# FICCI BHARAT R&D SUMMIT 2025

*Innovating Together:*
*Industry-Academia Collaboration*







## FICCI Compendium of Research Work/Technologies for Commercialization

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*Innovating Together: Industry-Academia Collaboration*







## FICCI Compendium of Research Work/Technologies for Commercialization

# Foreword



India's goal of becoming a global innovation hub depends on its ability to convert research excellence into viable solutions for national and global challenges. R&D is essential for building a sustainable, competitive economy. Fostering collaboration between industry and academia will be crucial to ensuring that scientific breakthroughs transition smoothly from the lab to the market.

FICCI Compendium of Research Works and Technologies for Commercialization 2025 present a vision for innovation, featuring over 50 technologies from esteemed academic and research institutions across India. This collection showcases the diversity of our innovation ecosystem, encompassing clean energy solutions, next-generation healthcare advancements, and initiatives in agriculture and food security that aim to empower farmers and ensure nutritional security. Additionally, the compendium covers critical areas such as defence, advanced robotics, water and waste management, and sustainable materials. Together, these innovations underscore the significant contributions of Indian research and development, aligning research outcomes with national priorities and global challenges.

This compendium is designed to serve as a bridge connecting innovators with industry leaders, policymakers, and investors. By providing a platform to showcase these technologies, it fosters the collaborations required to accelerate commercialization, scale solutions, and maximize societal and economic impact. The demonstrations at the FICCI Bharat R&D Summit 2025, along with the evaluation by the Industry Jury, further strengthen this bridge, offering invaluable feedback and enabling real opportunities for partnerships.

On behalf of FICCI, I commend the researchers and institutions whose pathbreaking work is featured in this edition. Their efforts represent the spirit of Atmanirbhar Bharat and reaffirm India's potential to shape solutions not only for herself but for the world. I am confident that this compendium will inspire stronger academia–industry synergies and play a significant role in advancing India's journey towards technology-driven growth.

**Jyoti Vij**
Director General,
FICCI


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# FICCI Compendium of Research Work/Technologies for Commercialization





# FICCI COMPENDIUM OF RESEARCH WORK/TECHNOLOGIES FOR COMMERCIALIZATION


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# 3-DOF BIONIC HAND WITH CONTROL-ASSIST MODE FUNCTIONALITY

## Key Facts:

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| **Product Maturity** | TRL 6: A working prototype is developed, tested with volunteers, and validated for multiple grasp patterns under real-use conditions. |
| **Product Discriminators** | Anthropometric Fit for Indian Population: First bionic hand designed specifically for Indian ergonomics. Multi-Mode Control: Combines EