobacco, sugar beet, soya beans, vegetables etc.

Scale of Commercialization: Commercialized



MANGO (MANGIFERA INDICA L.) MICRONUTRIENT FOLIAR SPRAY FORMULATION

INTRODUCTION:

Among seven micronutrients, three micronutrients are required in relatively large quantities compared to other micronutrients and they are zinc, iron and boron. These micronutrients although are abundantly present in soil, they are not made available to plant due to variations in soil pH, soil organic matter interactions and presence of other antagonistic ionic reactions. Thus the plants suffer for want of these nutrients and result in deficiency symptoms.

Formulation: Micronutrient formulation is a combination of very essential nutrients, shelf life enhancers and filler material in required proportion & quantity. This product has been found to be more effective when applied in the form of foliar spray. Product has shelf life of 2 years. Cost of Production of 1 Kg Formulation is about Rs.140.00.

SALIENT FEATURES:

Increase in the yield of mango.
Recommended for both the bearing trees and non-bearing juvenile trees
Recommended twice for juvenile trees (young plantations, before yielding)
Recommended four times for bearing trees; two times before flowering and two times after flowering

ADVANTAGES:

Quick response to nutrients sprayed
The absorption of micronutrient through soil application is approximately one month for field crop and 3-6 month for perennial crop
Higher Efficiency
Foliar micronutrients are useful in drought and winter when soil salinity, alkalinity and acidity conditions are ineffective.

Scale of Commercialization: Ready for commercialization





FOLIAR MICRONUTIRENT FORMULATION FOR BANANA (MUSA Sp.)

BRIEF DESCRIPTION:

Micronutrients when foliar applied are more readily available to the plant than soil applied micronutrient. Foliar spray used to supplement soil applications of fertilizers and to correct deficiencies that develop during the crop production. A premier Horticulture Research institute of India has developed a unique and crop specific foliar micronutrient formulation for banana. Product developed based on the soil analysis, crop analysis and physiological studies of banana crop grown in all major agro climate zone of the country.

SALIENT FEATURES:

Increase in the yield from 5000 kg to 10000 kg per hectare.
Average quantity required for 3 sprays is approx 15 kg. .
An average improvement of 20% in the bunch yield.
Improvement in the quality of fingers.

COMPARATIVE ADVANTAGE:

Quick response to nutrients sprayed which are absorbed within 24-28 hours of application as compared to 10-15 days for soil application of NPK.
Absorption of micronutrient through soil application is approximately one month for field crop and 3-6 month for perennial crop
Higher Efficiency: Nearly 40-60 percent nutrients absorbed by plant in foliar application where as only 15-30 percent NPK are taken in soil application.
Foliar micronutrients are useful in drought and winter when soil salinity, alkalinity and acidity conditions are ineffective.
If root health is poor due to nematode, fungal and bacterial infections foliar nutrient helps to compensate for the loss of root nutrient

Scale of development: Commercialized





MICRONUTRIENT FOLIAR FORMULATION FOR VEGETABLE CROPS

BRIEF DESCRIPTION:

The biodiesel can be used either in blend or neat form in mobile and stationary diesel engines in place of fossil diesel without any engine modification. . Using this technology, a world class biodiesel can be produced with which it is possible to mitigate the environmental pollution by having low pollutants in the exhaust and carbon dioxide generated will be utilized by the vegetation for its growth. Forward Integration of Jatropha cultivation on wasteland to biodiesel preparation with the aim of attaining fuel of a quality fit for neat application in unmodified engines. Major Raw Materials to be utilized for Jatropha Biodiesel are: Jatropha oil and Methanol.

SALIENT FEATURES:

The unit operations are simple to operate and maintain.

Jatropha methyl ester (biodiesel) produced complies with the stringent EN14214 specifications.

Euro III emission norms have been met in studies.

The process can handle variations in Jatropha oil quality without compromising on biodiesel quality.

Zero effluent discharge through integration.

ADVANTAGE:

Zero effluent discharge as all by-products, including catalyst, are recovered in saleable form or recycled in integrated process.

Mileage obtained with the neat biodiesel is comparable in most cases with that obtained with fossil diesel.

The biodiesel in neat form has been used successfully in mobile and stationary diesel engines without any engine modification and down to a temperature of +2oC.

All the operations in the core process are at ambient temperature making it an energy





FOLIAR MICRONUTRIENT FORMULATIONS FOR SPICE CROPS

[Ginger, Turmeric, Black Pepper & Cardamom]

BRIEF DESCRIPTION:

In order to compensate for the lack of available nutrients in soils and to overcome the nutrient deficiency in plants, an external supplementation of these deficient nutrients is commonly applied to soils to improve the plant growth and yields. The currently available foliar nutrient mixtures contain different combinations of secondary nutrients, micronutrients and humic acid or fulvic acid. Major machinery required for this process is Pulverizer, SS Mixer, Packing Machine, etc.

Indian Institute of Spices Research (IISR) has developed and patent protected (Patent Filed in India) crop specific i.e., Ginger and Turmeric (for soils with pH below 7 and above 7), Black Pepper and Cardamom micro nutrient mixtures for foliar application.

Salient Features:

These micronutrient supply all the essential nutrients in a balance manner that support and promote growth of spices
Environment friendly process
Easy transportation and long shelf life up to one year

Advantages:

15 to 25 % increases in yield
Overall improvement in the health and quality of crops
Formulations are water soluble and compatible with simple or complex fertilizers
Low cost investment for manufacturing, cost of production is Rs.70/kg with cost benefit ratio of 1:2.5





ALKALINE PROTEASE PRODUCTION

In recent years there has been a phenomenal increase in the use of alkaline proteases as industrial catalysts. These enzymes offer advantages over the use of conventional chemical catalysts for numerous reasons, for example they exhibit high catalytic activity, a high degree of substrate specificity, can be produced in large amounts and are economically viable. Although many other classes of enzymes are currently in industrial use, the focus of this review is on alkaline proteases from various sources. This is because the organisms producing enzymes capable of catalysing the reactions at the extremes of pH above neutrality, having been considered as oddities thereby receiving little attention until the last decade.

SALIENT FEATURES:

- A strain of Bacillus sphaericus, isolated by IMTECH scientists showed protease activity upto 70,000 AU/litre in 100 L fermenter with a medium containing starch and soyatose.
- This know-how can be used for the production of a better quality enzyme for use in detergents and in leather industry for bating etc.

ADVANTAGES:

- Alkaline proteases are thermotolerant at higher temperatures.
- These enzymes have better activity.

The technology is ready for licensing



THEAFLAVINS

Theaflavins are a group of polyphenols compounds and are formed by the enzyme mediated reaction of tea polyphenol oxidase (PPO), found native to tea leaves and in other organs of tea plant with tea catechins (flavan-3-ols and their gallated esters), as its substrate, during black tea manufacture. The management of cholesterol levels is one of the most common reasons to take tea theaflavins. Theaflavins may also support the heart and digestive system as well as provide antioxidant support. This technology has been developed for enzymatic process for the production of tea theaflavins using tea catechins. Theaflavins are antioxidant and natural preservatives.

Salient Features:

- This is a process for the development of a highly efficient solid state matrix by the activation of acrylate based polymer resin having specialized functional groups for immobilizing biologically active macromolecules such as oxidases, in particular plant oxidases.
- Theaflavins without any loss of biological activity and leaving the product remaining in vitro without adherence to matrix rendering the matrix safe towards product poisoning and subsequent partial or complete loss of biological activity of the matrix bound enzyme system and thus well adapted to and well suited bioreactors based on such systems.

Advantages:

- Final Product is free from toxic chemicals/solvents.
- Biological activity of theaflavins is not compromised by the process.



ENZYMATIC RAPID FIBRE OPENING

The leather industry is one of the most traditional export-oriented industries, earning significant foreign exchange. Collagen fibre opening in the beam house operation of leather processing is conventionally accomplished by using lime. This has been reported to be achieved by the alkali action as well as osmotic pressure built up in the skin matrix. But the spent lime liquor generated in the stage of operation causes pollution when discharged as effluent, as this waste contributes to high pH, TDS and COD. This technology provides a process for the preparation of the enzyme formulation. It essentially relates to development of an enzymatic formulation comprising galactosidases and proteases from microbial source. It finds potential application in leather processing industry for effecting rapid fibber opening.

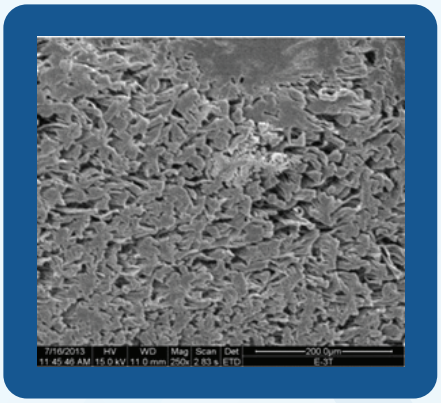
SALIENT FEATURES:

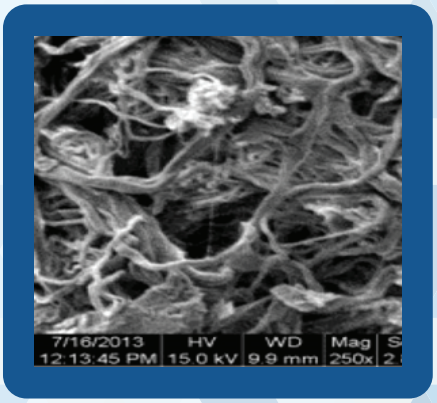
- The technology provides an enzyme preparation containing more than one enzyme of galactosidases to accomplish effective cleavage of the collagen bound carbohydrate moieties.
- The enzyme formulation can be used in leather processing at pH ranging from 4.0- 12.0 without the addition of lime or any other solid carrier thereby reducing the BOD and COD of the effluent and the pollution thereof.
- It provides a rapid fibre opening using an enzyme preparation of fungal origin.

ADVANTAGES:

- Harmful lime replaced with benign enzymes.
- Fibre opening achieved in 30 minutes compared to 72 hours conventional process.
- 0.5 % (v/w) used in the place of 10% (w/w) lime.

Technology developed and validated at lab scale.





GENETICALLY ENGINEERED AND STABLE LIPASE VARIANTS

Lipases are water-soluble enzymes that catalyze the hydrolysis of ester 30 bonds in triacyl glycerols and often also exhibit phospholipase, cutinase and amidase activities. They are used for the production of detergents, pharmaceuticals, perfumes, flavour enhancers and texturising agents in cosmetics. Detergent industry is largest proportion of industrial application of lipases.

Salient Features:

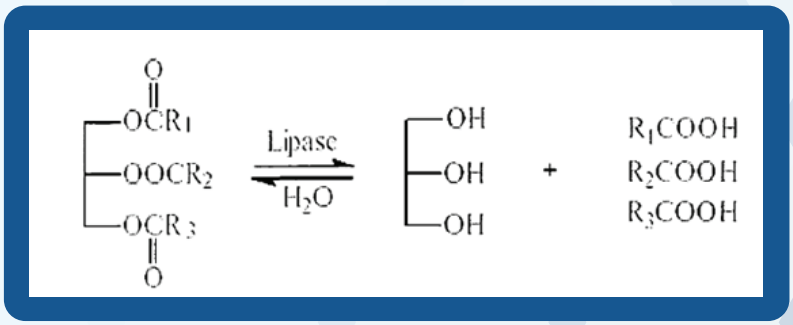
- This technology relied initially on the ability to create random variations in the original gene sequence and expression of the corresponding proteins in E. coli.
- The produced variants of the original sequence had altered sequence, hence altered properties. The variants, at a proteins level, were tested for their thermostability and those sequences which demonstrate improved thermostability were the next round of random mutagenesis and screening.
- By sequential accumulation, of the mutants and subsequent pooling of the mutations the thermostability of lipase was improved by 200-fold at high temperature. High temperature range includes temperature ranges from 50-90°C.

Advantages:

- These lipases have low substrate specificity, i.e., they have ability to hydrolyze fats of various compositions.
- They have ability to withstand relatively harsh washing conditions (pH 10-11, temperature up to 60°C).
- They have ability to withstand damaging surfactants, organic solvents and proteases.

The technology is ready to be licensed.

SCALE OF DEVELOPMENT: Commercialised



HIGHLY EFFICIENT SOLAR ABSORBER COATING FOR WATER

INTRODUCTION

A Cost-effective black chromium coating (NALSUN) has been developed for solar water heating applications. For solar thermal power generation, high-temperature absorber coatings are used in concentrating solar power (CSP) systems. The direct method of harnessing solar energy is the solar thermal conversion using solar collectors. These collectors use spectrally selective absorber surface which has high absorptance (α) in the solar spectrum region (0.3-2.5 μm) and low thermal emittance (ε) in the infrared spectrum region (2.5-30 μm).

APPLICATIONS:

Used for domestic/industrial water heating applications

SALIENT FEATURES:

- High absorptance (a) (>95%); low emittance ( ) (< 20%)
- Cost effective room temperature

SCALE OF DEVELOPMENT: Technology Commercialised.



HIGH TEMPERATURE SOLAR SELECTIVE COATING FOR SOLAR THERMAL POWER GENERATION

INTRODUCTION

A thermally stable solar selective coating useful for harnessing solar energy comprising a first solar absorber layer of TiAlN being deposited on a substrate selected from the group consisting of glass, silicon and metal, a second solar absorber layer of TiAlON deposited on the first solar absorber layer and a third antireflection layer of Si3N4 deposited on the second solar absorber layer.

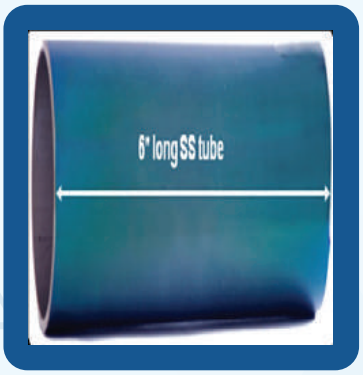
APPLICATIONS

- Parabolic trough receiver tubes and linear Fresnel technology for solar thermal power generation.
- Solar water heating Solar industrial heat process

SALIENT FEATURES

- High absorptance
- Low emittance
- High thermal stability in vacuum
- High thermal stability in air
- Nanometric scale tandem absorber
- Stable under UV irradiation

SCALE OF DEVELOPMENT: Lab Validation completed.





MANUFACTURING TECHNOLOGY FOR CARBON FIBRES

INTRODUCTION

A new fully integrated technology to manufacture Carbon Fibres from basic raw materials. The use of these materials results in products with very high strength, high stiffness and very low weight. Ability to fabricate complicated shapes and large sized components with relative ease is another major advantage of using composites. The production of carbon fibres starts with the synthesis of polyacrylonitrale- a synthetic polymer. This is done by polymerizing acrylonitrale in the presence of catalysts. The polymer is then purified by washing with water, filtered and dried. The entire process requires precise control of the processing conditions.

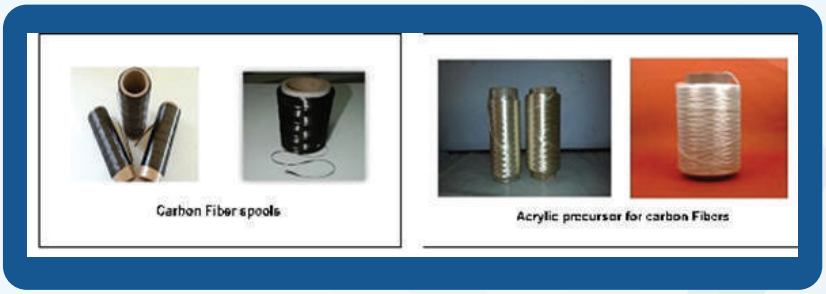
APPLICATIONS

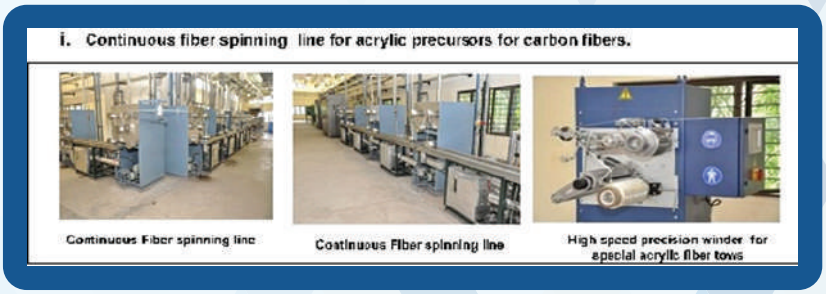
High strength, high stiffness and light weight structural materials for aerospace and other high performance structures.

SALIENT FEATURES

- High strength
- High stiffness
- Light weight

SCALE OF DEVELOPMENT: Technology Licensed awaiting commercialisation.





TECHNOLOGY FOR LUBE OIL RECLAMATION

BRIEF DESCRIPTION:

Lubricating oil used in engine oil has to be replaced at regular stage. Lubricating oil becomes unfit for further use due to accumulation of contaminants in the oil and chemical changes in the oil. Earlier used oil has no application value due to lack of technology for re-refining or economically infeasible refining technology. In the new developed technology used oil is reclaim with cost efficiency.

Reclamation of used oil is stepwise process, where in the first step used oil is freed from water by settling and large solids by removed by filtering. Oil is slightly heated to boil off any emulsified water and some of the fuel diluents. Any free water present in the oil is removed by passing through series of special filters. The dehydrated oil is treated to remove carbon and other colouring matters and then subjected to distillation. In the distillation process all unwanted aromatic contaminants present in the paraffinic lubricating oil fraction are removed. By application of this process lube oil can be reclaimed to high purity.

COMPARATIVE ADVANTAGES:

High vacuum distillation process yields above 80%.
Environmental free (Acid Free)
Refining almost eliminates the CO2 emission, which would have been otherwise released due to burning of used oil.
Can be utilized for making low grade grease or burnable briquettes.
Production of re-refined lube oil uses significant less energy compared to the production of crude lube oil.

Scale of Development: Ready for commercialization







LIQUID DEODORANT CLEANER

Brief description:

The technology has been developed for the production of Liquid Deodorant Cleaner using eco-friendly raw materials & chemicals. It is a concentrated liquid deodorant that eliminates all types of odours on hard and soft surfaces. The deodorant produced by the new developed technology has application in cleaning of floors & titles, bathrooms, toilets, polishing glass & ceramic articles etc. Major raw materials used are wax, plasticizer, emulsifying agent, oil, and surfactant.

Comparative Advantages:

Use of eco- friendly raw materials & chemicals.
Can be adopted as cottage scale technology in rural areas.
No sophisticated machineries involved.
Contains natural insect repellent
No highly skilled labour required.
No by-products generates

Scale of Development: Commercialized



Fig: Product in the Market



Fig: Technology Demonstration

A COST EFFECTIVE PROCESS FOR RECOVERY OF LOW SODIUM SALT FROM BITTERN

Realizing the demand of low sodium salt which is commonly prepared by homogeneous mixing of NaCl and KCl, a new process has been developed which is a cost effective process for the production of low sodium salt using the bittern, the mother liquor left out after production of salt in solar salt works. The process involves the desulphatation of bittern using cheap agents like distiller waste liquor of soda ash plants and processing the desulphated bittern for the recovery of low sodium salt via the intermediate product carnallite.

SALIENT FEATURES:

- The homogeneous mixture of sodium chloride and potassium chloride, which constitutes low sodium salt, can be produced directly from 29-30° Be' bittern instead of producing such salt through artificial mixing of the two solids as presently undertaken.
- The ratio of potassium chloride and sodium chloride can be adjusted in the range from 20% KCl to 70% KCl according to customer requirements by varying the baume density at which the carnallite crystallizer pan is charged.
- The process involves no heating or cooling except final drying of product in an oven and the production of crude carnallite is carried out under ambient conditions with the help of solar energy while subsequent processing of the carnallite for recovery of low sodium salt is also carried out under ambient conditions.
- Patented Technology.

ADVANTAGES:

- Other nutrients like calcium and magnesium which are beneficial in small amounts are drawn from bittern itself and need not be added from outside.
- The supernatant liquor remaining after formation of low sodium salt can be recycled in the carnallite pan to boost yield of the process.
- A variety of calcium ion-containing raw material can be used for the desulphatation of bittern required for carnallite production when the bittern contains high levels of sulphate

Technology is ready to be licensed.



FREE FLOWING IODIZED SALT

Certain elements like sodium, chlorine, calcium, magnesium, phosphorous, iron, zinc, copper, manganese and iodine are required for maintaining metabolic and physiological additives of human body. Iodine plays an important role in emulating proper physical and mental growth of human being. The daily requirement of iodine is 40 micrograms for children up to six months of age and 150 micrograms for a grown up adult. The common salt is always associated with many impurities and some of them are hygroscopic in nature and therefore when powdered to their requisite grain size it may not be free flowing which is a much required property. The impurities in salt affect the shelf life of iodine. Therefore, it is necessary to incorporate small quantity of chemicals viz., anti-caking agents along with iodating chemicals to the common salt after purifying in order to get a free flowing iodised salt.

The process involves grinding raw salt, followed by washing in a wash column draining of wash liquor submerging washed salt crystals in solution containing iodating and anti-caking chemicals, loading of wet washed salt to mechanical devices, removal of solution from salt in mechanical devices, drying, sieving and packing.

SALIENT FEATURES:

- The salt obtained by this process is a free flow iodised salt which is almost similar to physical as well as chemical properties to salt obtained by forced evaporation techniques.
- It has 98.2-99.2% purity, 32 ppm iodine and 200-500 micron particle size.

ADVANTAGES:

- The process produces a purer salt with less soluble as well as insoluble impurities.
- It has uniformly sized salt crystals which are coated with iodating and anti-caking agents.

Technology is ready to be licensed.



CHROME MELAMINE SYNTAN

Melamine-chrome complex comprises imines group. A novel melamine-chrome complex for leather processing is provided which is a metal based synthetic tanning agent having ability to enhance the thermal and physical resistance of the hide/skin when used in tanning. it acts as a tanning agent as well as re-tanning agent. The process for the preparation of the melamine-chrome complex is also given.

Salient Features:

- In addition to re-chroming, filling of the looser portions like belly is possible.
- Chromium-melamine condensate devoid of formaldehyde as cross linker.

Advantages:

- Ideal replacement to formaldehyde based condensed products employed for re-tanning and other industrial applications.
- Due to the presence of large number of hydroxyl groups, it provides additional binding sites for fixation of chromium as well as other organic molecules such as dyes.

Technology is ready to be licensed.



GLUE/GELATIN FROM TANNERY WASTES

Glue/gelatin can be produced from the collagenous component of the connective tissues present in skin, bone and sinews. While the chemical constituents of both glue and gelatin are same, they are essentially differentiated by purity, colour, processing conditions.

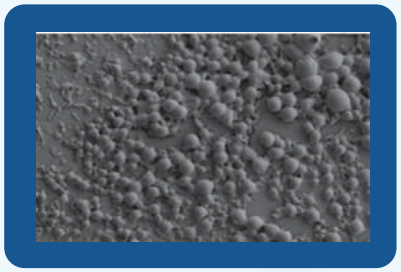
SALIENT FEATURES:

- The raw stock of glue is less refined and the extraction process involves drastic conditions, whereas gelatin processing requires clean edible raw materials, stringent processing conditions, control and purification.
- Glue/technical gelatin is not sterilized during manufacture. But edible gelatin undergoes sterilization prior to drying

ADVANTAGES:

- Gelatin is used for the preparation of capsules, jellies, adhesives etc
- It is also extensively used in pharmaceutical, photographic and abrasive industries.

Technology is ready to be licensed.



COLLAGEN SHEET FOR WOUND DRESSING (FROM BOVINE SOURCE)

A Process for the preparation of burn/wound dressing material using bovine collagen.

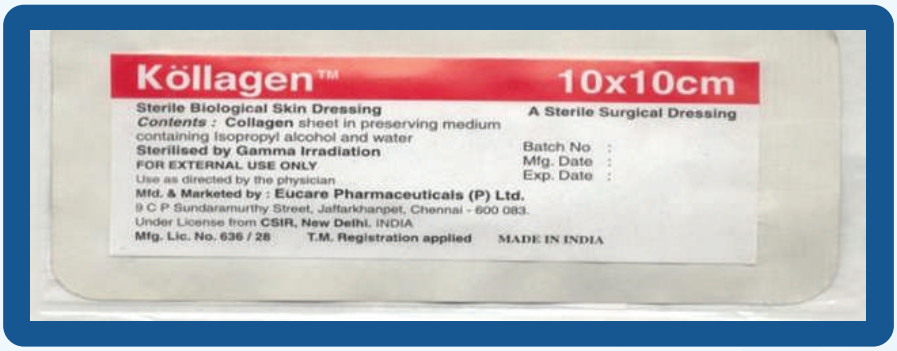
Salient Features:

- Collagen Sheet prepared using bovine collagen exhibits excellent wound/ulcer healing properties and can be used for healing of 2nd degree non infected wounds.

Advantages:

- Burn/Wound cover dressings (dressing material)
- Collagen sheets are proteinaceous in nature and the raw material is abundantly available from slaughter houses

Technology is ready to be licensed.



TECHNOLOGY FOR THE PRODUCTION OF BIODIESEL FROM JATROPHA SEED

BRIEF DESCRIPTION:

Excessive use of inorganic fertilizer and low organic matter in soil and production of high yielding hybrids resulted deficiency of micronutrients and has become a major problem. Correction of nutrient disorder through soil has become very difficult due to soil degradation, poor root health and excessive phosphorus. Application of micronutrients through foliar spray is used to supplement soil applications of fertilizers and to quickly correct deficiencies that develop during the crop production. The new product is developed based on the soil analysis, crop analysis and physiological studies of vegetables grown in all major agro climatic zones of the country. The developed formulation can be utilized for the following crops.

Tomato: Commonly susceptible to, boron, copper, zinc and magnesium deficiencies. Foliar spray from 30 days after planting till 3 weeks before final harvest results in increased yield and quantity.

Ornamentals: In general ornamentals crops are highly susceptible to iron deficiencies, especially roses, under poly house cultivation. Foliar application of ferrous sulphate at 0.5 percent with a surfactant is recommended to correct these deficiencies.

SALIENT FEATURE:

Quality of water does not affect the efficacy of uptake.
Compatibility with pesticides and can be mixed with any pesticides in spray schedule.
Higher nutrient uptake efficient
Non toxic if used at recommended dose.
Commercially available smaller and cheap shampoo sachets are recommended as surfactant due to their availability to small and marginal farmers.

Scale of development: Commercialized





POROUS CONDUCTING PAPER FOR FUEL CELL APPLICATION

INTRODUCTION

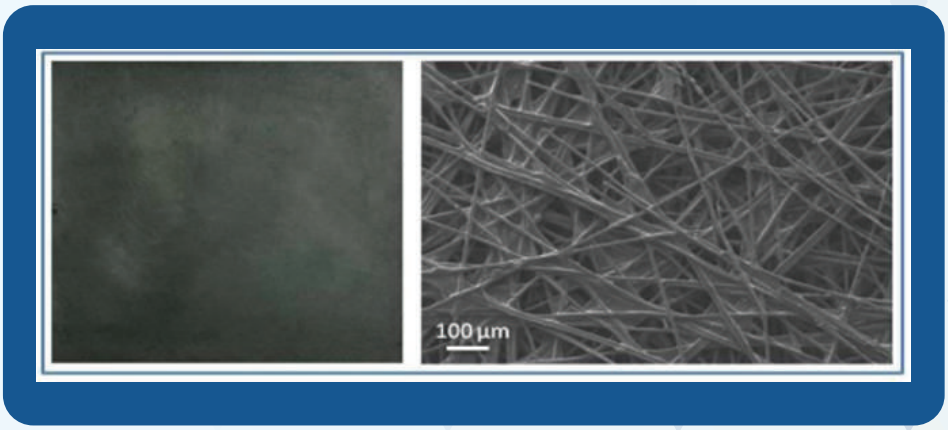
A fuel cell uses the chemical energy of hydrogen to cleanly and efficiently produce electricity, with water and heat as by products. Fuel cells are unique in terms of the variety of their potential applications; they can provide energy for systems as large as a utility power station and as small as a laptop computer. Fuel cells have several benefits over conventional combustion-based technologies currently used in many power plants and passenger vehicles. They produce much smaller quantities of greenhouse gases and none of the air pollutants that create smog and cause health problems. If pure hydrogen is used as a fuel, fuel cells emit only heat and water as a byproduct. The complete process is divided into two parts.

A. The formation of chopped carbon fibre preform mat following the paper making technique
B. Impregnation of the preform with suitable binder followed by composite making technique.

PROCESS

- Choice of suitable grade of carbon fiber.
- Selection of appropriate length of the chopped fibers.
- Designing of experimental set up for the uniform dispersion of chopped carbon fibres to make porous carbon fibre preform
- Impregnation of preform with thermostat resin
- Curing of the resin under specific conditions
- Carbonization and Graphitization of the green perform

SCALE OF DEVELOPMENT: Technology Commercialised.



TP-16 BIOFERTILIZER

INTRODUCTION

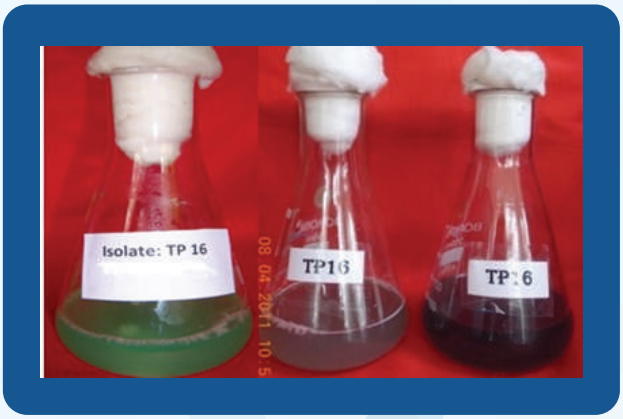
The continuous use of chemical fertilizers and manures to enhance soil fertility and crop productivity causes unexpected environmental degradation, including leaching of nitrate into ground water, surface runoff of phosphorus and nitrogen, and eutrophication of aquatic ecosystems. Microbial inoculants which flourish as beneficial free living soil bacteria and as rhizosphere bacteria in plants; which grow in and around plant tissues improve soil quality and stimulate plant growth and also help in nutrient use efficiency by plants. Based on beneficial characters of bacteria, a free living soil microbe designated as TP-16 was evaluated to be used as bio-fertilizer. The application of bio-fertilizer based on TP-16 also fortifies the soil quality. The present technology know-how describes the use of TP-16 in sustainable crop production and soil fertility improvement. CSIR-NEIST has developed both liquid and carrier based formulations from a plant growth promoting TP-16 microbial strain. The bio-fertilizer is suitable for recovery of degraded soil; improves soil biological properties; promotes yield in plantation crops (tea) and agronomically important crops as desired.

SALIENT FEATURES AND APPLICATIONS

- The bio-fertilizer is suitable for recovery of degraded soil; improves soil biological properties
- The bio-fertilizer is suitable for recovery of degraded soil; improves soil biological properties; promotes yield in plantation crops (tea) and agronomically important crops as desired
- The application of the bio-fertilizer TP16 reduces the amount of use of synthetic nitrogen urea by half the amount keeping intact the plant growth and harvest index of rice and fresh leaf yield in plantation crops tea.

SCALE OF DEVELOPMENT:

Pilot scale demonstration done, prototype tested in actual field conditions & all critical scaling issues addressed. Final Product based on the technology is selling into the market.




Technologies in
DIAGNOSTICS

INTEGRATED CORROSION MONITORING SENSOR (ICMS) GADGET

INTRODUCTION

ICMS is a versatile integrated sensor gadget, a basket of sensors to measure potential, corrosion rate, resistivity and temperature simultaneously to alert us on the health of structures/bridges/-reactors. Early detection of corrosion through this all terrain compatible embeddable sensor has been made accessible through a custom designed Mobile App for corrosion monitoring in civil infra structures. Keeping this handy and wireless remote control, one can have round the clock monitoring of civil structures aided by scientific data from anywhere and everywhere.

APPLICATIONS

- Corrosion Monitoring in Concrete Structures likes
- Nuclear Reactor Buildings
- Dams,Tunnels
- Bridges and Viaducts
- High-rise and historical buildings
- Foundations, Construction sites
- Settlement areas

SALIENT FEATURES

- Predictive maintenance utilizes non-destructive testing through sensor technology
- Detects the existence of the damage on the structure
- Locates the damage as and when occurs
- Quantifies the severity of damage
- Reliability-centred maintenance included
- Alerts and extends clues on Corrective maintenance





NOVEL METHOD FOR SIMULTANEOUS DETECTION AND DISCRIMINATION OF BACTERIAL, FUNGAL, PARASITIC AND VIRAL INFECTIONS OF EYE AND CENTRAL NERVOUS SYSTEM

This technology provides diagnostic methods for identification of the single causative agent or more than one causative agent of ocular and nervous system infections among many probable pathogens, which can cause the infection. All the pathogens affecting a discrete area of eye or nervous system generally cause same clinical manifestations or syndromes. This technology relates to detection and discrimination of the pathogen among the set of probable pathogens in a single test without resorting to a battery of tests each being directed at detection of one pathogen.

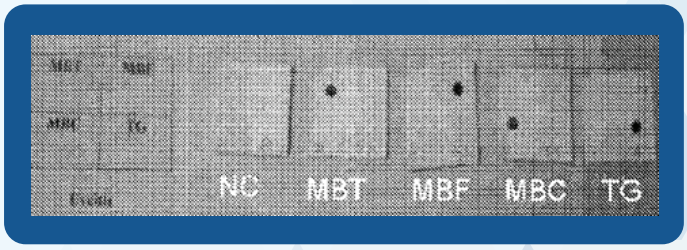
Salient Features:

- The technology utilizes a set of chemically tagged pathogen specific forward and reverse primers that have been uniquely designed to specifically amplify target sequences from a pathogen in a multiplex polymerase chain reaction (PCR).
- It combines the high sensitivity of PCR assay and the high specificity of identification by hybridization on to a macro-array with the detection of hybridization by color detection methods, the end result of which can be monitored by naked eye.
- However, fluorescent labels such as Quantum Dots, Cy3, Cy5, FITC can also be used and the product could be visualized by fluorescence microscopy.

Advantages:

- Highly efficient and time saving kit.
- Identification of specific pathogen at very early stage of infection will help the physician to select the appropriate treatment regimen for spread of the disease and its cure.
- Identification of multiple infections from the same samples will also be useful for a treatment using combination of drugs for effective therapy.

The technology has already been commercialized.



MOISTURE SENSOR & MOISTURE METER

INTRODUCTION

Mesoporous γ-alumina based capacitive sensors have been developed for detection of trace moisture. Thin films of ?-alumina-based sensors have been fabricated by sol-gel and screen-printing techniques and the necessary circuitry has been made. The meters can detect moisture from 5 to 20 ppm in transformer oil.

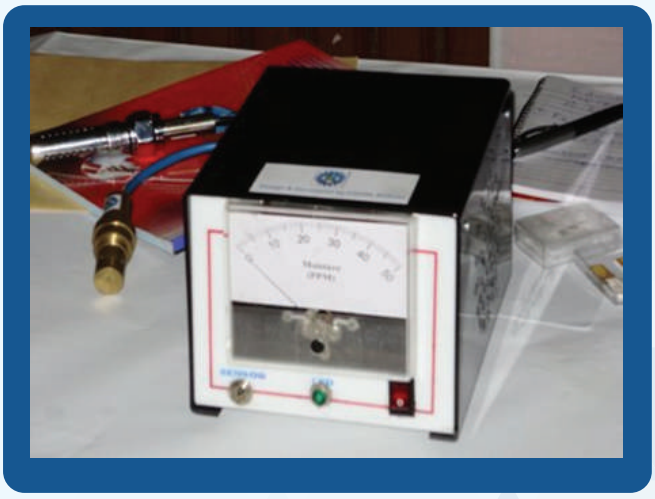
APPLICATIONS:

Moisture detection in any system or environment

SALIENT FEATURES

ppm moisture detection in transformer oil useful for improving the dielectric break down voltage of transformer oil and a process of preparation thereof.
Non hazardous and non toxic.

SCALE OF DEVELOPMENT: Ready for commercialization.



PORTABLE MAGNIFYING INSTRUMENT USEFUL FOR COLPOSCOPY

Colposcopes deal with wide three-dimensional objects that are neither telescopic nor microscopic in nature and provide magnifications in the range of 6x to 40x. Colposcopes in hospitals are generally shared among a number of physicians for examination/investigation. Associated delay in examination may lead to delay in diagnosis and adds to the cost and suffering of patients of cervical carcinomas.

Salient Features:

- It includes an optical system, an integrated energy efficient, low powered and an intensity controlled illumination system; a power pack and mounting.
- It is capable of providing a distortion free clear continuously varying 10x to 15x magnification of a three-dimensional wide object;
- The optical system may have an eyepiece lens system and an objective lens system. The illumination system may have a plurality of light emitting diodes (LEDs) mounted in such a manner that the angle between the LEDs is maintained with respect to the optical axis of the lens system.

Advantages:

- Lightweight for hand held use; highly portable.
- Clear distortion free view at close range for direct observation of cervix.
- Viewing of considerable area at a time and examination of whole cervix with minimum planetary motion.
- Comfortable depth of field for examination of 3 dimensional wide objects.
- Affordable for individual doctors to use the invention in their chamber and in mass cancer detection camps.
- Very compact in pencil battery powered illumination embodiment.

The technology has been developed and validated at the laboratory level.



SALIVARY FLUORIDE DETECTION KIT

Fluoride has been recognized for 50 years as an important defence against tooth decay. According to well-researched studies, fluoride treatments reduce decay by an astounding 20 to 40 percent. Ithelps teeth fight decay by repairing or restoring the loss of minerals on the tooth enamel. Loss of minerals in the enamel is what causes cavities. Bacteria present in the mouth produce acids that eat at the surface of the tooth, damaging the natural balance of minerals that make up the tooth's enamel. The indigenous salivary fluoride level detection kit and sensor station is unprecedented in its kind towards diagnosis of salivary fluoride level for the welfare and betterment of the society.

Salient Features:

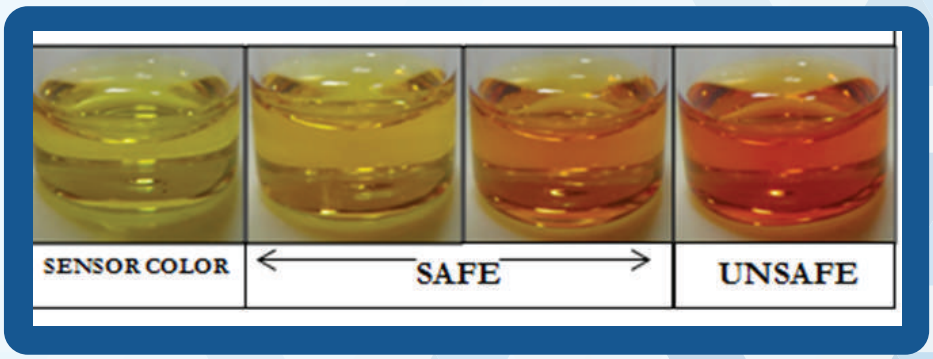
The salivary fluoride detection kit has mainly two components:

- Solution Kit: chemical compound that could exclusively detect fluoride from human saliva has been synthesized. The solution kit has been prepared by employing this chemical compound where a colour chart has been provided for the convenience of the users.
- Sensor station: The developed sensor station has the potential to transmit the vivid transition in colour after mixing the saliva and the chemosensor into a readable digital output signal. This is immensely helpful since a person by own can carry out the test without the aid of any trained personnel or experts in related domain.

Advantages:

- User friendly and can be used for community dental care purposes.
- Light weighted and portable.
- The solution kit is available at a very low cost (Rs. 5/unit)
- Methodology is very simple.

The technology is ready to be licensed.



SURGICAL MICROSCOPE FOR EYE SURGERY

Surgical Microscope is a medical instrument to assist the doctor for cataract surgeries and many other eye related diseases. This instrument, which enables eye surgeons to perform delicate anterior and posterior segment procedures, has evolved over the last few decades into a highly sophisticated device. For clear visualization of the operating field so as to enhance the surgeon's view of the microscopic structures, the design is on the principle of telescopic magnifier and four steps magnification are achieved by using two telescope of desired power in direct and reverse direction. The fifth step magnification is achieved by direct viewing. According to the technical requirement large working distance at relatively low magnification is maintained.

Salient Features:

- The opto-mechanical design has been perceived specifically to meet the requirements of eye surgical applications like keratoplasty, keratoprothitics and cataract operations.
- It is a portable surgical microscope with specialized optomechanics in the form of a motorized focusing control by foot paddle, for eye surgeries.
- With upgraded magnification, lighting system, incorporating recording feature through camera and real time display, improvements in aesthetics, etc., its advanced version could be offered in a short time.

Advantages:

- A true stereoscopic observation for reliable acquisition of three dimensional structure of the object field.
- Good resolution with excellent contrast along with excellent and uniform illumination of the field of operation and also in depth of cavity.
- Wide magnification range to guarantee a rapid change over from low power to high power for detail observations.



MYOMETER

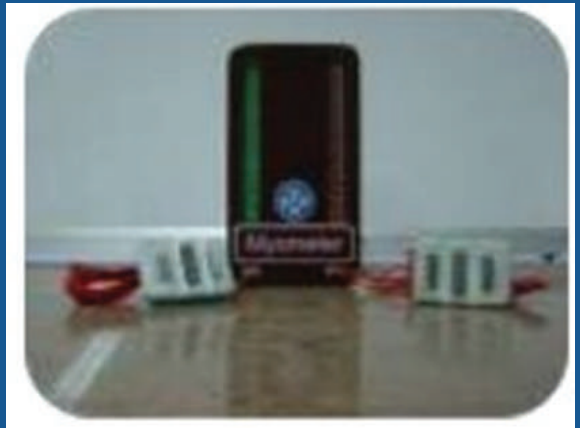
Myometer is a handy device which is used to find out the optimum location of the EMG electrodes placement for the proper functioning of the myoelectric arm. It shows the real time functioning of the muscles by giving strength of the EMG signal produced by the muscles during relaxation and contraction. The myometer is a multi uses device for medical applications. It can be used in all applications where the level of strength of the muscles is to be carried out.

Salient Features:

Myometer explores the Electromyogram (EMG) signal generated by muscles activity at a particular location. The activity of muscles during contraction or relaxation is picked up by EMG active electrode and displayed on a graphical LCD in real time.

Advantages:

- The technology is very useful for hospitals for the physiotherapy treatment and in all the applications where the level of strength of the muscles is to be carried out.
- Estimated end product price is Rs. 15,000 as compared to the other similar products that are available in the market which cost around Rs. 1.0 Lakh.



PULMOSCAN: AN AFFORDABLE FORCED OSCILLATION TECHNIQUE BASED DEVICE FOR BETTER POINT OF CARE SCREENING OF LUNG DISEASE

Increasing global urbanisation and pollution has led to a steady increase in both Obstructive Airways Diseases (OAD) which affects an estimated 650 million globally. Forced Oscillation Technique (FOT) has shown the most promise as an alternative to conventional spirometry, requiring minimal instruction and training and therefore suitable for all ages. But the problem with FOT devices is their bulkiness and high cost which makes poorly marketed. The technology offers a handheld, portable, battery operated FOT device that uses novel design and analysis elements to improve sensitivity beyond existing solutions, while lowering price by 90% and reducing the risk of infection transmission between patients. This would permit early, accurate, and cost effective screening of OAD.

Salient Features:

- World's first handheld, portable and battery powered FOT device.
- Pulmoscan find application in medical field for early and accurate diagnosis measurement of lung function.
- This can guide changes in lifestyle and therapeutic interventions can improve the quality of life and reverse or arrest the decline in lung function.

Advantages:

- Highly cost effective; brought the cost of FOT devices from Rs 1.2 million to Rs. 0.2 million.
- As a portable device, it can be carried everywhere for mass screening purposes.
- Battery operated, so can be used in areas with limited power supply/frequent power cuts.

The technology is ready to be licensed.



CIRCULAR ELECTROPHORESIS

Nucleotide and protein electrophoresis is widely used to understand the changes occurring in their structure. The techniques currently available are horizontal electrophoresis for DNA /RNA; vertical, 2D and rod electrophoresis mainly for proteins. The major drawback in these techniques is the fact that the current flow is unidirectional and is applied to a large surface area. This reduces the extent to which these molecules can be resolved. The other problem is that these units are big and need a lot of power to be run hence they are not portable.

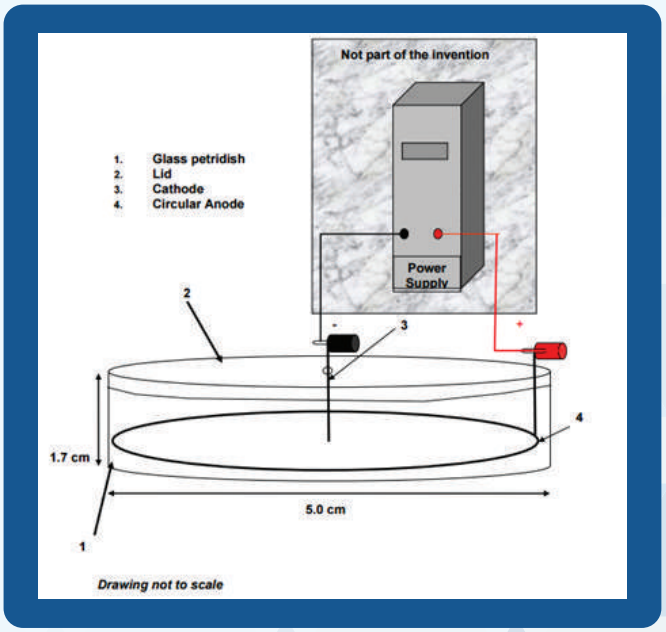
Salient Features:

Present technology provides a process for making a circular electrode and product thereof for conducting electrophoresis of nucleotides (DNA, RNA) and proteins which comprises of a circular anode and a cathode in the middle, thereby providing a portable device with uniform electric field over a small surface area thereby a increasing the resolution of macromolecules.

Advantages:

- Smaller than conventional electrophoresis instruments thus more portable.
- It provides better resolution in separation of macromolecules.

The technology is ready to be licensed.



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. The type of test needed, and to what frequency, will depend on the unique components specific to the water source in question. This water analysis kit can be used for for the analysis of physico-chemical and bacterial parameters in drinking water in the field.

Salient Features:

- It is comprised of an improved incubator for the bacteriological analysis of a sample which comprises two concentric chambers and the peripheral gap between the chamber being filled with an insulating material.
- It is also equipped with a colorimeter.

Advantages:

- Portable and operated on 220 V AC.
- Used for onsite water quality assessment with respect to pH, conductivity, TDS, chloride, residual chlorine, nitrate, sulphate and iron in drinking water.

The technology is incensed and will be in market soon.



THERMO-STABLE ELISA KIT

ELISA is a very sensitive and highly specific diagnostic method and can be used for detection of an array of disorders and pathologies. Antibodies are the main the component of an ELISA kit that make it so quick, specific and sensitive because antigen-antibody interaction is known to be almost identical to lock and key model. However, being glycol-proteins antibodies are highly susceptible for degradation by even slightly high temperatures, acidic/alkaline conditions, and presence of organic solvents etc and they must be kept in highly specific conditions with temperature range -4 to -20 . This technology addresses the storage temperature issue and can be used to maintain the integrity of antibody structure at 37 upto 3 months. By using this technology ELISA kits for detection of cortisol, progesterone, 17α-OH–progesterone, estrone glucuronide, androstenedione, corticosterone and HCG have been developed and tested.

Salient Features:

- This is a platform technology and can be used with any existing ELISA kits.
- The integrity of the ELISA components is retained is retained for a period of few months.
- Can be used in point of care devices for remote areas and mass screening for diseases.

Advantages:

- This technology enables the manufacturers to transport the ELISA kits without worrying about additional expenses of low temperature maintenance.
- Kits are very stable in different kinds of climatic conditions.
- This technology can be used for community health camps at the places with limited power supply or frequent power cuts.
- Very low production cost and the kits are at par with the imported technologies.

The technology is ready to be licensed.



SOIL MOISTURE INDICATOR

Depletion of available water resources for agriculture is a cause of concern. This can be addressed by efficient irrigation management practices. In most of the farmers' fields, irrigation scheduling based on soil moisture is almost not in practice. For this, devices like soil moisture indicator / meter are essential to assess the status of soil moisture before scheduling irrigation. This is due to the non availability of easy-to-use, rugged, effective and inexpensive soil moisture indicators. Hence, to assess the soil moisture level in fields as well as potted plants, Sugarcane Breeding Institute has developed a simple and farmer-friendly electronic Soil Moisture Indicator (SMI).

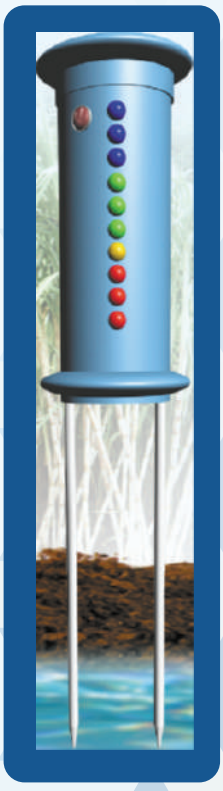
Salient Features:

- It comprises of a sensor rod and a casing. There are either two metal sensor rods (two individual rods spaced at distance of about 5 cm) or a combined rod. The casing houses an electronics and batteries for power.
- The resistance between the sensor rods depends on the moisture content in the soil between the rods. The electronic circuit is designed in such a way to display moisture levels by glowing any one colored LED / lamp out of the 10.

Advantages:

- Suitable for use in agricultural farms as well as in potted plants.
- Suitable for different soil types.
- Low cost (About Rs.500.00)
- Indicates soil moisture level with more objectivity by ten different colored LEDs.

The technology is ready to be licensed.



ACOUSTIC MILK ANALYSER

BRIEF DESCRIPTION:

Milk is very important due to its special nutritive value and important role for human and animal health. It has all the substances needed by organisms in its easiest assimilable form. Its has high value proteins, fat, A and D vitamins playing an special role in Calcium and Phosphorus fixation in bones , low cholesterol compared to other foods of animal origin. This pricing method derives component values from prices for milk and associated products, which rise and fall with changing market conditions. As a result, milk component levels are important factors in herd management. In addition to being indicators of cow health and nutrition, component levels directly impact farm income. Thus the precise analysis of milk is of utmost importance.

SALIENT FEATURES:

- The system is capable of measuring milk contents like butterfat (%), solid nonfat (%), proteins (%), lactose (%), density and added water (%) in milk.
- Measurement time is 40-45 seconds.
- Accuracy of the system is: Butterfat ±0.1%; Solid nonfat ±0.2%; Protein ±0.2%; Lactose ±0.2% and water ±5%.

ADVANTAGES:

- Portable and user friendly.
- Auto calibration at field can be done.
- Cost effective.

The technology of has been tested at laboratory and ready for field trials.



IODINE VALUE METER

INTRODUCTION

Iodine Number is the number of centigrams of iodine absorbed by one gram of oil or fat. CSIO has developed a system to measure iodine number of oil. It is a low cost, portable instrument and easy to operate. The instrument is based on measurement of change in potential across the sensing and reference electrodes when immersed in a mixture of test reagent and oil. The LCD display is a direct measure of Iodine Number.

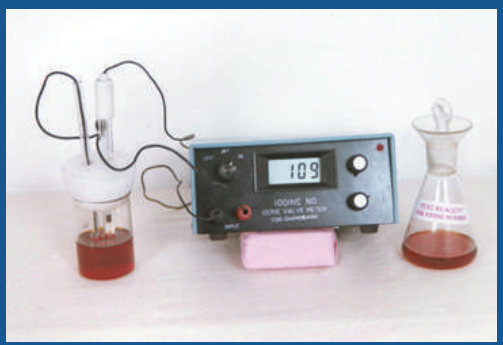
APPLICATIONS

- Iodine Number of oils, fats & unsaturated compounds.

TECHNICAL SPECIFICATIONS

- Measuring Range : 0 – 199 Iodine number
- Accuracy : 1 Iodine number
- Resolution : 01 Iodine number
- Display : 3 ½ Digit LCD
- Electrode : Combined Electrode Platinum & Calomel
- Battery / Mains : For display operation 9V Cell & 220V/50Hz mains
- Dimension : 17.4cm (L) x 14cm (B) x 7.3cm (D)
- Weight : 1Kg (Approx.)

SCALE OF DEVELOPMENT: Technology Commercialised.





RISK ASSESSMENT OF WATER BORNE PATHOGENS, DETECTIONS BY BACTERIOLOGICAL WATER TESTING KIT (BWTK)

INTRODUCTION

A defined substrate media as Bacteriological water testing kit (BWTK) has been developed to detect the presence/absence of total coliforms, faecal coliforms, Aeromonas hydrophila, Yersinia enterocolitica and Listeria spp. from drinking water. A combined culture, BWTK and multiplex Polymerase Chain Reaction (PCR) molecular tool, as water testing kit has been designed for simultaneous detection of Y. enterocolitica, A. hydrophila and E.coli in drinking water.

ADVANTAGES

- BWTK over conventional method like to perform the test, one need to add water to the kit and incubate.
- No equipment is required.
- Specific color changes denote the presence of the target microbe, emerging pathogens, total coliforms and Escherichia coli.

SCALE OF DEVELOPMENT: Technology available for licensing

TEST KIT FOR MICROBIOLOGICAL QUALITY OF DRINKING WATER

INTRODUCTION

Test kit for Microbiological Quality of Drinking Water is a simple device to test the portability of drinking water. This test does not need any laboratory facility. The process is based on the detection of H2S producing organism in drinking water, which is present along with Coli forms. The process is the preparation of 20X concentrated media by mixing some chemicals in a definite proportion.

The production can be proportionately scaled-up by increasing the ingredients. One ml portion of this solution is absorbed on a folded tissue paper (80 sq. cm), which is placed in McCartney bottle, sterilised in an autoclave and dried at 50oC under sterile conditions.

Dry and sterile media is provided in the screw-capped bottle, which is ready for use. The water to be tested is filled to the upper level of the bottle and bottle is gently shaken for 5 minutes and kept at room temperature for 18 hrs.

SALIENT FEATURES

- It is inexpensive.
- Reliable.
- Convenient method of testing in field conditions.

SCALE OF DEVELOPMENT: Technology Commercialised.




Technologies in
WATER TREATMENT SECTOR

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

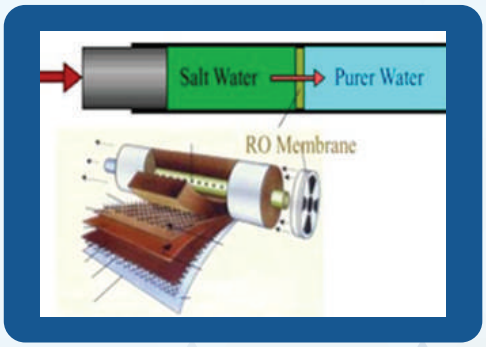
BRIEF DESCRIPTION:

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



LOW COST TERAFIL WATER PURIFICATION SYSTEM

BRIEF DESCRIPTION:

"TERAFIL" is a user friendly green technology for purification of both surface and ground water at minimal cost. Terafil disc, which is the core filtering mechanism, is made up of red clay, river sand, and wood saw dust; without any use of chemicals. It is an efficient, affordable and sustainable technology for safe drinking water in both rural & urban sector.

Terafil red clay is a low cost and sustainable water purification media (disc/candle) for efficient treatment and filtration of turbid and high iron containing drinking water. Pores in the Terafil disc are separated from one another by a ultrafine sintered clay membrane, but are connected through capillaries in the clay membranes whose openings are within 200 nm diameter; much smaller than iron colloids, turbid particles and most of the pathogens. Complete removal of iron and suspended particles from water is achieved along with significant removal of pathogens through this medium without clogging its core. Fitted with food grade plastic or stainless steel containers it serves a point of use water filter for domestic purpose (50 litre/day). A battery of discs can be fitted to water tanks for community usage (1000-100,000 litre/day).

COMPARATIVE ADVANTAGES:

Low cost water filtration, Suitable for MSME/Cottage industry, marketing in rural and urban sector, Use of local materials, Long life of product

Scale of Development: 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.

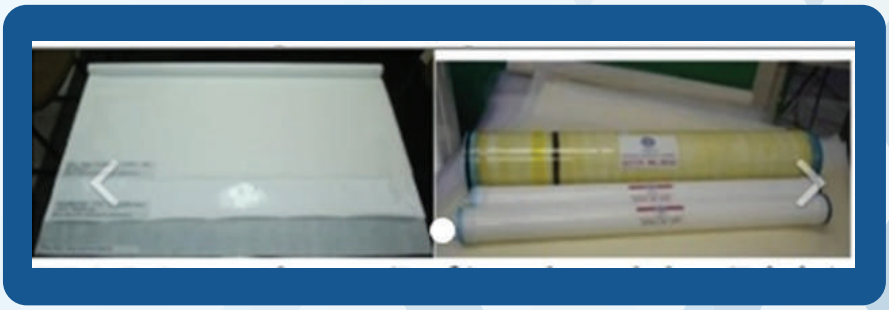
This technology has been successfully developed for manufacturing hollow fibre (HF) microfiltration (MF) and ultrafiltration (UF) membranes having discrete molecular weight cut off (MWCO) values from polymers like polysulphone, polyethersulphone polyvinylidene fluoride, polyacrylonitrile and blends of 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.

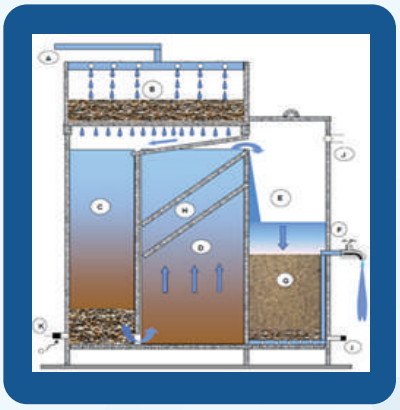
COMPARATIVE ADVANTAGES:

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

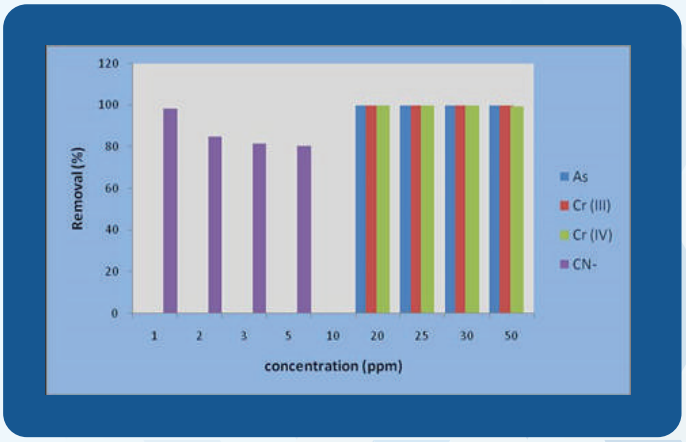
Presence of arsenic (As) and chromium metal ions in drinking water has become the issue of global concern. Long-term exposure to even low concentrations of arsenic in the drinking water may cause skin, lung or prostrate cancer and cardiovascular, pulmonary, immunological and neurological disorder. A 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

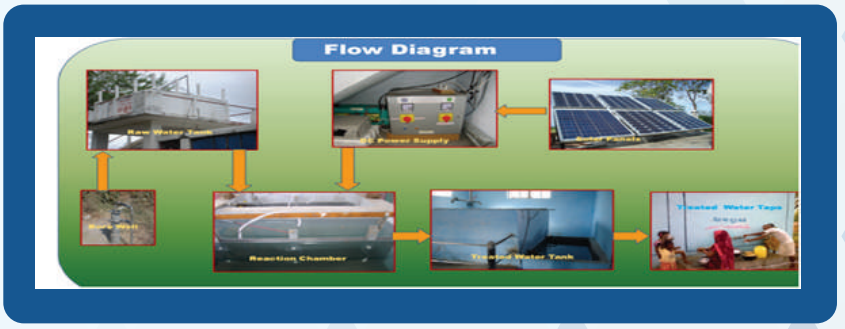
Electrolytic de-fluoridation process is a water purification system suitable for fluoride affected area with water containing excess fluoride. The defluoridation process is based on the principle of electrolysis, using aluminium plate electrodes placed in the raw water containing excess fluoride. During 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.



CERAMIC MEMBRANE BASED TECHNOLOGY FOR REMOVAL OF ARSENIC AND IRON FROM GROUND WATER

INTRODUCTION

Complete Technology package up to 20000 LPD for commercial exploitation. Proving the performance of the process for removal of arsenic to below 10 ppb (as per WHO recommendation) using highly contaminated ground water (1-1.5 ppm As & 10-15 ppm Fe) along with provision for sludge encapsulation and backwashing. Removal of Iron below 0.3 ppm and can be used as iron removal plant in absence of arsenic in groundwater.

APPLICATIONS

- Removal of Iron, Arsenic and other suspended and colloidal particulate matter from contaminated groundwater.

SALIENT FEATURES

- Simultaneous removal of arsenic and iron from highly contaminated ground water for producing sparkling quality drinking water(with arsenic content below the WHO recommended limit (As <0.01 ppm) and negligible iron content (Fe<0.1 ppm)
- Excellent adsorption capacity of the media (7-8 times higher than normally used granular Ferric Hydroxide)
- Modular design with flexible production capacity (500-20000 LPD. 12 hours operation a day)
- Semi-automatic, user-friendly operating procedure can be operated by even the female members of the community.
- One time media addition in 3-6 months is sufficient for 0.5-1 ppm arsenic content in raw water and continuous addition of chemicals or media regeneration is not required.
- Scope of supplying quality drinking water at a much lower cost
- Low sludge volume.

SCALE OF DEVELOPMENT: Technology commercialised and 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.



IMPROVED IRON REMOVAL

INTRODUCTION

The presence of excess iron in ground water creates several problems including health hazards to the masses and also causes rust, stains on house hold washings and laundry. Groundwater iron removal process in the present work is adapted to remove iron efficiently from the groundwater without affecting the other water quality parameters. The present work comprises of a improved iron removal plant (IIRP) which accommodates a force & lift type arrangement fitted with the existing India Mark-II hand pump, number of holes around the aeration chamber, pre-settling chamber, settling chamber and a outlet tap to collect the safe iron free drinking water. Improved iron removal plant (capacity: 800 Lit/hr.) for community purpose use has been designed & developed by laboratory. The know-how for which is ready for transfer & commercialization. Removal of iron from water containing ferrous salt is done by oxidation accompanied by the dissolved oxygen introduced into the water through aeration and precipitation.

SALIENT FEATURES

- Plant capacity – 800 lit/hr of treated water delivery
- Iron removal capacity - from 15 mg/lit to 0.1 mg/lit.
- Attachable to the existing Mark-II hand pump
- Instant iron free water and Cost effective
- Naturally available sand and gravels used for removal
- No electric power requirement- Implementable in remote villages
- Useful to community service: a small village may cover for drinking purpose only
- Attachable to the existing Mark-II hand pump
- Simple in design-Operation and Maintenance
- Instant iron free water

INDUSTRY SECTOR: Societal Initiative

SCALE OF DEVELOPMENT: Ready for licensing



WATER FILTER FOR ARSENIC REMOVAL

INTRODUCTION

An affordable, portable, power free purifier and detection kit for producing arsenic safe water. We also invented a simple dip-stick type kit for the detection of arsenic before and after filtration using gold-Nano sensor integrated paper strip.

A portable and power free arsenic water filtering unit that contains a simple cartridge made of modified rice husk which is easily available as agriculture waste from the rice milling industry. Capacity: 25 Litres Flow rate: 3-4 Lit/hr Cartridge life: ~Expected1000 Lit.

The arsenic unit has storage capacity 25 liters and flow rate 4-5 liter per hour and its average adsorbent life will be 1800 liters. The system has one filter unit and one replaceable cartridge and it doesn't require running water as well. One unit will cost upto Rs 900. It will be of great use in Ganga-Meghna-Brahmaputra delta regions where there is no access to arsenic-free safe drinking water.

SALIENT FEATURES

- Domestic type adsorption based multi-stage water filtration unit
- Remove both arsenic (III) and arsenic (V) to the desired permissible limit (~10 ppb) of drinking water
- No electricity
- No running water required
- Flow rate: ~ 4-5 L / hour
- Adsorbent life (average): ~1800 L
- Storage capacity: ~25 L

INDUSTRY SECTOR: Filtration of arsenic contaminated water for drinking purpose

SCALE OF DEVELOPMENT: The developed arsenic filtration unit will be deployed among the areas of West Bengal where arsenic level is high.




Technologies in
HERBAL SECTOR

HERBAL CHOLESTROL LOWERING FORMULATIONN

INTRODUCTION:

Researchers have developed, Gugulipid,a cholesterol lowering drug taking the lead from ancient Indian system of medicine“Ayurveda”. The Drug has been developed from the plant, Commiphora mukul. Ayurvedic Practitioners have been utilizing the gum of the tree of Commiphora mukul commonly known as "Gugglu". Ayurvedic literature also mentions the gugglu as a drug for the treatment of goutt, arthritis, rheumatism and lipid disorders.The establishment of promising hypolipidaemic activity in a non-toxic fraction of guggulu led to the identification of the active constituents, gugulsterones. However, as the fraction was equally active as the individual active entities, this fraction designated Gugulipid has been developed as a drug. Gugulipid passed through all the three phases of clinical trials successfully and was found to possess hypolipidaemic activity comparable to the present drug of choice, Clofibrate.

SALIENT FEATURES

- Guggul helps reduce high cholesterol, because it lowers harmful low-density lipoproteins while elevatingthe beneficial high-density lipoproteins.
- It helps prevent blood platelet aggregation and breaks up already formed blood clots. Thus, it helps prevent heart disease and stroke.
- No side effects.

COMPARATIVE ADVANTAGES:

Unlike other synthetic drugs this is a herbal formulation and thus does not possess any toxic effects.

SCALE OF DEVELOPMENT:

Clinical trials conducted on a large number of patients have clearly indicated the supremacy of gugulipid over other drugs due to absence of any significant side effect. The cholesterol lowering effect is also quite remarkable The use of Gugulipid led to the average reduction in serum cholesterol and triglycerides by 24% and 22% respectively and there were 80% responders in a group of 330 hyperlipidemic patients. As clofibrate is on the verge of being phased out on account of toxic manifestations, there is a scope for introduction of Gugulipid at international level.

Ready for licensing.



A HERBAL ANTI-DIABETIC DRUG (AYUSH-82)

INTRODUCTION:

Diabetes is a syndrome characterized by chronic hyperglycemia due to disturbance in carbohydrates, protein and fat metabolism resulting from either defect in insulin or secretion or a combination of two. It is mainly of 2 types-type 1 and type 2. Type 1 has low frequency of occurrence affecting only 10% of all cases while 90% cases are affected by type 2. 75 million people are suffering from diabetes across the globe with 6.9 billion USD are diabetes related expenditures. Ayurvedic system of medicine is an age old system that provides methodology for treatment of several diseases and its literature containing many drug prescribed for treatment of diabetes. Researchers have developed a new formulation from different types of indigenously available herbs named as Ayush 82. It has demonstrated good control over diabetes in animals and more than 50% of human patients.

SALIENT FEATURES



- Derived from natural sources
- No side effects
- Biocompatible and Biodegradable
- Effective

PRECLINICAL STUDIES:

Sub-acute toxicity studies were done on Wistar rats. No significant effect in the blood biochemistry, hematology and weight of the vital organs observed in comparison to the control, indicating formulation's safety. Acute toxicity studies were carried out on Swiss albino mice (I.B.). Ten times intended therapeutic dose of the formulation was administered orally. There were no pre-terminal deaths, no toxic signs and abnormal behavior in the animals.

CLINICAL STUDIES:

The study was done on 886 patients at council's peripheral central research institutes wherein Ayush-82 was administered thrice daily. The formulation showed good efficacy in 41.25% patients and fair response in 34.41% patients. 6.24% patients showed poor response and no response was seen in 18.11% patients. There was statistical significant reduction in fasting and post-prandial blood sugar level along with clinical improvement with no adverse effects.

SCALE OF DEVELOPMENT:

The product is ready for licensing. The details about plant and machinery are also available for setting up the manufacturing plant.

ANTI COUGH HERBAL FORMULATION

INTRODUCTION

The product is an anti-cough, anti-tussive, and throat soothing synergistic herbal formulation comprising of an extract of Piper cubeba, Glycyrrhiza glabra, Acorus calamus Alpinia galanga, Zingiber officinale and pharmaceutically acceptable additives as a syrup, lozenges or chewable tablets for preventing cracking of voice, dryness of mouth and toning of voice, vocal cord; the present invention also provides a method of preparation of this formulation.

SALIENT FEATURES

- For preventing dryness of mouth, cracking of voice by toning the vocal cord, sustaining of voice, For treating bronchial catarrh and allergic reactions in throat, and For mast cell regeneration.
- The invention is non-toxic and provides no mortality.
- It provides expectorant, and throat soothing properties.
- It does not affect the body weight, kidney, liver and spleen as administered orally to rats For six days

COMPARATIVE ADVANTAGES

Anti Cough Herbal Formulation for dryness of mouth, cracking of voice and throat soothing.It is safe to use and does not causes drowsiness.

STATUS OF DEVELOPMENT

Ready for commercialization



HERBAL FORMULATION FOR ARTHRITIS

INTRODUCTION

Arthritis (rheumatoid and osteo-arthritis) is an autoimmune disease affecting the collagens of the stress bearing joints. About 1% of the world's population is suffering from rheumatoid arthritis. The main symptoms include inflammation and swelling of symmetrical joints, pain, fatigue, and long lasting stiffness after rest. Private spending of an Indian household out of total expenditure on health is 50%. Therefore, keeping in account cost-effectiveness of health care and management in developing countries, Researchers have developed a herbal anti-arthritis ointment for developing countries.

SALIENT FEATURES

- **Derived from natural sources**
- **No side effects**
- **Biocompatible and Biodegradable**
- **Effective**

PRECLINICAL STUDY:

Collagen induced arthritis mouse were developed in the laboratory by following standard method. The mice were divided into three group namely-control, arthritic and drug treated arthritic. Western blotting, ELISA and PCR results showed decrease in mediators of inflammation by observing the serum parameters in the drug treated arthritic group. Serum parameter includes TNF-α, IL-Iβ, IL6, and MMP-9.

CLINICAL STUDY:

A Total of 45 patients were examined by applying anti-arthritis for 3 months. The blood samples were collected pre and post treatment and reduction in serum parameters were observed. Biochemical parameters like ESR and rheumatoid factors were also reduced.

SCALE OF DEVELOPMENT:

The product is ready for licensing. The details about plant and machinery are also available for setting up the manufacturing plant.





HERBAL FORMULATION FOR TREATING DIARRHOEA IN CHILDREN (AYUSH – GHUTTI)

INTRODUCTION

Although diarrhoea is not a deadly disease as such yet due to ignorance, lack of medical facilities and late treatment, children suffer heavily and by the time they reach some proper medical institution the cases turn complicated to the extent of irreversible state. Infant mortality rate amounts very high in tropical countries like India and Africa due to infantile diarrhoea. In spite of enormous expenditure incurred to improve health standards of the masses, diarrhoea still poses the same threat especially in rural areas. Considering the gravity of the disease, the AYUSH GHUTTI has been scientifically developed in Ayurvedic system to prevent diarrhoea and fever in children. This is useful for development of proper digestion and assimilation as well as prevents the said disease conditions in childhood.

SALIENT FEATURES

- Derived from natural sources
- No side effects
- Biocompatible and Biodegradable
- Effective

CLINICAL STUDIES

Clinical studies to establish the efficacy of AYUSH Ghutti were carried out at RSSCA, Varanasi. AYUSH Ghutti was tried in 50 cases each in trial and control group. Significant improvement was noted in the episodes and duration of diarrhoea and excess cry. Significant improvement in C3 and C4 levels (enhancement of immunity) was also reported.

SCALE OF DEVELOPMENT

The product is ready for licensing. The details about plant and machinery are also available for setting up the manufacturing plant.



A HERBAL ANTI-EPILEPTIC DRUG (AYUSH-56)

INTRODUCTION

Epilepsy is nervous system disorder that leads to transient loss of consciousness with or without convulsions, accompanied by terrifying physical movements born of derangement of memory, intellect and mind. The medicines presently used are mostly synthetic. From being expensive besides their adverse effects, they show zero result in 30% patients. Ayurvedic system of medicine is an age old system that provides methodology for treatment of several diseases and its literature containing many drug prescribed for treatment of diabetes. Ayush 56 is one such medicine that has demonstrated significant reduction in frequency and duration of fits in more than 60% of human patients.

SALIENT FEATURES

- Derived from natural sources
- No side effects
- Biocompatible and Biodegradable
- Effective

PRECLINICAL STUDIES:

No toxic effect of drug revealed in acute and sub-acute toxicity studies.

CLINICAL STUDIES:

The study was done on 273 patients at peripheral central research institutes. The formulation showed complete control on 32% patients. 18% patients showed marked control and moderate control in 15% patients. 35% patients showed no control by the treatment. No adverse events were reported. It was found as an add-on therapy to modern anti-epileptic treatment with no withdrawal cases.

SCALE OF DEVELOPMENT: The product is ready for licensing. The details about plant and machinery are also available for setting up the manufacturing plant.





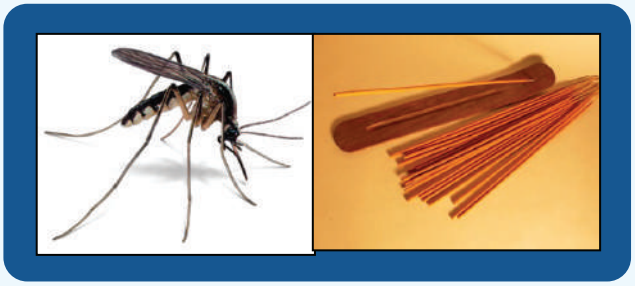
MOSQUITO REPELLENT HERBAL INCENSE STICKS

INTRODUCTION:

Mosquitoes are known to transmit many diseases such as malaria, dengue, yellow fever, filariasis and Japanese encephalitis. There were an estimated 214 million cases worldwide in 2015. Approximately 90% of all malaria deaths occur in Africa.Therefore, it is important to develop suitable mosquito repellent products. Mosquito repellents currently used for domestic purposes are mainly synthetic pyrethroids products with high mammalian toxicity and are less harmful than general insecticides but still are not totally safe for prolonged use.

SALIENT FEATURES

- Derived from natural sources
- No side effects
- Biocompatible and Biodegradable
- Effective



PROCESS:

Several workers have been studying the mosquito repellent properties of plant or plant mixture in different parts of the world. However, formulations in the form of incense stick are quite limited in the market. Researchers have developed a herbal formulation, which is useful against mosquitoes as repellent. The present invention also provides a mosquito repellent herbal incense stick and the formulation is prepared by mixing ground plant parts from plant species of North East India such as Ocimum gratissimum (leaf), Anphineuron spp (leaf) and Polygonum hydropiper (whole above ground part) together with binders (Litsea glutinosa) and fillers (wood dust). The formulation is effective to repel the mosquitoes significantly. The invention has been protected by filing patent application.

ADVANTAGES:

- The formulation is safe, eco-friendly and provides significant mosquito repellent activity.
- The formulation is easy to prepare and can be prepared with hand rolling.
- Ingredients required for preparing the formulation are easily and abundantly available.
- The cost of production is marginal.
- Field trials indicate no/any human toxicity.
- The formulation i.e. mosquito repellent herbal stick can be used extensively by village people as it is easy to use and does not require even electricity like mat.
- The manufacturing of mosquito repellent herbal stick needs little investment for which the technology opens up huge rural employment generation in production and its marketing.

SCALE OF DEVELOPMENT: Ready for commercialization

HEBAL FORMULATION FOR ENHANCING IMMUNITY IN CHILDREN (AYUSH – BALARASAYANA)

INTRODUCTION

According to WHO, the mortality rate of children under 5 is very alarming. 5.9 million Children under the age of five, died in 2015, due to preterm birth complication, intrapartum-related complications, diarrhea, pneumonia and malaria and malnutrition. Ayurveda, the ancient science of life provides utmost focus on promotion/maintenance of health. The susceptibility of young children towards various infections or diseases is mainly due to their poor immunity. The Rasayana drugs provide longevity optimum strength of physique, improves memory and intelligence. Considering the general ailments affecting the infants and children, the AYUSH BALARASAYANA has been scientifically developed for treating the ailments.

SALIENT FEATURES

- Derived from natural sources
- No side effects
- Biocompatible and Biodegradable
- Effective

CLINICAL STUDIES:

Clinical studies conducted at various peripheral centers to establish the efficacy of Balarasayana which showed significant improvement in immunity. Significant improvement in duration and episodes of excess cry, diarrhoea and vomiting was observed. Highly significant improvement in episodes of cough/cold and fevers was also observed when compared to placebo.

SCALE OF DEVELOPMENT:

The product is ready for licensing. The details about plant and machinery are also available for setting up the manufacturing plant.





ASVIKA PORTABLE DISTILLATION UNIT

INTRODUCTION:

Asvika units have been specially designed as a small portable mini distillation unit for small scale entrepreneurs, farmers, R & D institutes etc. The unit has been designed for producing high quality natural rose water, but can also be used for efficiently for the distillation of spice oils like coriander, cumin, garlic etc and aromatic oils like mints, grasses, basil etc.

SALIENT FEATURES

- Pure stainless steel construction with long life.
- Efficiently designed with shell & tube condenser for proper condensation & complete oil recovery.
- Can be operated by firewood, agro wastes, LPG / kerosene burners
- Highly efficient with less distillation time.
- Fitted with SS wire mesh to prevent burnt note in product.
- No pollution at workplace due to provision of chimney.
- Modular construction for easy assembly at site.
- Easy and simple in installation and operation and can be operated even by layman and women.

COMPARATIVE ADVANTAGES

The processing costs are very nominal unlike other available distillation units in market.

SCALE OF DEVELOPMENT

Ready for licensing.

Volumetric capacity:

60 lts, Herb lading capacity Rose flowers: 12-15 kg, Aromatic herb: 20-25 kg, powdered spices 8-10 kg



DRY POWDER INHALATION OF PARTICLES CONTAINING ANTI-TUBERCULOSIS DRUGS

INTRODUCTION:

Tuberculosis (TB) is a leading cause of infectious lung disease, and considered the foremost cause of death due to a single microorganism. Tuberculosis has become a significant opportunistic disease among population with a high incidence of acquired immunodeficiency syndrome (AIDS).The occurrence of TB is most often due to Mycobacterium tuberculosis (MTB)infection, and the lungs are the primary site of infection for the systemic pathogen. Problems created by bacterial infection are linked to their ability to survive and multiply inside the body, especially in the lungs, and to the natural immune response of the infected host. The product is an inhalable, biodegradable microparticle composition comprising one or more anti-tubercular drugs for the target specific drug delivery to manage pulmonary tuberculosis.

SALIENT FEATURES

- Completely eradicates tuberculosis (TB)-causing bacteria from the lungs of experimentally-infected mice and guinea pigs in four weeks (20 doses of 80-100 micrograms).
- If combined with half the recommended oral dose of the same drugs, extra-pulmonary site of infection (spleen) is also completely cleared of bacteria, with no relapse over the next four weeks if animals receive no further treatment.
- Activates macrophages infected with TB-causing bacteria to mobilize innate bactericidal responses when they pick up inhaled particles (host-directed therapy in addition to chemotherapy).
- Completely safe for chronic (90-days, repeated daily doses, 5 days/week) inhalation by Rhesus monkeys—also in acute/subacute inhalation safety/toxicity studies in mice.
- Potential for “therapeutic isolation” of TB patients who receive inhalations (since some inhaled particles will come out every time they cough), thereby blocking transmission of TB.
- Potential to reduce total duration of treatment, significantly reducing probability of infecting naïve individuals.

COMPARATIVE ADVANTAGE:

Treatment of pulmonary TB with orally-administered drugs is sub-optimal—exposing non-target tissues to toxic drugs and requiring large doses to build up effective concentrations in lungs. Prolonged dosing is required to build up and maintain effective concentrations in lungs. Patients remain infectious for considerable periods after initiating drug treatment. But in this case the drug requires comparatively lesser time for treatment and thus have lesser probability of infecting naïve individuals.

SCALE OF DEVELOPMENT

- Developed, Animal Trials Done.
- Patent Granted in South Africa
- Ready for commercialization.

FLOMOP-ESSENTIAL OIL BASED DISINFECTANT

INTRODUCTION

The WHO estimates that exposure to inadequate drinking water, sanitation and hand hygiene was responsible for 58 per cent of deaths from diarrhoea in 2014, adding up to 840,000 deaths in low and middle-income countries. This translates into 1.5 per cent of the global disease burden and 5.5 per cent for children under five. There is also growing evidence that repeated exposure to unsafe drinking water, poor sanitation and inadequate hygiene have a significant impact on stunting.

To deal with hygiene related issues,cleaning house and office with disinfectant can be a great help.Thus a herbal disinfectant can be very useful to deal with this problem. FLOMOP is an essential oil based disinfectant that can be used for cleaning floor .It is a natural based disinfectant and thus is totally safe to use.

SALIENT FEATURES

- Effectively repels household insects.
- Contains essential oils and light liquid paraffin as base.
- Formulation is non-toxic, safe to use with no side-effects.

COMPARATIVE ADVANTAGES

The disinfectants already available in the market contain harmful chemicals such as formaldehyde, ethane dialdehyde, n-propanol, benzalkonium chloride, phenol etc.

SCALE OF DEVELOPMENT

- Ready for licensing.
- Bench Scale up to 10 liters batch
- Cost of production of formulation is about Rs.350-400/L



GERANIUM OIL BASED HAIR SHAMPOO

INTRODUCTION

Dandruff is a common scalp disorder affecting almost half of the population at the post-pubertal age and of any sex and ethnicity. It often causes itching. It has been well established that keratinocytesplay a key role in the expression and generation of immunological reactions during dandruff formation. The severity of dandruff may fluctuate with season as it often worsens in winter.Dandruff is rare before puberty, peaks in the teens and early twenties, and declines with age thereafter. Most cases of dandruff can be treated with specializedshampoos.

Herbal shampoos are the best choice because of their natural ability to fight dandruff and they posse's biocompatible and biodegradable properties. Geranium is a perennial shrub with small pink flowers and pointy leaves that is native to South Africa.Out of the many varieties of the plant, Pelargonium graveolens is the source of the essential oil. The oil is widely used in aromatherapy and contains a number of beneficial compounds.

SALIENT FEATURES

- A combination of pure aromatic molecules with essential oil with anti-fungal activity.
- Unique blend of the herbal extracts with natural essential oils.
- Shampoo removes fungal infection that causes dandruff.
- Formulation is non toxic, safe to use with no side-effects.

COMPARATIVE ADVANTAGES

Unlike other anti-dandruff shampoos it does not contain any harmful chemicals and surfactants.

SCALE OF DEVELOPMENT

- Bench scale up to 10 kg batch
- Technology ready for transfer



HANDKOOL - HERBAL HANDWASH

INTRODUCTION

The study conducted by antibacterial products manufacturer found that, together with China, South Africans care the least when it comes to hygiene. The survey was done on the hygiene habits of 12000 people in 12 countries, 1000 from each. To deal with hygiene related problems many handwash are present in market but they are generally chemical based.

Handkool is a highly effective hand and surface disinfectants, which kill a broad spectrum of the disease causing germs and also removes dirt and stains completely with ease by using various plant essential oils. The disinfectants are able to kill all the pathogenic bacterial and fungal strains tested at the recommended concentration. They are non-corrosive and bio-safe.

SALIENT FEATURES

- Broad spectrum ant-microbial liquid
- Contains herbal bio-actives
- Formulation is non-toxic, safe to use with no side-effects
- Formulation is eco-friendly and doesn't possess any environmental and health hazards

COMPARATIVE ADVANTAGE

The disinfectants already available in the market contain harmful chemicals such as formaldehyde, ethane dialdehyde, n-propanol, benzalkonium chloride, phenol etc.

SCALE OF DEVELOPMENT

- Technology transferred for commercialization
- Cost of production of formulation is about Rs.75-100 /L



HERBAL COLOURS FOR COSMACEUTICALS

INTRODUCTION:

The product is a safe, eco-friendly, health protective and beauty enhancing herbal colours from plants. The herbal safe colours have been developed from different plant species belonging to the genus Arnebia, Jatropha, Lithospermum, Macroiomia, Maharanga, Onosma. Various novel colours were differentially extracted by following certain well-defined extraction methods and these can be changed by treating them with acids or bases. These colours are lipophilic in nature and have antimicrobial and anti-inflammatory properties. These novel herbal colours are highly useful in different cosmaceutical application like lipstick, eye shadow, rouges, and glow glitters. Another important objective of the present invention is to use these colours in lipstick with a medium of aroma therapy in order to get desired effects like mood enhancement, sensual pleasure, anti-depressant and creative thoughts inducer.

SALIENT FEATURES

- Being herbal, colour does not have adverse effect of synthetic colours like skin rashes and allergic reactions.
- Herbal colours are antimicrobial, antioxidant and anti-inflammatory in nature.
- Different colours are available like yellow to orange, red to red purple etc.
- The herbal colours can be made in various shades in a cost-effective manners.
- Plant source is easily available in India, neighbouring countries and in the market.

COMPARATIVE ADVANTAGES:

The herbal colours are lipophilic in nature and can be used for cosmeceutical purposes like lipsticks, lip balm, eye shadow, rouges and glow glitters etc. These are non-toxic and biocompatible.

SCALE OF DEVELOPMENT: Ready for licensing.



HERBAL OINTMENT FOR WOUNDS

INTRODUCTION

A wound is a type of injury which happens relatively quickly in which skin is torn, cut, or punctured (an open wound), or where blunt force trauma causes a contusion (a closed wound). In pathology, it specifically refers to a sharp injury which damages the dermis of the skin.

Antimicrobial and antifungal Herbal Ointment for Wounds and useful for regeneration of the dead cells and connective tissues.

SALIENT FEATURES

- Novel herbal formulation for treatment of cuts burns and wounds. This formulation is for external use and exhibits regeneration of the tissue. Formulation used in fresh cuts and wounds, effective in healing diabetic wounds, exhibits regeneration of dead tissue.
- Naturally derieved.
- Bicompatible.
- Non-toxic

COMPARATIVE ADVANTAGE

The herbal formulation is antimicrobial and antifungal, gives immediate relief to inflammation. Unlike the commercial wound healing formulations, it is useful for regeneration of the dead cells and connective tissues.

SCALE OF DEVELOPMENT

Lab validation has been completed.



HERBICHEW - TOBACCO & CHEMICAL FREE HERBAL MIXTURE

INTRODUCTION

Tobacco use is the greatest potentially remedial problem throughout the world, and it is the number one preventable cause of death in the developed world. Clinicians have a particularly important role as patient advocates in health promotion, discouraging smoking initiation, encouraging and assisting smoking patients to quit, and participating in social efforts designed to curb smoking at various levels. To deal with this problem researchers have developed a herbal chew which is a tobacco free mixture.

SALIENT FEATURES:

- Anti-oxidant
- Refreshing mouth freshener, taste like gutkha
- Anti- bacterial
- Digestive in nature
- Tobacco de-addiction property

COMPARATIVE ADVANTAGES

- Production process of Tobacco & chemical free herbal mixture having Herbs, Menthol, Areca nut with binder useful in individual addicted to chewing gutkha, pan masala or similar products.
- HERBICHEW is a Tobacco & chemical free herbal mixture which useful in individuals of all age groups, especially those addicted to chewing gutkha, pan masala or similar products.

STATUS OF DEVELOPMENT

Ready for licensing.

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MEMORY ENHANCER: A HERBAL FORMULATION

IINTRODUCTION:

Waterhyssop, a perennial creeping plant (Bacopa monnieri) has been in use as a nerve tonic for rejuvenating mental health and for enhancing memory. This plant, found extensively in wet, marshy and damp areas, has been mentioned by ancient sages, medical men in almost all social, medical and religious treatises. Ayurveda, the ancient science of life has more than one reference of the plant for the enhancement of memory and mental agility of mankind. Pharmacological properties of this plant have been clearly mentioned as having properties of cognitive enhancement and anxiolytic effect. The other treatise makes this more explicit and describes Waterhyssop to be effective in memory loss. A quality herbal preparation has been developed from B. monnieri which has been standardised in terms of its bacosides contents.

SALIENT FEATURES:

- During efficacy and safety studies in rodent and non-rodent models, the waterhyssop extract was found safe and efficacious.
- Preclinical neuropharmacological studies demonstrate that both the standardised extract and bacosides improve short-term and intermediate memories, thus, improving the long-term memory.
- The bacosides also significantly enhance protein synthesis in those regions of the brain which are implicated in the memory formation, a possible explanation for its memory improving effect.

COMPARATIVE ADVANTAGES:

Unlike other drugs present in market for enhancing memory this drug is safe to use.

SCALE OF DEVELOPMENT:

Double blind cross over clinical studies have been carried out in children, elderly persons and normal healthy volunteers. Studies carried out in normal healthy volunteers, elderly subjects with age associated memory impairment and children with attention deficit hyperactivity disorder (ADHD) have shown that the drug is safe, well tolerated, efficacious and devoid of any side effects. Study on children with ADHD has shown that the preparation, after 12 weeks of its use, significantly improves sentence repetition, logical memory and paired associate learning.

Ready for licensing.



MOSAWAY - NATURAL MOSQUITO REPELLENT CREAM

INTRODUCTION:

The herbal formulation named MOSAWAY-Natural Mosquito Repellent Cream having Plant extract and essential oils with natural binding material, which is used to prevent mosquito bite. A process for the preparation of a formulation useful as natural mosquito repellent which comprises : mixing natural pyrethrins obtained from pyrethrum flower, oil of plant origin such as herein and natural wax

SALIENT FEATURES

- Natural formulation to repel mosquitoes
- Unique blend of the herbal extracts with natural essential oils
- Formulation is non-irritant, safe to use with no side-effects

COMPARATIVE ADVANTAGE

Herbal based mosquito repellent creams with minimised side effects

SCALE OF DEVELOPMENT

Licensed awaiting commercialisation



MANUFACTURING OF NATURAL COLOURS

INTRODUCTION

Natural Dye refers to colors obtained from plants, insects and mineral substrates and are used for dyeing in cosmetics, pharmaceuticals, textiles and food industry. The plant kingdom offers a vast source of natural dyes/colors obtainable from various plant parts. The main natural dye/color substances used worldwide have been extracted from the leaves, fruits, seeds, flowers, barks and roots of dye-yielding plants. In prehistoric times, man used to dye furs, textiles, and other objects with natural substances of vegetables, and to a lesser extent also of animal origin.

SALIENT FEATURES

- Process for the manufacturing of natural colours which are non-hygroscopic crystalline in nature and readily soluble in water and alcohol.
- Natural colours produced from black carrot having application in food & nutraceutical industry, textile industry, paper industry, paint industry, dairy industry, bakery industry, pharmaceutical industry

COMPARATIVE ADVANTAGE

Encouragement for using natural colours in novel products like textile printing, food, cosmetic, pharma, infant toys and crayons, handmade paper etc

SCALE OF DEVELOPMENT

Technology ready for commercialization.



MANUFACTURING OF NATURAL COLOURS

INTRODUCTION

Keeping in mind the menstrual hygiene among rural women, the biodegradable, skin friendly, medicated and scented sanitary napkins technology was developed utilizing plant derived bio-actives that prevent bacterial and fungal infections. These are low cost, infection preventing aromatic sanitary napkin. Low cost medicated sanitary napkin with natural aroma, prepared by using plant extracts, aloe vera and essentials oils. Napkin protects from bacterial infection, provides skin hygiene and also relief from unpleasant odor.

SALIENT FEATURES

- The napkin is perfumed with natural aroma, which minimizes the unpleasant odour during usage
- This Naari sanitary napkin is a unique, medicated, low cost product for common masses
- This medicated skin hygienic sanitary pad prevents subsequent infections due to its antibacterial nature and thus avoids many UTI related diseases.
- Natural anti-bacterial molecule that prevents infection

COMPARATIVE ADVANTAGE

The plant extracts used in this innovative product with pleasant aroma provide wellness and comfort, heal other- skin related infections and minimize feeling of itching and irritation during usage. Also, plant-derived absorbent shows comparatively higher water- and blood- absorbing capacity than the super absorbent polymers used in other napkins currently available in the market.

SCALE OF DEVELOPMENT

Technology ready for commercialization.




Technologies in
METALLURGY SECTOR

BATTERY GRADE MATERIALS FROM SPENT CATALYSTS, SLUDGES, SECONDARIES, t EFFLUENTS, PRIMARY AND LOW-GRADE ORES

Process for the production of battery grade material from industrial wastes and secondary resources.

Salient Features:

Electrode materials for primary and secondary battery applications such as

- Electrolytic Manganese Dioxide (EMD) from low grade and secondary resources containing Mn
- Nickel hydroxide from secondary resources
- Cobalt hydroxide / oxide from secondary resources

Advantages:

- Production of battery grade materials which have a high market value and demand compared to traditional metal products.
- Processing of industrial waste thereby negating disposal and environmental problems

Technology is ready to be licensed.



COLUMN THICKENER AND A PROCESS THEREOF FOR DEWATERING OF IRON ORE SLURRY

Efficient de-watering system with a tall vertical column for dewatering of slurry. In mineral based Industries, separation of solids from water is part of the process. All the mineral based industries need large quantity of water, for processing the materials. Recovery and recycle of water back to process is done by sedimentation equipment known as thickeners.

Salient Features:

- The column thickener could be used for dewatering in the mineral industries.
- Patented Technology (PCT)

Comparative Advantages:

- Space required to install the plant is less as compared to the conventional thickeners.
- Overall performance of the process is enhanced and day to day maintenance requirement is less.
- The instrument contains different feed inlet points along the height of the column. Depending on the capacity of overflow water and underflow slurry density requirement inlet point can be varied.
- Provisions have been given to apply magnetic field to the column the applied magnetic field will increase the settling rate of the iron ore slurry.
- An auxiliary inlet point has been provided at the bottom of the column for clearing jam if it happens in the bottom conical portion of the column.
- Larger aspect ratio of the column helps to increase the underflow slurry density of the thickener.
- No moving part

Technology is ready to be licensed.



EYE-ON-PELLET: ONLINE PELLET ANALYZER FOR IRON ORE PELLETIZATION INDUSTRIES

The system can estimate the size of iron ore pellets at a pelletization disc during its formation and provide size distribution data in real time which is displayed, transmitted and stored. This helps for online control, parameter optimization and post analysis so that the pelletization discs can be operated to achieve maximum productivity with reduced recycling.

SALIENT FEATURES:

- The system is plug and play type and has quick installation time
- Non-invasive and cost effective method of size analysis
- Indigenously designed and developed and can be customized based on clients need
- Helps for timely control of RPM/water/feed-rate
- Helps in parameter optimization for a new type ore
- Reduces the recycling load & enhances plant productivity
- The size distribution data recording and transmission
  - Locally displayed (for onsite operator)
  - Transmitted and stored (for control room)
  - Post Analysis Report day wise or hour wise (higher officials or R&D team)

ADVANTAGES:

Pelletization industries use disc pelletizers to produce pellets of different sizes. However, there is a need of producing pellets of a desired size range, such as 8-18 mm. There is also a need to produce higher percentage pellets in a particular sub size range, such as among 8-18 mm, may be 70% in the range of 8-12 mm (customer requirement). Currently, the productivity of a pelletization plant depends mostly on an experienced supervisor/operator who has to keep eye on multiple disc pelletizers at a time. This leads to sub-optimal performance.

Technology is ready to be licensed.



HIGH PURE METALS FROM SPENT CATALYSTS, SLUDGES, SECONDARIES, EFFLUENTS, PRIMARY AND LOW-GRADE ORES

Recovery of metals from waste/secondary sources not only enhances the resource base but also results in a corresponding decrease in the requirement for mining ores and the supply of energy and also reduces the problem of disposal of linked industrial wastes.

SALIENT FEATURES:

- Qualities of the final products are at par with metals produced from primary resources. Low grade, complex materials, industrial wastes, effluents and secondary resources can be successfully used as raw materials.
- High pure (electrolytic grade) metals for manufacturing of industrial products and alloys Copper, Nickel, Zinc, Cobalt, Aluminium, Lead.

ADVANTAGES:

- High pure metals which fetch higher revenue in the metals market
- Processing of industrial waste thereby negating disposal and environmental problems

Technology is ready to be licensed.

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HIGH PURE TELLURIUM POWDER FROM ANODE SLIME

The process includes electrolytic preparation of greater than 99.5% pure tellurium powder from copper refining anode slime with simultaneous removal of lead without affecting the precious metals recovery.

Salient Features:

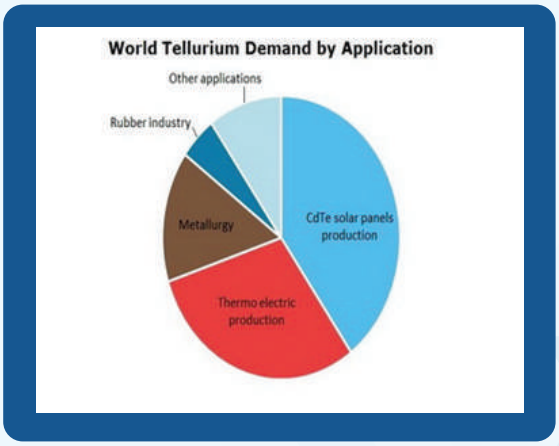
- High pure tellurium powder obtained for solar cell, electronic applications and alloying element.

Advantages:

- High pure tellurium powders are produced which is a more profitable product compared to other common metals.
- Load on the precious metals recovery unit is reduced owing to the removal of lead and reduction of mass.
- Precious metals in the anode slimes are not lost in the tellurium recovery process.

Technology is ready to be licensed.

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INDUSTRIAL COATINGS BY ELECTROPHORETIC DEPOSITION

An advanced coating technology at room temperature based on Electrophoretic deposition has been developed. The process is a colloidal forming technique where charged, colloidal particles from a stable suspension are deposited onto an oppositely charged substrate by the application of a dc electric field.

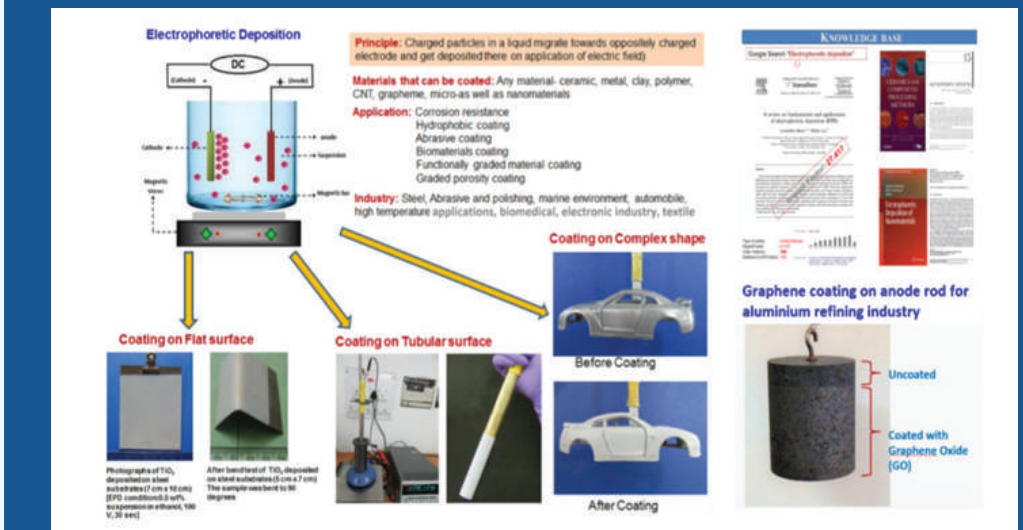
SALIENT FEATURES:

- The process is simple, rapid, cost effective and easy to scale up.
- It can be used to coat any type of material- organic or inorganic, including ceramics, metals, clays, pigments, polymers, graphene, carbon nanotube and their composites on any type of surface - flat, tubular or complex shapes.

ADVANTAGES:

- The technology is fully mechanized and computer controlled.
- The technology is generic, and customized coating solution can be provided to specific needs of any industry.

Technology is ready to be licensed.



LOW ASH COAL PRODUCTION FOR UTILIZATION IN METALLURGICAL INDUSTRIES

This is for development of technology to produce low ash (<10%) coal from coking & non coking Indian high ash coal by combination of physical/chemical and biological process so that the same can be utilised in DRI/ BF and other metallurgical industries.

SALIENT FEATURES:

- It has been observed that if feed ash is less than 30%, it is easily possible to achieve 10% ash coal with reasonable yield by physical beneficiation either coking or non-coking coal at coarser as well as finer sizes. The quality of the coal indicates that it can be used for metallurgical purposes even in blast furnace injections.
- The carbon value can be recovered from coal washery slimes by flotation process to achieve less than 10% ash coal.
- A 2 million tonne per annum capacity of coal washery to achieve 10% ash coal the backup period is 3 years.

ADVANTAGES:

- It is easily possible to achieve 10% ash coal with reasonable yield with feed ash less than 30%
- Can be utilised in Blast furnace injection / DRI and other metallurgical purpose
- ROI within 3 years

Technology is ready to be licensed.



MAXIMIZING THE RECOVERY OF FLAKY GRAPHITE IN BENEFICIATION PROCESS

The process involves attrition technique to maximise the recovery of flaky graphite (-600+210 micron) with a more yield of 20-30% in beneficiation process. The cost of flaky graphite is more than the fine powder.

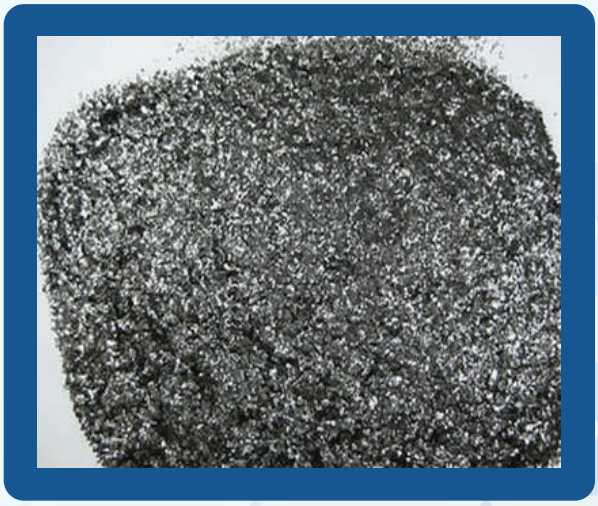
Salient Features:

- Recovery of flaky graphite
- Cost effective beneficiation process

Advantages:

In traditional process, the ore is ground to its liberation size, and then it is floated in conventional flotation cell. During grinding the ore in ball mill, the flaky graphite breaks down because of its flat surface to a shorten size. As a result, the recovery of flaky graphite goes down in the present practice. The market demand of flaky at particular coarse size has high demand as well as cost is also too high. The process was developed to recover the flaky graphite by introducing the attrition technique before grinding circuit.

Technology is ready to be licensed.



PROCESS DEVELOPMENT FOR PRODUCTION OF GRAPHENE OXIDE (GO) FROM NATURAL GRAPHITE

One step manufacturing of graphene oxide from high pure graphite by attrition technique in high energy dual drive planetary ball mill.

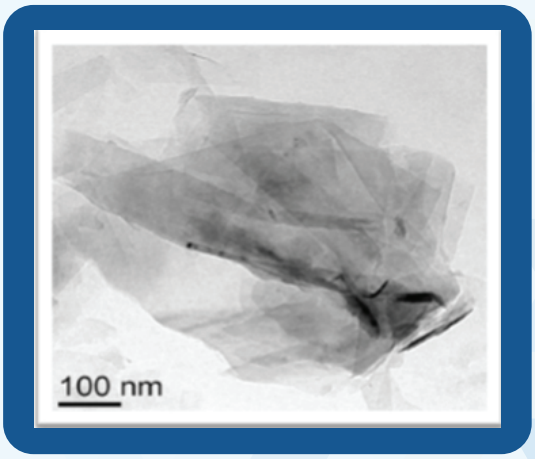
SALIENT FEATURES:

- This is an improved process for preparation of graphene oxide from high pure natural graphite (more than 99.9 % Carbon) by dry process using dual drive planetary ball milling.
- It is a novel process for preparation of graphene oxide from high pure natural graphite using shearing action of balls in dual drive vertical swing planetary ball mill.
- It is worth mentioning that no acids and chemicals are used to produce graphene oxide in this present process.

ADVANTAGES:

- It is a single step process for mass production
- Eco friendly mechanical process without using any chemical
- No waste generation

Technology is ready to be licensed.



PROCESS DEVELOPMENT FOR PRODUCTION OF HIGH PURITY GRAPHITE FROM NATURAL GRAPHITE

This is an eco-friendly process to produce more than 99% carbon in combination of chemical leaching and physical beneficiation from natural graphite.

SALIENT FEATURES:

- Eco friendly process
- Production of more than 99% carbon
- Import substitution.
- Patented Technology

COMPARATIVE ADVANTAGES:

By conventional process, it is not possible to produce more than 95% fixed carbon from high grade graphite ore. It is due to coating of the graphite on the surface of the gangue particles and mechanical entrainment of gangue particles in the concentrate during the flotation. To get high purity graphite (more than 99% of carbon) both chemical leaching & physical beneficiation process have been developed.

Technology is ready to be licensed.



PROCESS TO BENEFICIATE LOW GRADE BAUXITE

Bauxite is used as raw materials for production of alumina by Bayer process. The process is suitable for bauxite ore mainly composed of gibbsite mineral. The process aims to reduce reactive silica below 2%, increase total alumina content more than 42% by physical beneficiation method. The attrition technique was used to scrub the ores in water by adding the suitable dispersing reagents using screw scrubber.

Salient Features:

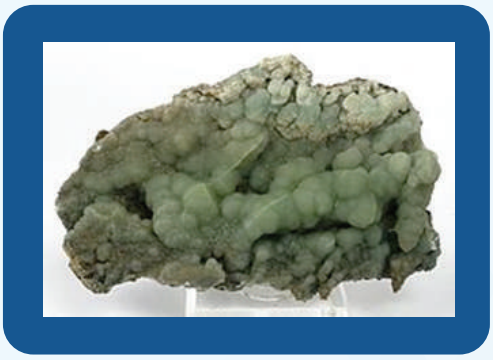
- The bauxite should not contain more than 5% of reactive silica, total alumina content more than 42% and Fe should be less than 15% to make economical viability of the process.
- As the high grade ore availability becomes the problem, low grade ore is needed to beneficiate to meet the requisite specification of the aluminaindustry.
- The reactive silica presents mostly in ultrafine forms. If it is more, it increases the consumption of sodium hydroxide in leaching process and also give negative impact in the downstream processes like settling, purification, crystallization, filtration and calcination.

Advantages:

- Reduces reactive silica content less than 2%
- Increase alumina content more than 42%

Technology is ready to be licensed.

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MEMORY ENHANCER: A HERBAL FORMULATION

IINTRODUCTION:

Waterhyssop, a perennial creeping plant (Bacopa monnieri) has been in use as a nerve tonic for rejuvenating mental health and for enhancing memory. This plant, found extensively in wet, marshy and damp areas, has been mentioned by ancient sages, medical men in almost all social, medical and religious treatises. Ayurveda, the ancient science of life has more than one reference of the plant for the enhancement of memory and mental agility of mankind. Pharmacological properties of this plant have been clearly mentioned as having properties of cognitive enhancement and anxiolytic effect. The other treatise makes this more explicit and describes Waterhyssop to be effective in memory loss. A quality herbal preparation has been developed from B. monnieri which has been standardised in terms of its bacosides contents.

SALIENT FEATURES:

- During efficacy and safety studies in rodent and non-rodent models, the waterhyssop extract was found safe and efficacious.
- Preclinical neuropharmacological studies demonstrate that both the standardised extract and bacosides improve short-term and intermediate memories, thus, improving the long-term memory.
- The bacosides also significantly enhance protein synthesis in those regions of the brain which are implicated in the memory formation, a possible explanation for its memory improving effect.

COMPARATIVE ADVANTAGES:

Unlike other drugs present in market for enhancing memory this drug is safe to use.

SCALE OF DEVELOPMENT:

Double blind cross over clinical studies have been carried out in children, elderly persons and normal healthy volunteers. Studies carried out in normal healthy volunteers, elderly subjects with age associated memory impairment and children with attention deficit hyperactivity disorder (ADHD) have shown that the drug is safe, well tolerated, efficacious and devoid of any side effects. Study on children with ADHD has shown that the preparation, after 12 weeks of its use, significantly improves sentence repetition, logical memory and paired associate learning.

Ready for licensing.



RECOVERY OF IRON VALUES FROM RED MUD

Red mud is a side-product of the Bayer process, the principal means of refining bauxite en route to alumina. The process is to recover iron values from red mud using reduction roasting followed by magnetic separation technique.

Salient Features:

- It needs very high intensity magnetic field. Hence the reduction roasting process was adopted.
- The goethite was changed to magnetite phase and then it was beneficiated using LIMS.
- The alkali materials are changed to the sodium silicate or aluminate during reduction roasting.

The reduction roasting process was demonstrated at the rate 60kg/hr feed of red mud using pilot scale rotary kiln after making the micro pellet.

- Possible to achieve 20% yield with 65% Fe in the concentrate.

Advantages:

- Indigenous technology
- Utilisation of red mud

Technology is ready to be licensed.



SCREW SCRUBBER EQUIPMENT FOR MINERAL PROCESSING

Scrubbing and classification of below 15 mm size ores & minerals by screw scrubber for value addition.

SALIENT FEATURES:

- Screw Scrubber is used for clay & slime particle removal in the pre concentration stage in mineral beneficiation. This equipment is suitable for but not restricted to iron ore, coal, chromite, manganese, graphite, phosphate, beach sand etc.

COMPARATIVE ADVANTAGES:

- Clay & slime particle removal
- Overall process productivity enhancement
- Enhancement of grinding efficiency with the use of screw scrubber in the circuit
- Different capacity can be designed

Technology is ready to be licensed.



HYDRAULIC TRANSPORTATION OF MINERALS ORES INDUSTRIAL WASTES

Hydraulic transportation being an environment friendly, bulk and distant means of transportation system, it is widely adapted by industries for transportation of minerals, ores and industrial wastes in powder form.

SALIENT FEATURES:

- A vertical pipe loop test facility consisting of 75 mm NB and 100 mm NB flexible hose pipes of 20 m long each has been set up to provide basic design data for transportation of sea bed minerals (manganese nodules) from a sea depth of 6 km in slurry form.
- Horizontal pipe loop test facilities (high concentration and low concentration) has been established in order to transport powdery materials (Ores, Minerals & Industrial wastes such as coal ash, red mud etc.) in slurry form at different concentrations and for providing basic design parameters for commercial slurry pipelines.

ADVANTAGES:

- energy saving,
- safe, silent, ecologically safe,
- reliable mode of transport,
- easy operation & maintenance

Technology is ready to be licensed.



BEACH SAND HEAVY MINERALS

Separation and purification of beach sand to produce valuable Heavy Minerals. The technology involved enables separation and purification of valuable beach sand minerals to produce high purity Heavy Minerals. The separation process exploits the difference in physical and physi-co-chemical properties of constituent minerals and uses gravity, magnetic, high-tension and flotation techniques.

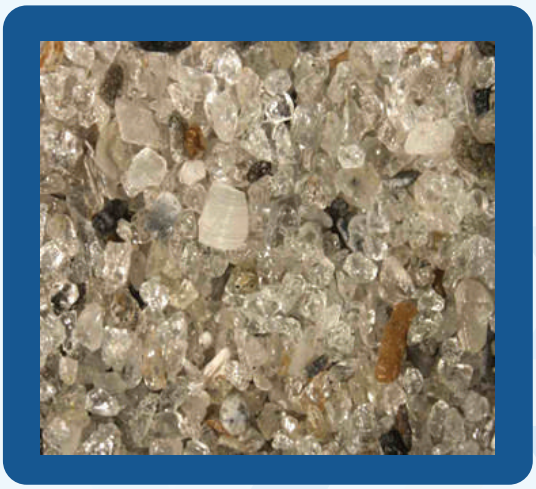
SALIENT FEATURES:

- The technology is utilised in manufacturing of ilmenite, garnet, zircon, sillimanite and monazite for various industrial use.

ADVANTAGES:

- The process is environmental friendly.

Technology is ready to be licensed.



BRIQUETTING OF ORE FINES

Production of briquettes of ore fines using briquetting press. Where availability of binder is not a limitation, the briquetting is always preferred, since it does not call for fine grinding of raw materials as in case of pelletizing and high temperature treatment as in case of sintering.

SALIENT FEATURES:

- The technology produces briquettes of ore fines with suitable binder through briquetting press.
- Ore fines and industrial waste can be utilized for metal production through this technology.

ADVANTAGES:

- The technology utilised is a green technology for utilization of ore fines as well as waste products of industry such as mill scale, flue dust etc.
- Greenhouse gases and other harmful ones are not generated through this technology.

Technology is ready to be licensed



COLD BONDED CARBON COMPOSITE PELLETS FOR UTILIZATION OF IRON ORE MICRO-FINES AND CARBON BEARING FINES

An energy efficient process for making Cold Bonded Carbon Composite Pellets

SALIENT FEATURES:

This process produces micro-pellets with high C content which will be used in sintering of iron ore for reduction of coke breeze consumption and in smelting reduction process with a short curing time.

ADVANTAGES:

- This is a cold bonding process, so it is energy efficient. Curing time is very short (5-10 min).
- It utilizes iron ore micro-fines and coal fines or coke fines or carbon containing waste fines in iron making or sintering.
- The micro-pellets provide energy to the sinter bed for reduction in coke breeze consumption. 38-48 % reduction in coke breeze has been found when 38 % blast furnace flue dust containing pellets were mixed with iron ore in sintering(12 kg scale)
- Since it is a composite pellet, it can be reduced faster than normal pellets C02 in steel plant's waste gas is utilized in strengthening of pellet.

Technology is ready to be licensed.



COLUMN FLOTATION TECHNOLOGY

Production of low grade ores and minerals by using column flotation technology. The technology of column flotation is a new mineral beneficiation method developed on strong scientific principles for processing of fine low grade ores and minerals.

SALIENT FEATURES:

- Improved metallurgical performance is due to:
  (i) less entrainment and entrapment,
  (ii) Independent control of operating variables,
  (iii) Froth washing provision and
  (iv)Control over bubble size - effective in fines collection.

- The technology finds its application in floatation of base metal ores (Cu, Pb, Zn ores), iron ores (hematite, magnetite, BHQ, etc), beach sand minerals (Sillimanite), industrial minerals (limestone, barite, etc) and graphite and coal fines.

ADVANTAGES:

The technique undertakes through reduced operating & capital costs as a result of:

a) No moving parts & Lower energy consumption,
b) Lower reagent consumption,
c) Substantial reduction in floor area - vertical configuration

Technology is ready to be licensed.



DE-PHOSPHORIZATION OF STEEL IN INDUCTION FURNACE

Calcined lump lime is used as flux material in basic oxygen furnace (BOF) steel making. Due to its high melting point and poor dissolution property, slag formation takes a long time. Since, Fe_2O_3–CaO has eutectic melting point of 1230°C at the composition of 22% CaO, material containing Fe_2O_3 and CaO can easily melt and form basic oxidizing slag at the very beginning of the blowing to make the refining process faster. A partially prefused synthetic flux in combination of mainly CaO and Fe_2O_3 has been prepared through micro-pelletization and sintering (MPS) of waste iron oxide fines generated in steel plant. The fines were converted to strong micropellets to make it suitable for sintering. Cold handling strength in micropellets was imperted by a novel CO_2 treatment technique at room temperature and cold compressive strength up to 9 kg/pellet with a good abrasion resistance could be observed. The sintering of the developed micropellets was carried out without using coke breeze and produced sinter showed good handling strength, resistance to thermal shock and weathering, low softening temperature and thus qualifying it as a suitable alternate flux material for BOF towards fast formation of oxidizing and basic slag.

SALIENT FEATURES:

Used for Iron and steel making For the production of quality steel, specifically in terms of phosphorus content.

ADVANTAGES:

- Ease of slag formation
- Controlled consumption of furnace lining
- Power consumption in the range of 30-40 KWh/ts during refining
- Steel with phosphorous below 0.05%

Technology is ready to be licensed.



FLUXED SINTER THROUGH MICRO-PELLETIZATION

Sintering is a process of agglomeration of fine mineral particles into a porous and lumpy mass by incipient fusion caused by heat produced by combustion of solid fuel within the mass itself. The developed process makes fluxed Sinter using the Micro-Pelletization technique.

Salient Features:

- Recycling of waste and using as suitable flux for making of steel.
- Micro-pellets are hard (CCS: ~10 kg/pellet) to withstand cold handling.
- Sintering is possible neither using any external heat nor any coke breeze and the waste material itself is the heat source.

Advantages:

- The produced sinter is suitable for using in both iron and steel making processes.
- No harmful/hazardous effect on environment
- Raw materials used are wastes.
- Fluxed sinters have superior high temperature properties in the blast furnace as compared to lump ore and acid sinters.
- These improvements include higher softening and melting temperatures and higher levels of reducibility.

Technology is ready to be licensed.



HIGHLY METALLISED LOW SULPHUR DIRECTLY REDUCED IRON (DRI) FROM IRON ORE SLIME AND REJECTED/MIDDLING COAL

Production Highly metallised low Sulphur Directly Reduced Iron (DRI) from Iron Ore Slime and Rejected/Middling Coal. DRI is suitable for induction furnace, electric arc furnace and blast furnace for iron and steel making.

SALIENT FEATURES:

- The process utilizes 100% waste materials to yield a value added product.
- Useful for converting steel plant wastes, fines/mining waste fines such as iron ore slimes/fines, middling and rejected coal containing more than 25% ash into highly metallised, low sulphur DRI

ADVANTAGES:

- Metallurgical Waste utilization.
- High Metallization (Metallization > 96%)
- Sulphur~0.006%S

Technology is ready to be licensed



PELLET SINTER COMPOSITE AGGLOMERATE (P-SCA) OF IRON OXIDE FINES FOR USE IN BLAST FURNACE

Micro-fines of iron ore are generally utilized in Blast furnace in form of indurated pellets because sinter bed has limitation of accepting fines. Charging of acid pellets with basic sinter is the normal practice in blast furnace. However induration of pellets is very cost intensive. Furthermore, due to low angle of repose pellets distribution during charging with other materials in blast furnace creates inhomogeneous distribution. In order to alleviate the above problem, a composite mass of acid pellet and basic sinter has been developed, wherein; green pellets made-up of micro-fines were mixed with basic sinter mix and sintered the combined mass in a sinter bed of 10-12 kg scale. In Pellet-Sinter Composite Agglomerate (P-SCA), iron oxide pellets are embedded in to the sinter mass.

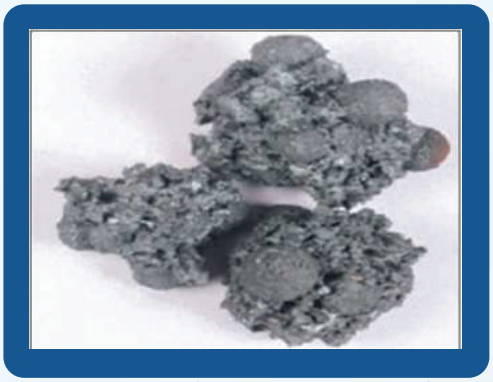
SALIENT FEATURES:

- It also uses steel plant's waste materials viz. LD sludge, mill scale etc (5-10%) with iron oxide micro-fines.

ADVANTAGES:

- The process yields a very good quality sinter even at the lower basicity that is usable in blast furnace.
- It increases the fines acceptability (30% above normal) improving permeability and decreases energy consumption (-20%) and flux consumption.

Technology is ready to be licensed.



PRODUCTION OF DIRECTLY REDUCED IRON

Production of Low-grade iron ores through technology involving washing, gravity, magnetic separation and finally recycling for maximum recovery.

Salient Features:

- The processing of low-grade iron ores involves washing, gravity, magnetic separation after which the products are calibrated lumps, sinter and pellet-grade concentrates for application in iron & steel making.
- For maximum recovery the intermediates are recycled.
- Arrangement for tailings disposal is needed. The technology have its application in iron and steel making.

- The process is environment friendly.
- No toxic/hazardous waste is discharged
- The intermediate products are recycled towards maximization of iron recovery

Technology is ready to be licensed.



SPECIFIC, SELECTIVE & GREEN REAGENTS FOR THE BENEFICIATION OF ORES, MINERALS & COAL

Production of effective and specific surfactants/collector reagents for ores and coal in flotation technique. The technology performance of flotation greatly depends on the surfactants / collector reagents used to create hydrophobic character specific & selectively on the particle surface to be floated. Hence, development of effective and specific reagents for the ores and coal is essential.

SALIENT FEATURES:

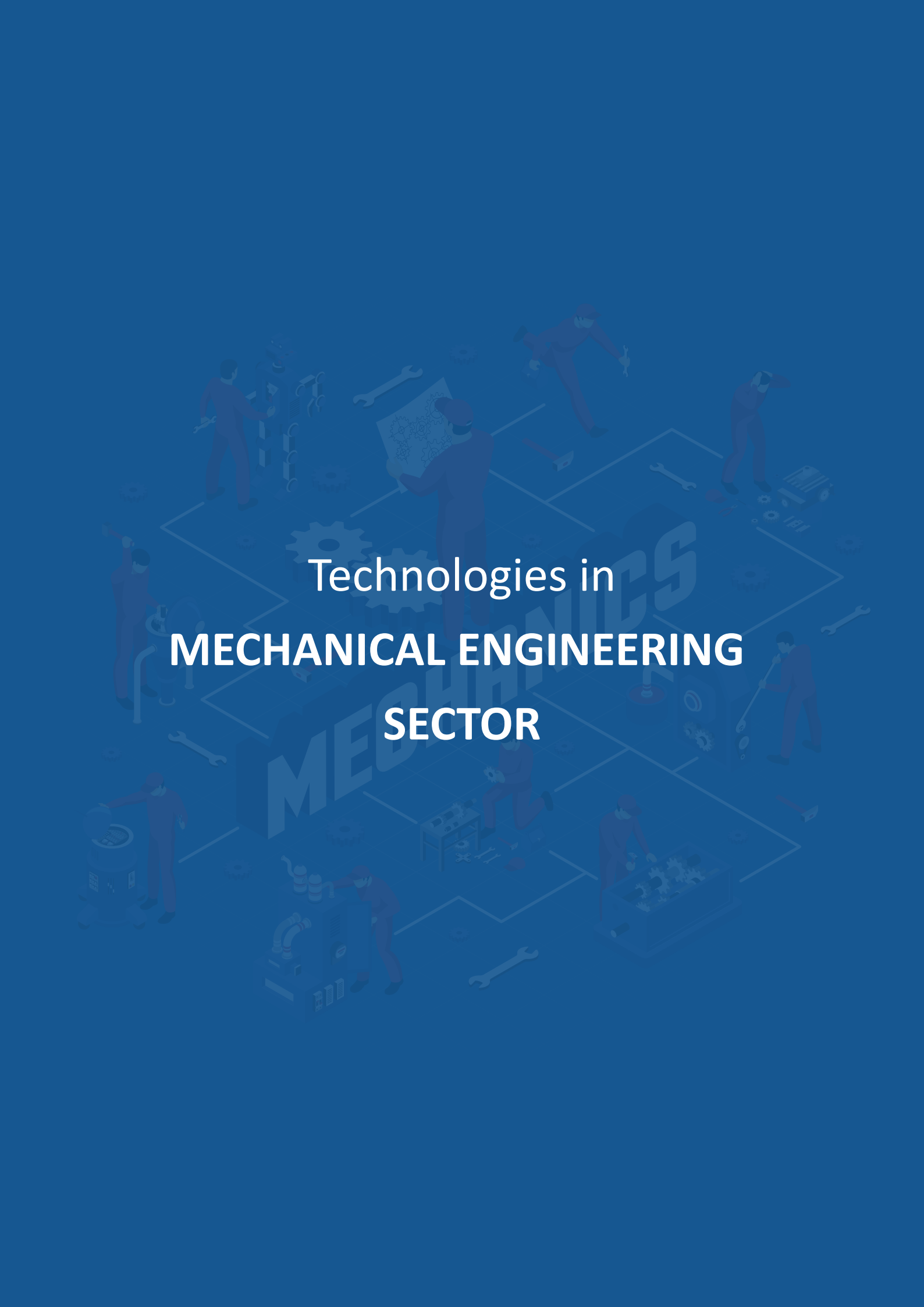
- Reagent for the beneficiation of Iron Ore Fines/Tailings by reverse flotation process.
- Reagent for the beneficiation of low-grade Barite and Limestone by reverse flotation process.
- Single reagent for the flotation of Coal fines (replacing diesel & frother).

ADVANTAGES:

- All the reagents are synthesized from vegetable oils and hence are completely bio-degradable.
- All the reagents are proven successful industrially.
- These reagents are economical & cost effective.

Technology is ready to be licensed.





Technologies in
MECHANICAL ENGINEERING SECTOR

KRISHI SHAKTI (10HP TRACTOR)

Bauxite is used as raw materials for production of alumina by Bayer process. The process is suitable for bauxite ore mainly composed of gibbsite mineral. The process aims to reduce reactive silica below 2%, increase total alumina content more than 42% by physical beneficiation method. The attrition technique was used to scrub the ores in water by adding the suitable dispersing reagents using screw scrubber.

Salient Features:

- The bauxite should not contain more than 5% of reactive silica, total alumina content more than 42% and Fe should be less than 15% to make economical viability of the process.
- As the high grade ore availability becomes the problem, low grade ore is needed to beneficiate to meet the requisite specification of the aluminaindustry.
- The reactive silica presents mostly in ultrafine forms. If it is more, it increases the consumption of sodium hydroxide in leaching process and also give negative impact in the downstream processes like settling, purification, crystallization, filtration and calcination.

ADVANTAGES

- Reduces reactive silica content less than 2%
- Increase alumina content more than 42%

Technology is ready to be licensed.

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CABINET DRYER FOR GINGER AND TURMERIC

Drying of freshly harvested ginger and turmeric to reduce their moisture content and thereby preventing the loss in quality and quantity of cash-crops during storage. Available general purpose dryers have been found to take about 15 hours for drying of ginger / turmeric slices, which consumes more energy, and also results in degradation of the quality of the product due to mould growth. Thus, they are not at all suitable for processing of high moisture content agro-crops like ginger/turmeric. The developed dryer enables faster drying (4-5 hrs.) with more uniform product quality.

Salient Features:

- Batch type; 50 kg per batch
- Moisture reduction from 85-90% to less than 10% in 4-5 hrs.
- Perforated SS trays with zigzag travel of hot air
- Uniform drying
- The developed dryer enables faster drying (4-5 hrs.) with more uniform product quality

The technology is ready to be licensed.



COTTON PICKING HEAD

Generally, coconuts are dehusked manually using either a machete or a spike which is time consuming and require man power. This improved manual and electric motor operated deshusking devices have been for user to dehusk coconuts satisfactorily without damage. This machine helps in reduction of human effort and improves the number of nuts processed per hour.

Salient Features:

- Electric Motor Operated
- Manual Operated (by foot/hand)
- Faster operation
- Do not require skilled operator
- Easy to fabricate, easy to handle
- Power transmission by Chain-sprocket
- Do not require any special arrangement to install
- Productivity: 200 coconuts per hour

The technology is ready to be licensed.



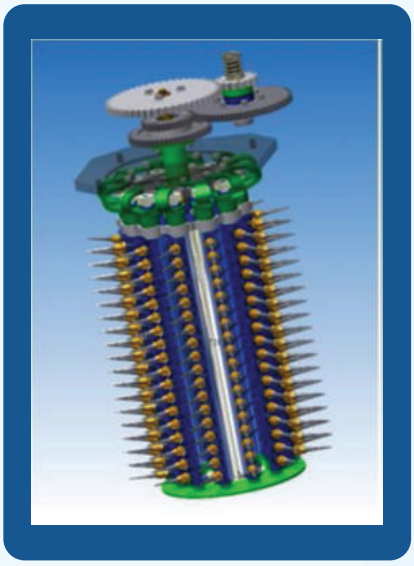
COTTON PICKING HEAD

Cotton can be directly picked using spindle type cotton picker head either using tractor or self-propelled machine. Cotton is an important cash crop of India. Mechanization of cotton harvesting is considered to be of vital importance due to impending scarcity of labour. Design and development of spindle type cotton picking mechanism will be made as a tractor driven unit / self-propelled unit (walk behind type).

SALIENT FEATURES:

- Spindle type, Two Inline Drums Mechanical Cotton
- Picker Head
- Picking efficiency: 85%-90%
- Trash content: 10%-12% seed cotton basis and 30%- 35% lint basis
- Row spacing: 70-100 cm
- Productivity: 0.25 ha/hr (single row)
- Power requirement: up to 45 hp (single row)

The technology is ready to be licensed





FLUIDIZED BED DRYER FOR AGRO CROPS

For drying in a safe desired level, storage & further processing of different oilseeds such as mustard, sunflower, soybean, groundnut etc. and other agro-crops and this dryer is used extensively.

Salient Features:

- State Oil & Oilseed Federations, Oilseed Growers Association, Oil Mill and Solvent Extraction plants, for drying of oilseeds
- Agencies dealing with storage of seeds, agro-crops, etc., for drying of Agro-crops Food Corporation of India.
- Drying of other items like tea, coffee, ginger, spices etc.

Advantages:

- Compact plant
- Short drying time
- Almost zero maintenance
- Better product quality, uniformity in temperature and moisture content
- Higher energy efficiency
- Simultaneous cleaning
- Not much skill required

The technology is ready to be licensed.



INTER-ROW ROTARY CULTIVATOR

Tractor mounted inter-row rotary cultivator is the economical and perfect solution for intercultural operations in wide row crops like vegetables, sugarcane, maize, cotton, soybean, peas, grams etc. Suitable equipment for intercultural operations in wide row crops with adjustable working width and adjustable working depth.

Salient Features:

- Machine Width: 2000mm
- Row Spacing: 40 – 60 cm
- No. of Rows: Three
- Working Width: 300 – 460 mm
- Weight of machine: 450 kg

Advantages:

- High Ground Clearance
- Adjustable Row Spacing
- Suitable for Indian Conditions
- Adaptable to small & marginal farmers [suited for 35-45 hp tractors]

The technology is ready to be licensed.



OFFSET ROTAVATOR FOR ORCHARDS

Mechanization of orchards is nascent stage in India and proper machinery to do the farm operations like tilling, inter-culture etc are not available. Side shifting capability of the rotavators can be used for proper inter-cultural applications in the orchard especially under the canopy. Using this option, the tractor operator will be able to till the soil under the tree canopy where tilling cannot be done with present rotavator designs. After incorporating this design feature in the rotavator, the operator can till soil in any given conditions like seed bed preparation, orchard tilling etc.

Salient Features:

- Effective working width: 1800 mm
- Side shift: 400 mm
- Offset of machine: 500 mm
- Tractor Power: 35-50 HP
- Actuation time of side shift: 0.5 sec
- Automatic Hydraulic Side Shift

The technology is ready to be licensed.



PNEUMATIC PRECISION PLANTER FOR VEGETABLES

Precision planting is the effective method to increase yield by planting the seeds in a row individually with utmost precision. Applicable in direct planting/seeding of small/irregular vegetable seeds.

SALIENT FEATURES:

- High Singulation accuracy (95%) ; Planting of seeds of diameter : < 4 mm
- Modular planting units adaptable for all tractors Depth controlling and profile following mechanism
- Specially designed for Indian Crop Production Practices for direct seeding at uniform depth with high Singulation accuracy

ADVANTAGES:

- Designed for Indian Crop Production Practices
- Direct Seeding of small/irregular seeds at uniform depth
- Empower Indian small & marginal farmers [suited for 35-45hp tractors]

The technology is ready to be licensed.



ROTARY DRUM WASHER FOR GINGER AND TURMERIC

Continuous hopper-fed washing of freshly harvested ginger and turmeric. Freshly harvested ginger/turmeric from field has lots of mud/dirt attached with it. So, it is first washed with water jet in a rotating drum before drying.

SALIENT FEATURES:

- Perforated rotary drum with spray nozzles to wash intricate-shaped ginger and turmeric
- Uniform washing @ 500 kg/hr.
- Recirculation of the used water with mud filter and pump

ADVANTAGES:

Reduces human drudgery and consequent environmental pollution by automatic washing in an enclosed vessel. Recirculation of the used water conserves the natural resource.

The technology is ready to be licensed.



AUTO DIPPER

Improper lighting arrangements on road in many of the developing countries like India coupled with the low sensitivity of human eyes and brain cause difficulty in driving at night. Bad driving habits and infrequent use of beam shifting/signals further exaggerates this problem and often remains the main reason for fatal road accidents at night particularly on highways. Auto Dipper, a device or system has been designed and developed to overcome this common problem for driving at night on highways.

Salient Features:

The system consists of one sensor to measure the intensity of light and an electronic circuit to control the shifting switch of the beam light. Main functions of the device are:

- Headlight beam shifting (high/low beam) after sensing the light of vehicle approaching from opposite direction.
- Giving stay on left (i.e. Don't overtake) signal to the vehicle following.
- Auto Dipper keeps the head light in "High" beam if there is no vehicle from opposite direction.
- While crossing, first momentry dip is given by the vehicle fitted with the auto dipper automatically when the two vehicles are at a distance of about 120 meters. Low beam continues till distance between the two is reduced to about 90 meters than this vehicle shifts to "High" beam, which continues till the two vehicles are 30 meters apart.

Advantages:

- The device is very small (2.5 inch cube) and can be fitted anywhere in the vehicle.
- Sensitivity range is adjustable from 0.5 lux to infinity.
- Cost is very low and the manufacturing of 1 unit costs around Rs 200.0 only.



Technologies in
ELECTRICAL AND ELECTRONICS SECTOR

ELECTRONIC WEIGHING BASED FRUIT SORTING SYSTEM

INTRODUCTION

India is the large producer of the fruits like mangoes, oranges, apples, etc. Sorting of these fruits with respect to their weight has great potential in grading them and in packing them safely to avoid bruises & damages, which will improve their exports as well as providing better customer satisfaction. With this in view, an electronic weighing based fruit sorting system was developed.

SALIENT FEATURES:

- Singulated fruits moving on a cup conveyor system are weighed dynamically using a specially mounted load cell and sorted into different grades according to user specified weight ranges.
- Range: 10 to 4000 g. Accuracy; +/- 7.5 gm of full range.
- No of sorting stations 4/5 (currently), extendable Throughput: 2 to 3 fruits/sec

APPLICATION:

The system sorts fruits into several categories based on their weights measured using an electronic weighing arrangement. Useful for sorting of fruits like mangoes, citrus, etc. Useful for the fruit processing industry, especially in packing of fruits.

SCALE OF DEVELOPMENT:

Laboratory system developed and ready for commercialization.



SYSTEM FOR DETECTION OF ADULTERATION IN MILK

The system is capable of detecting adulterants such as urea, salt, detergents, boric acid, caustic soda, Lye (NaOH), soda, hydrogen peroxide and many more unknown adulterates in raw milk. A novel voltammetry system for detection of adulteration in genuine milk with synthetic milk is described in which the measurement of current response is performed on a single working electrode during the voltage sequence with the measurement procedure.

SALIENT FEATURE:

- Minimum Detection level of adulterants-Urea:1gm/l; Salt:2gm/l; Detergent: 2gm/l; Soap:1%; Soda: 1gm/l;
- Working Principle-Electrochemistry for milk adulteration.
- Measurement time: 40-45 Sec.
- Designed for installation at milk collection center at village and Tahsil level.
- Detects adulterants like urea, salt, detergents, liquid soap, boric acid, caustic soda, ammonium sulphate, formalin and hydrogen peroxide in raw milk.

ADVANTAGES:

- Portable and user friendly system
- Electrochemical detection
- Low cost system and Green technology

SCALE OF DEVELOPMENT:

- **Technology commercialization and demonstration has been successfully**



X-RAY IMAGING BASED MANGO SORTING SYSTEM

INTRODUCTION

Inspection of mangoes for internal defects has great potential in improving the mango exports as well as providing better quality mangoes to the internal market. With this in view, an x-ray imaging based mango sorting system was developed. The indicative cost of scanning the mango works out to be about Re.0.40 per mango using the existing developed system for a throughput of 1.0 to 1.2 tons per hour.

Sorting of mangoes based on internal defects such as seed weevil and spongy tissue. Image processing methods employed for sorting mangoes. Image texture analysis and special features extraction to identify the defects.

SALIENT FEATURES:

- X-ray imaging system employed for continuous scanning of mangoes.
- Integrated with mango sorting assembly.
- Specially designed hardware for mango detection and sort control.
- Dedicated software modules for image capture, image processing, analysis and sorting.
- Image processing methods employed for sorting mangoes.
- Image texture analysis and special features extraction to identify the defects.
- User interactive menu driven software for calibration and scan settings.
- Real-time automated system.
- Sorts post-harvested mangoes especially export varieties.
- Non-destructive X-ray imaging technique.
- No health hazards – safe for consumption.

SCALE OF DEVELOPMENT:

Laboratory prototype has been developed & already commercialized.



HANDHELD MILK QUALITY ANALYZER

Design and Development of low cost handheld milk quality analyzer for detection of adulteration in milk and measurement of fat content of milk for domestic usages.

SALIENT FEATURES:

- Provides milk fat measurement-Measure the percentage of fat content in milk.
- Provides milk adulteration check-It detects adulterants like urea, salt, soda, ammonimum sulphate, formalin and hydrogen peroxide in raw milk and processed milk.
- Working Principle-Electrochemistry for milk adulteration check and optical transmittance for milk fat measurement.
- Measurement time :around one minute.
- Sample Volume: 10 ml
- Green Technology (chemical-free adulteration check).
- Handheld and battery operated.
- User-friendly low cost system.
- Milk Fat Measurement - 0-9% with 0.3% accuracy.
- Minimum Detection level of adulterants- Urea: 1 gm/l; Salt: 2 gm/l; Detergent: 2 gm/l; Soap: 1%; Soda: 1 gm/l;
- Domestic milk testing
- On-the-spot milk testing by food authorities.

SCALE DEVELOPMENT:

- Technology development has completed and ready for commercialization.



ON-LINE MONITORING OF FREE FATTY ACID (FFA) IN EDIBLE OIL

The system uses Near Infrared Spectroscopy (NIRS) techniques for monitoring of Free Fatty Acid (FFA) in sun-flower oil. The system can be extended for measurement of FFA in other edible oils. The system is useful for on-line monitoring of FFA, which is an important quality parameter, in edible oils like sun-flower oil. The monitoring will be helpful in optimizing the process and improve the quality of the product.

Salient Feature:

- On-line monitoring of FFA content in sunflower oil at the end of oil extraction/refinery process prior to packaging/storage
- Adaptable to measure both high (5-10%) as well as low values (< 1%) of FFA
- User friendly Graphical User Interface (GUI) with features for live data display, data-logging, bar charts and report generation
- System can be easily integrated into the process line with minimal changes without affecting prduction
- Adaptable for other edible oils of different FFA ranges at different process stages and flow rates by suitable modifications & appropriate calibration procedures

Competing Features:

- The system provides a non-destructive, instantaneous, cost effective and accurate estimation of FFA content in sunflower oil.
- Measurements avoid the wastage of samples and chemicals.
- Results can be utilized in optimizing the process and enhancing the product quality.
- System is easy to operate and does not require trained personnel. Economically priced with good return value.
- Adds negligible incremental cost on the production
- Reduces human induced errors and results in energy reduction

Scale of Development: Technology demonstration has been successfully.



SMART-CAMERA BASED SYSTEM FOR SORTING OF BISCUITS

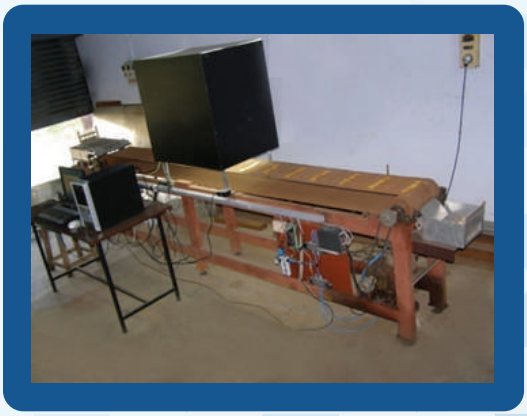
- The developed system inspects and sorts biscuits moving on a conveyor based on dimensions and color (baking level). The measurement of colour and dimensions is useful for quality control of bakery products.
- Measurement of colour of biscuits is useful in optimum setting of the baking oven parameters.
- Measurement of dimensions is useful in removing damaged, misshapen and over/ under sized biscuits The developed system with suitable modifications can be useful for inspection and sorting of other bakery products

SALIENT FEATURE:

- This is On-line quality inspection of biscuits. It measures the colour (baking level in terms of under, normal & over baked) of biscuits.It measures the dimensions (length and width) of biscuits
- Measures the colour and dimensions of the biscuits moving on the conveyor up to a maximum speed of 6 meters/minute.
- Smart camera based embedded system for sorting of biscuits based on colour and dimension. Smart camera embeds DSP board and camera for image acquisition and processing.
- Expert decision support system based on artificial neural networks for automated biscuit colour classification. Detection and rejection of under/over baked biscuits.
- Rejection of biscuits not meeting dimensional tolerances. A supervisory computer system for integrated monitoring.

Scale of Development:

Laboratory system has been developed and demonstrated.



1KW GRID TIED /STAND-ALONE SOLAR INVERTER

INTRODUCTION

A Semi-automatic inverter which can work as grid connected as well as stand-alone inverter.

APPLICATIONS

Household applications

SALIENT FEATURES

- Grid current THD is less than 5% for nominal loading
- Galvanic Isolation feature provided
- No battery is required
- System protection: Over/Under voltage, Over/Under frequency, Short Circuit; Over Current
- Protection.

SCALE OF DEVELOPMENT: Technology field test completed.

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Technologies in
ELECTROCHEMICAL AND CORROSION SECTOR

PEMELECTROLYSER

INTRODUCTION:

PEM electrolyzers use a Proton Exchange Membrane which uses a solid polymer electrolyte. When current is applied on the cell stack, the water splits into hydrogen and oxygen and the hydrogen protons pass through the membrane to form H2 gas on the cathode side.

APPLICATION/USES:

- Weather balloons
- Thermal power plants
- Fuel cells

SALIENT TECHNICAL FEATURES FOR THIS UNIT:

- The raw material is pure water
- Hydrogen on demand
- Pressurized Hydrogen
- Microprocessor controlled
- LED display indicates system status
- Automatic leak detection Low water and poor-quality indication

STATUS OF COMMERCIALIZATION: Commercialized



AMORPHOUS ALLOY COATINGS BY SPUTTERING FOR SURGICAL TOOLS AND BIOIMPLANTS

INTRODUCTION:

Implant materials have significant requirements in medical industries due to orthopedic ailments of elders, fractures caused by accidents, sports injuries, bone replacements, revision in surgeries, changes in lifestyle, etc. Contamination of bone and its deterioration is a common problem in patients because of inflammation, improper integration, infections, and mechanical instability. Therefore, demand of high efficiency implant is increasing day by day. It is important to design and develop suitable implants with improved properties of mechanical strength, antibacterial, corrosion resistance, hemocompatibility and biocompatible to address those challenges. Implant materials should have proper surface chemistry for long life duration. Metals, ceramics and polymers are promising materials which are extensively used as implant materials. Metallic implants are superior in its mechanical properties, biocompatibility and corrosion resistance, but they are bioinert materials, and this is unable to match with osseointegration properties. It is important to make a note that corrosion of metals are difficult of detect in the form of pitting, cracking, fatigue, fretting, crevices, galvanic etc. which are the major problems inside the liquid medium of body.Titanium (Ti), Ti alloys, stainless steel (SS), magnesium (Mg) alloy, cobalt (Co)-chromium (Cr) alloy, zinc (Zn) alloy, gold, iron (Fe), alloy tantalum, etc.,are used as metallic implants. Ceramic materials are specifically used for dental implants such as hydroxyapatite, zirconium oxide, aluminum oxide, tricalcium phosphate, silicates, etc. Surface tailoring on the implant surface plays an important role, mainly to improve performance and durability.

APPLICATION/USES:

To enhance mechanical and corrosion properties; Hemocompatible& Biocompatible; Antimicrobial; low roughness and Noncytotoxic in nature. Coatings for short-term implants/Elimination of secondary surgery

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Sputtering is a vacuum-operated and eco-friendly technique.
- Lower Young's modulus of 50-100 GPa
- Better hemocompatibility
- Noncytotoxicic (Graded less than 1 as per ISO 10993-5,2009)
- Antibacterial and biocompatible
- Biodegradable (Elimination of secondary surgery)

Status of Commercialization: Yet to be commercialized



Degradable amorphous alloy coatings Glassy metal coated surgical tools

MULTICOAT PROTECTIVE SCHEME FOR CONCRETE STRUCTURES AND BRIDGES

INTRODUCTION:

To improve the performance and durability of reinforced concrete surfaces on bridge structures, additional protection systems are frequently required, particularly in refurbishment situations. Typical concrete protection systems for bridges can be classified as hydrophobic impregnations, sealing impregnations, surface coatings, or corrosion inhibitors. These are designed for use in different situations or collectively in alternative combinations, to greatly reduce damage to the concrete surfaces and to stop or significantly reduce the rate of steel reinforcement corrosion. Thus, preventing the even more significant structural damage, that would otherwise occur.

APPLICATION/USES:

- Four coat systems are used for the protection of concrete structures and bridges for long duration of 10 years from corrosive marine as well as industrial environments.
- The coatingng can be applied by spray or brush.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- This system consists of epoxy primer, epoxy -MIO undercoat, Epoxy TiO, top coat followed by Ali. Polyurethane finish coat

STATUS OF COMMERCIALIZATION: Commercialized



Pamban bridge is coated with this multicoat system

3-CHLOROMETHYL AZETIDINONE ESTER (CEPHALOSPORIN ANTIBIOTIC)

INTRODUCTION:

Cephalosporins are beta-lactam antimicrobials used to manage a wide range of infections from gram-positive and gram-negative bacteria. The five generations of cephalosporins are useful against skin infection, resistant bacteria, meningitis, and other infections.

APPLICATION/USES:

- Cephalosporins are antibiotics used to treat a wide variety of bacterial infections, such as respiratory tract infections, skin infections, and urinary tract infections.

STATUS OF COMMERCIALIZATION: Yet to be commercialized



3-Chloromethyl azetidinone ester (Cephalosporin Antibiotic)

ELECTROCHEMICAL DYEING OF COTTON FABRICS

INTRODUCTION:

For environment-friendly dyeing, electrochemical dyeing method was researched. The low consumption of additives during dyeing is beneficial to environmental protection,and the electric field of electrochemical dyeing reduces the salt. Moreover, the K/S value of the fabric increases significantly at the same dye concentration. The alkaline electrolyte in the electrolytic cell may enhance the self-corrosion of the electrode during the electrochemical dyeing process.

APPLICATION/USES:

- Vat dye is most popular among the dye classes used for the coloration of cotton fabrics, particularly, when high fastness standards are required to light, was,hing and chlorine bleaching

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Indigenous single step and simple operation. Alternate process to the chemical dyeing process.



ELECTROCHEMICAL CONVERSION OF DL-HOMOCYSTINE TO DL-HOMOCYSTEINE

INTRODUCTION:

An industrial process for the electrochemical synthesis of DL-Homocysteine from DL-Homocystine is described. DL-Homocysteine is a key intermediate for the synthesis of Citiolone (a powerful agent used to treat bronchitis and nasal catarrh). The work starts with a fundamental study, the voltammetricbehaviour of DL-Homocystine, followed by a laboratory and pilot plant study and finishes with the development of an industrial process.

APPLICATION/USES:

- Pharmaceutically important Intermediates

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Electro- catalytic process through Paired Electro synthesis Route with 200% Efficiency.

STATUS OF COMMERCIALIZATION: Commercialized



R1,4-NAPHTHOQUINONE

INTRODUCTION:

1,4-Naphthoquinone or para-naphthoquinone is an quinone derived from naphthalene. It forms volatile yellow triclinic crystals and has a sharp odor similar to benzoquinone. It is almost insoluble in cold water, slightly soluble in petroleum ether, and more soluble in polar organic solvents. In alkaline solutions it produces a reddish-brown color. Vitamin K is a derivative of 1,4-naphthoquinone. It is a planar molecule with one aromatic ring fused to a quinone subunit.

APPLICATION/USES:

- Pharmaceutically important Intermediates

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- More economical method than other methods involving inorganic oxidizing agents, because the oxidant can be regenerated and used, has excellent selectivity and avoids disposal of spent reagents.



Schematic diagram for the conversion of Naphthalene

SMART SELF HEALING COATING OF CONDUCTING POLYMERS FOR CORROSION PROTECTION

INTRODUCTION:

Corrosion has always been a matter of great concern especially when metals and alloys are in contact with corrosive environment. Nearly 88 % of corrosion control strategy is based on organic coatings. Normally corrosion preventive coating schemes have 3 coats viz. primer coat, intercoat, top coat. The present innovation deals with the designing of smart self healing coatings of conducting polymers which can be used for preventing corrosion of iron under hostile environmental conditions. The objective of the invention is to design conducting polymer composites by incorporating filler materials and suitably selecting a medium for polymerization so that the resultant epoxy coatings can be used for prevention of corrosion in saline water conditions.

APPLICATION/USES:

- Pharmaceutically important Intermediates
- Conjugated polymers are designed which have Smart action and have self healing ability: pin hole/scratch site passivation
- Environmental friendly/based on green technology (free from heavy metal ions and
- hazardous chromates)
- Long service life
- Economic feasibility
- Additional antistatic property
- Curing is done at 140o C -145o C for 30-45 minutes

SALIENT TECHNICAL FEATURES:

- These polymers can also be used as additive formulation with cement for the water soluble conducting polymer based antirust (JangRodhak) cement.
- These polymer-based paints have found immense application to fight against corrosion. These coatings overcome the drawbacks of conventional anticorrosive schemes and offer many advantages.
- The technology has been patented in India and US titled “Smart Coatings of Conducting Polymer Composites for corrosion protection in Marine Environment” and “Self-healing anti corrosive coatings and a process for the preparation thereof” respectively.

STATUS OF COMMERCIALIZATION: Demonstrated and ready for commercialization

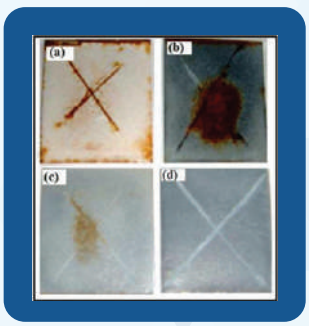


Figure: Salt Spray Images of powder coated sample of (a) Epoxy coated (b) Conducting polymer coated at 6 % loading (c) & (d) Modified Conducting Polymer coated at 1.5 % and 6 % loading to 1,4-Naphthoquinone

BIODEGRADABLE INHIBITOR FOR PREVENTING SCALE AND CORROSION DEPOSITS OF STEEL PIPELINE IN COOLING WATER SYSTEM AND PROCESS THEREOF

INTRODUCTION:

Steel has versatile application in chemical, structure and construction industries owing to its mechanical properties. However, it is susceptible to corrosion in acid environments. Thus, it requires to protect the steel from corrosion. Different types of corrosion resistance steel, coatings and inhibitors are developed to mitigate the corrosion, but, inhibitor is the best remedies to control the corrosion of steel in acid condition. Moreover, organic and green inhibitors used in acid condition for descaling, acid pickling, pipelines, boiler tubes and oil-wells. Organic inhibitors reduce the dissolution of steel in acid but, it is hazardous, expensive and needs expertise to synthesize the inhibitor.

APPLICATION/USES:

- Open circulating cooling system used in power plants
- Cooling towers & pipelines used in chemical industries
- pipeline used in nuclear power plants for cooling purpose

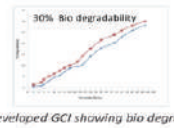
SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Low toxicity to aquatic species;
- Ion-toxic to mammals
- Biodegradable
- Safe for workers to handle
- Environmentally safe
- Non-volatile, non flammable or non-explosives

STATUS OF COMMERCIALIZATION: Yet to be commercialized

GREEN INHIBITORS FOR COOLING WATER SYSTEMS

S. No	TEST CONDITION	EFFICIENCY (%)
1	Control(without inhibitor)	-
2	PGA-300 ppm+AM-100 ppm	84
3	PGA-500 ppm+AM-100 ppm	92
4	PGA-500 ppm	73
5	PGA-400 ppm+AM-50 ppm	95
6	Po43- treatment 50 ppm+5th test	83
7	Po43- treatment 100 ppm+5th test	96



CECRI developed GCI showing bio degradability

No.	SYSTEM	EFFICIENCY (%)
1	SCW	-
2	HEDP-100 ppm	71
3	HEDP-200 ppm	100
4	PGA-400 ppm	97

Temperature Tolerance up to 55-600 C : PROVEN

TRIBOLUMINESCENT (TL) PAINT TRIGGERED LUMINESCENCE SIGNAL IDENTIFYING SMART CAMERA FOR CRACK DETECTION OF STRUCTURAL COMPONENTS

INTRODUCTION:

TL-based sensor systems have a great potential for wireless, in-situ and distributed (WID) structural health monitoring when fully developed. Triboluminescence is one of the types of luminescence that could be activated by mechanical stress.

APPLICATION/USES:

Reliable real-time damage assessment of engineering structures such as buildings, dams, bridges, aircraft and spacecraft At present no single technique is available to provide reliable results in a cost-effectivemanner.

- Damage of various structures components such as buildings, bridges, and aircraft.
- Marine and Space application.
- Fiber-reinforced concrete structure.
- To detect leakages in tunnels/ pipelines.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Real-time failure monitoring of structure
- Fuse system of army warhead.

In-built remote monitoring

- Cost effective
- Eliminate skilled operator

STATUS OF COMMERCIALIZATION: Yet to be commercialized



SIMULTANEOUS DETECTION AND INHIBITION OF CORRODING STEEL STRUCTURES IMINE FUNCTIONALIZED SILICA AEROGELS AND ITS PROCESS THEREOF

INTRODUCTION:

Amine-functionalized thin films are highly desirable technologies for analytical, material, and biochemistry applications.

APPLICATION/USES:

Facile synthetic approach to prepare imine modified silica nanoparticles by dipping amine modified silica aerogels in acetone. When applied over mild steel plates IMSNP was found to be sensitive (via color change) and inhibitive (prolonged salt spray) for the corroding steel structures.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- First synthesis of imine terminated silica nanoparticles, by dipping amine silica nano particles in acetone at ambient pressure and temperature. The volume of the gels was retained by supercritical CO, drying.
- The Imine terminated silica nanoparticles can coordinate with Transition metal ions to change their body color through the Schiff base mechanism.
- The imine silica nanoparticles can be mixed with acrylic primer and coated on steel structures to detect and inhibit the corrosion of steel structures.
- The conventional tedious synthesis of dyes based on Schiff base can be eliminated and replaced through this simple and effective synthetic scheme.
- In addition to its fascinating corrosion-sensing properties, imine silica nanoparticles can act as corrosion inhibitor for protecting steel structures.

STATUS OF COMMERCIALIZATION: Commercialized



Pristine mild steel (MS) IMSNP coated MS

3-KW LT-PEMFC FOR STATIONARY POWER APPLICATION

INTRODUCTION:

Polymer electrolyte membrane fuel cell (PEMFC) technology is one of a portfolio of alternative methods for delivering energy that currently is under aggressive development by academic, governmental, and industrial organizations. In this specific case, the PEMFC devices are of interest as a means of converting fuels, such as hydrogen, methanol, hydrocarbons, and chemically reformed hydrocarbons into electrical energy, generally close to the device or facility requiring that power. Major potential applications for PEMFC units include automobiles, buses, fork lift vehicles, laptop computers, and other small devices, and local power generation to support homes, businesses, and cell phone towers.

APPLICATION/USES:

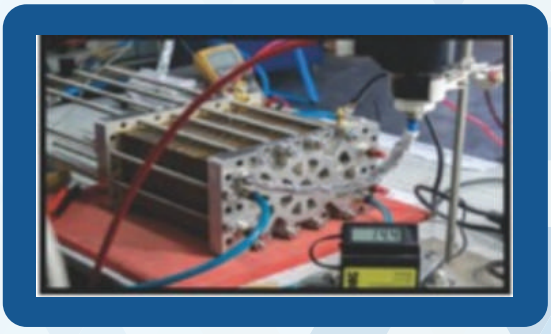
- 3 kW electric power output for telecom towers

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Low Catalyst content
- Better durability
- Reliable power source
- No pollutants
- Elimination of DG set.

STATUS OF COMMERCIALIZATION: Yet to be commercialized





DEVELOPMENT OF MODIFIED POLYMER ELECTROLYTE MEMBRANES FUEL CELL (PEMFC) STACKS FOR HYDROGEN REMOVAL

INTRODUCTION:

Automobiles are a primary application of polymer electrolyte membrane (PEM) fuel cells, which operate under low temperature and high efficiency, to reduce fossil fuel consumption and CO2 emissions. Using hydrogen fuel, PEM fuel cells can reach a practical efficiency as high as 65% with water as the only by-product. Almost all the major automakers are involved in fuel cell electric vehicle (FCEV) development.

application/uses:

- 1 kW air cooled PEMFC stack for hydrogen utilization

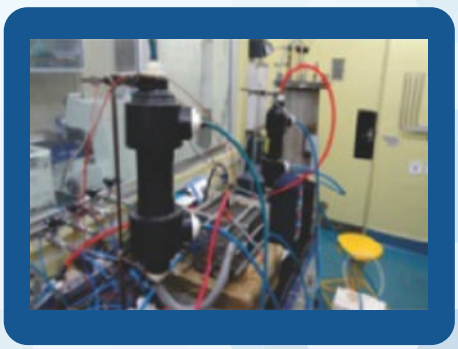
SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Air cooled stack
- Ambient pressure of operation
- Hydrogen utilization
- Pollution free device
- Reliability and durability

STATUS OF COMMERCIALIZATION: Commercialized



20 cell, 1 kW PEMFC stack H2-O2: 1.45 kW; H2-air: 1.0 kW to 1,4-Naphthoquinone



1 kW PEMFC system demonstration at IGCAR, Kalpakkam

ELECTROPLATING OF GOLD

INTRODUCTION:

Gold plated – sometimes called electroplated – items are made with a layer of gold on the surface over another type of metal underneath. On some occasions, items are gold plated to try and fool buyers or cash-for-gold operators. But for the most part, plating is done to enhance the look or wearability of a piece of jewelry. Gold plating is an easy technique, but before beginning the process, make sure your plater follows the best practices for best plating results**.**

APPLICATION/USES:

- Used for satellite and other decorative ornaments.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Good adhesion
- Good throwing and covering power
- High plating rat
- Good cathodic current efficienc
- Suitable for functional application
- Bright appearance

STATUS OF COMMERCIALIZATION: Commercialized



Gold plated momentum wheel for satellite

CORROSION RESISTANT INHIBITIVE ADMIXTURE FOR PORTLAND POZZOLANA CEMENT

INTRODUCTION:

Corrosion of steel in concrete is influenced by various factors such as pH reduction, carbonation, chloride ingress, etc. Among them chloride ingress play an important role in decreasing the durability of concrete structures. To counteract this corrosion problem, various preventive measures such as coating to steel, coating to concrete, cathodic protection, addition of super plasticisers and corrosion inhibiting admixtures have been reported.

APPLICATION/USES:

- **Process involves adding inhibitors in the form of powders during manufacturing of cement or while making concrete at site**
- **More corrosion resistant than normal cement due to the inhibitive nature of the additives**
- **Used for constructions in aggressive marine environments**

STATUS OF COMMERCIALIZATION: Commercialized

Table 1 Physical Properties

Test	PPC	Inhibitor admixed PPC
Compressive Strength {N/mm^2} Mortar specimens (3 days) Mortar specimens (7 days) Concrete specimens (28 days)	16.00 17.75 387	16.50 19.83 387
Tensile Strength {N/mm^2}	1.240	1.260
Consistency [for 33 mm penetration]	0.328	0.290
Initial setting time (minutes)	149	135
Final setting time (minutes)	345	330

Table 2 Corrosion resistant properties of cements

Performance Studies	Added chloride (ppm)	PPC	Inhibitor admixed
Weight loss (Corrosion Rate - mmpy)	10000	0.0191	0.0029
Electrochemical Impedance (Rct value) (K ohms cm^2)	10000	3.591	49.377
Linear Polarization resistance (Rp value) (K ohms cm^2)	10000	6.220	31.554
Anodic Polarization Potential (mV) Initial	1000	0.750 0.250	1.100 1.000
Peak potential Current (micro ampere)	10000	110	0.325



Corrosion free concrete structure

INTEGRATED CORROSION MONITORING SENSOR (ICMS) GADGET

INTRODUCTION:

ICMS is a versatile integrated sensor gadget, a basket of sensors to measure potential, corrosion rate, resistivity and temperature simultaneously to alert us on the health of structures/bridges/reactors. Early detection of corrosion through this all-terrain compatible embeddable sensor has been made accessible through a custom designed Mobile App for corrosion monitoring in civil infra structures. Keeping this handy and wireless remote control, one can have round the clock monitoring of civil structures aided by scientific data from anywhere and everywhere.

APPLICATIONS:

- **Corrosion Monitoring in Concrete Structures likes**
- **Nuclear Reactor Buildings**
- **Dams, Tunnels**
- **Bridges and Viaducts**
- **High-rise and historical buildings**
- **Foundations, Construction sites**
- **Settlement areas**

SALIENT FEATURES:

- **Predictive maintenance utilizes non-destructive testing through sensor technology**
- **Detects the existence of the damage on the structure**
- **Locates the damage as and when occurs**
- **Quantifies the severity of damage**
- **Reliability-centred maintenance included**
- **Alerts and extends clues on Corrective maintenance**

SCALE OF DEVELOPMENT: Technology ready for Commercialization.



CECRI's Second generation sensor in the form of ICMS



Functioning of ICMS as model App

INDIGENOUS Li-ion BATTERY

INTRODUCTION:

Li-ion batteries are a popular choice of rechargeable battery for use in many applications like portable electronics, automobiles as well as stationary applications for providing uninterruptable power supply. Lithium-ion batteries are currently used in most portable consumer electronics such as cell phones and laptops because of their high energy per unit mass relative to other electrical energy storage systems.

APPLICATIONS:

- Solar Lantern, toys, power banks.
- XEV's, Solar (grid).
- Medical and all commercial Electronic equipments.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Cathode material delivers a capacity of 175 to 225 mAh/g compared to commercial LICO2.
- Carbon paper eliminating use of copper foil and reducing the cost by 5%
- Separator superior to celgard materials.

SCALE OF DEVELOPMENT: Yet to be commercialized.



LSolar lantern



LED flood light, Power bank, BMS circuit

CORROSION RESISTANCE THERMAL COATING FOR HYDROCLAVES

INTRODUCTION:

In producing thermal coat on surface subjected to high temperatures and ram flows coat material is prepared to be laid on surface to be protected and cured at high temperature and pressure. The markedly available protective coatings are not withstanding high temperature and humidity. Thus, we have prepared a suitable polymer composite of Epoxy -Silicone, Corrosion resistance thermally stable pigments are incorporated in it and the performance is evaluated as per ASTM standards.

APPLICATIONS:

This coating is used to protect the steel structures from corrosive as well as high pressure and temperatures

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- The polymer composite of Epoxy - Silicone composite developed is highly corrosive resistance.
- Thermally stable pigments are incorporated and exhibited performance as per ASTM standards



LED flood light, Power bank, BMS circuit

METAL OXIDE IMPREGNATED FABRICS FOR SURGICAL MESH

INTRODUCTION:

Surgical mesh is a medical device that is used to provide additional support when repairing weakened or damaged tissue. The majority of surgical mesh devices currently available for use are made from man-made (synthetic) materials or animal tissue. The metal oxide impregnated fabrics will be non toxic in nature and antibacterial based on the metal oxide.

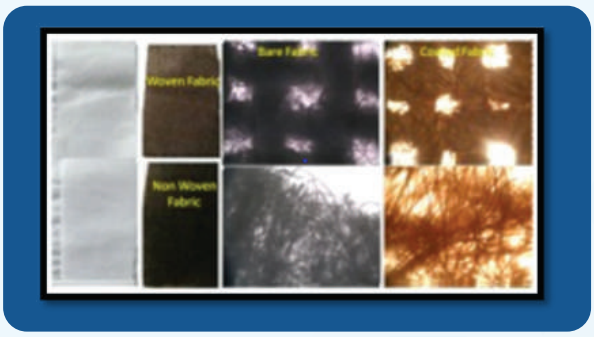
APPLICATIONS:

- Fabrics for wound healing pads/surgical mesh.
- Plasma treatment enhanced the coating with metal oxide in fabrics.
- Fabric obviously suppressed platelet and red blood cell adhesion.

SALIENT TECHNICAL FEATURES INCLUDING COMPETING FEATURES:

- Fabric has high antioxidant activity.
- Non toxic in nature.
- Antibacterial efficiency may be controlled by type of metal oxide and its application.
- The antibacterial property is regenerable.
- The antibacterial fabrics attained excellent washing durability.

STATUS OF COMMERCIALIZATION: Yet to be commercialized



Schematic diagram for the conversion of Naphthalene



KrF based Pulsed Laser Deposition and Microscopic Images.

COLLOIDAL MULTI-COMPONENT CZTSSE INKS FOR SOLAR CELLS

INTRODUCTION:

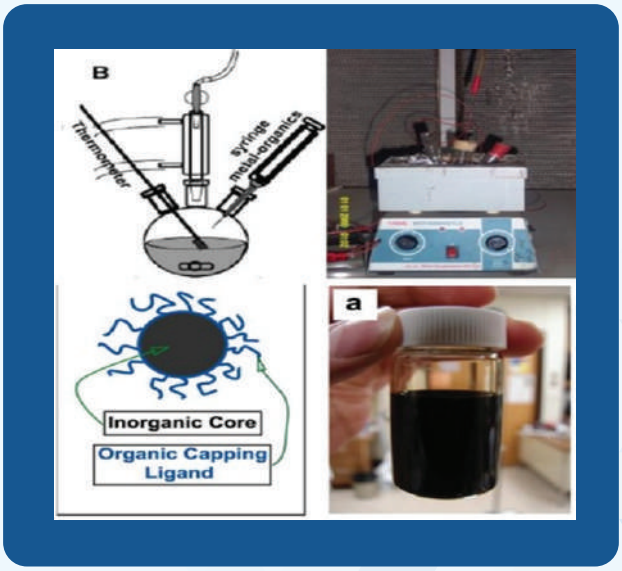
One of the Solar cell Materials, multi-component (CZTSSe) chalcopyrite-based materials developed by using a non-vacuum process combine benefits from the presence of both Sulphur and selenium, wherein individual CZTS &CZTSe, certain limitations do exist. Our inks can be easily deposited by spraying, printing, dipping, and coating over large-area substrates.

ADVANTAGES:

- These inks are aqueous-free and contain no hydrazine and other toxic solvents which are not environmentally friendly.
- Coating of these inks is possible on flexible substrates due to low processing temperature (<450°C), which can prevent degassing, curling, and deformation of the substrate.

APPLICATIONS:

- These inks can be used as absorber layers in thin-film solar cells and also as photo-cathodes in Dye-Sensitized Solar Cells (DSSCs).



MICRO FUEL CELL

INTRODUCTION:

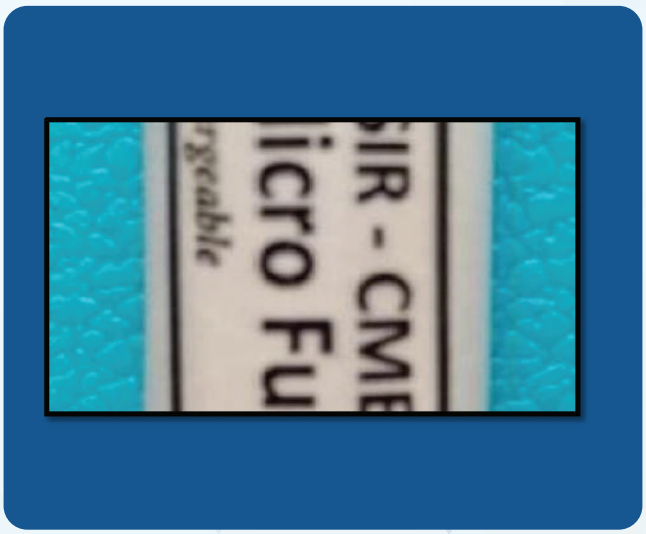
The micro fuel cell is a power source for electronic devices that converts chemical energy into electrical energy. The developed liquid-based fuel cell can undergo an in-situ charging-discharging process like batteries, eliminates the complexities associated with previous micro fuel cells, and can contribute to the development of affordable and novel rechargeable batteries. The developed micro fuel cell can generate 1.5 V, 1000 mAh per cell which can be stacked upon to extract more energy (~ 1W).

APPLICATIONS:

The stand-alone novel rechargeable micro fuel cell can work for a prolonged duration to meet the energy demands of low-power electronics. The innovative solution can address the energy demand of every person on this planet.

SALIENT FEATURES:

- Handheld
- Rechargeable and re-usable
- Disruptive
- Solution for



CARBON COMPOSITES BIPOLAR PLATES FOR HYDROGEN-BASED FUEL CELL APPLICATIONS

INTRODUCTION:

Fuel cell is electrochemical device that convert chemical energy of the reactants (H2 and O2) directly into electricity & heat with high efficiency. The main components of PEM fuel cell are composite bipolar plate, porous carbon paper electrode, polymer electrolyte membrane and platinum catalyst. Carbon composites bipolar plate is a multi-functional component within the PEM fuel cell stack. It connects and separates the individual fuel cells in series to form a fuel cell stack with required voltage, it main function is uniform distribution of fuel gas and oxygen over the whole active surface area of the membrane electrode assemblies (MEA), conducts electrical current from the anode of one cell to the cathode of the next, facilitates water management within the cell, supports thin membrane and electrodes and clamping forces for the stack assembly, among other things. Essentially the composites bipolar plates are lightweight and the electrically-conducting plates which join together the anode of one cell to the cathode of another.

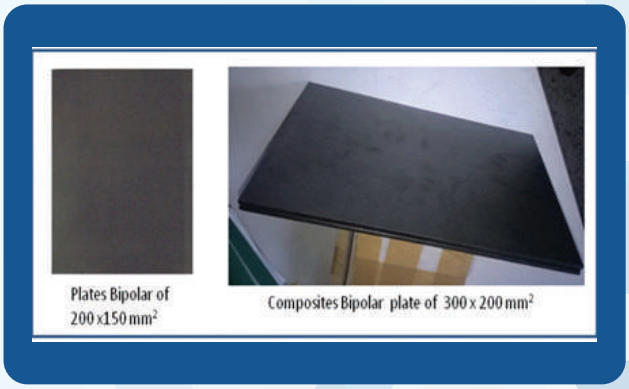
APPLICATIONS:

- The present invention provides a process for the preparation of low-density multi-component graphite composite bipolar plates for fuel cell applications. The molded plates were fabricated using different particle sizes of expanded graphite, chopped carbon fibre, carbon nanotubes, and thermosetting polymer as a binder. The expanded graphite (EG), which is vermiform in shape, offers high surface area and therefore good affinity to polymers. The multicomponent graphite composite bipolar plates possess high electrical and mechanical properties.

SALIENT FEATURES:

- Low-cost and indigenously developed

STATUS OF COMMERCIALIZATION: Commercialized



DEVELOPMENT OF FREE STANDING AND FLEXIBLE CARBON NANOTUBE PAPER

INTRODUCTION:

Free-standing carbon nanotube (CNT) film (Bucky paper) is a very important material for various applications i.e. batteries electrode, supercapacitors, actuators, sensors, conducting reinforcement, EMI shielding, and structure application. A process has been developed to prepare different sizes of flexible CNT papers i.e. 10 cm die, 20 cm × 20 cm, and 35 cm x 35 cm. These thin free-standing papers are prepared by steps of dispersion, ultra-sonication, and vacuum filtration of CNTs.

APPLICATIONS:

- Technology is a cost-effective approach to the preparation of the flexible freestanding paper
- Utilizes low-cost ingredients in the processing
- The present technology is a cost-effective approach to the preparation of flexible free-standing paper by utilizing low-cost ingredients in the processing.

SALIENT FEATURES:

- Free-standing carbon nanotube (CNT) film finds wide application in batteries electrodes, supercapacitors, actuators, sensors, etc.
- Electrodes for Batteries and Fuel Cells Reinforcement Sheet
- EMI Shielding Materials for Aerospace and Automobiles
- Lightning Protection Armor Plating
- Thermal Heat sinks for Electronic Equipment Air and Liquid Filtration Systems



A COST-EFFECTIVE PROCESS FOR THE PRODUCTION OF HIGH-PURITY SOLAR SALT IN SOLAR SALT WORKS

INTRODUCTION:

The invention is related to a cost effective process for the manufacture of high purity solar salt in the field meeting all the global specifications. The process relates to an improved process for the preparation of solar salt from sea/ sub-soil/ lake brines which are the major sources of salt in the country. More specifically the invention relates to a cost-effective process for preparation of common salt wherein both the absolute purity as well as the ratio of Ca to Mg is important by the end users such as Chlor-alkali and soda ash industries.

ADVANTAGES:

- Sea brine or sub-soil brine, as the case may be, can be upgraded through the process of the invention to yield improved quality of solar salt with high absolute purity and also with desired Ca2+ to Mg+ ration directly in the field.
- The process is cost-effective as it involves the use of inexpensive alum at low dosage level as already reported in the prior art followed by a minor adjustment of pH with small quantity of hydrochloric acid which does not add significantly to cost.
- The process of the invention can be practiced in any solar salt works regardless of its size and location.

SALIENT FEATURES:

- High purity solar salt production in easy way
- Low cost of production



Solar Salt to 1,4-Naphthoquinone

WEARABLE METHANOL FUEL CELL POWER PACK FOR SOLDIERS

INTRODUCTION:

Hybrid power sources consisting of a fuel cell and a rechargeable battery have high potential for satisfying a wide variety of requirements for mobile/portable and silent power sources in the range of 20–2000W. Batteries are best suited for short mission durations (<24 h) at low power requirements (<20 W). Many approaches for smaller power sources (20–50 W) utilizing Proton
Exchange Membrane fuel cells have been explored and have shown high potential. As per the study, a soldier is carrying ~ 18 kgs of primary and secondary batteries for a short mission apart from his gadgets and riffle. This puts the soldier under certain limitations on his mission such as time duration and faster movement.

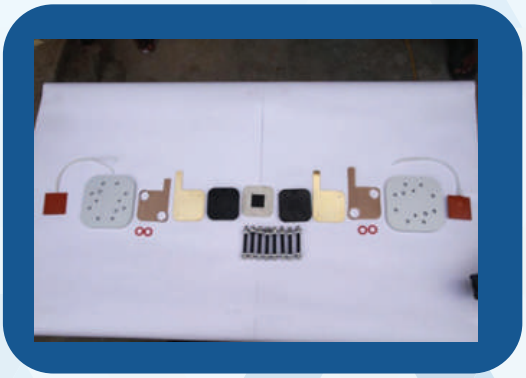
This project is to develop a wearable light weight portable power pack powered by Reformed Methanol Fuel cell delivers 50 watts of reliable power to energize the gadgets. Wearable RMFC power pack consists of five main components.

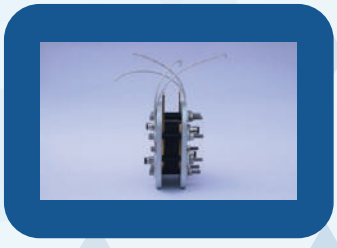
1) PEM fuel cell stack 2) Methanol Reformer 3) Control electronics 4) Power Manager and 5) Methanol Cartridge

ADVANTAGES:

- The present invention relates to a new catalyst and associated with a new process. The main application is the provision of hydrogen from methanol, formaldehyde or formic acid at room temperatures.
- The major novelty of this project is the reformer that reforms methanol mixture at room temperature and to fed the reformate gas as it is to a fuel cell stack with CO-tolerant membrane electrode assemblies**.**







SCALED-UP SYNTHESIS OF HIGH POWER LI-ION BATTERY MATERIALS-INDIGENOUS TECHNOLOGY DEVELOPMENT

INTRODUCTION:

High power Li-ion battery materials synthesis and scaling-up from milligram-scale to kilogram-scale is highly challenging. The key challenge is in retaining size-structure-performance correlation at all scales for indigenous technology development. In the project, the objectives are to develop synthesis methods for selected Li-ion battery cathode and anode materials that retain high energy density while delivering high power. The vision of the invention is to build the next generation energy storage devices with an excellent power density and high energy density for hybrid electric vehicles (HEV) and pure electric vehicles (EV).

SALIENT FEATURES:

- Normally, an ordinary mobile phone Li-ion battery can deliver less than 0.5 kW/kg power with respect to the weight of the battery. This invention tries to introduce nano-engineered high power Li-ion battery materials (both cathode and anode) that can deliver > 5 kW/kg power. India as a country is aspirating to achieve 100% electric vehicle (EV) sales by 2030, and can rise to become manufacturing hub for batteries.
- The deliverables include preparation of half-a-kilogram of cathode and anode materials that retains about 70% of its 1C rate specific capacity even at 60C rate and a comprehensive characterization of the materials ensuring the repeatability of the synthesis.
- Prototype of sol-gel process for the scaled-up synthesis of Li-ion battery materials developed at laboratory scale.

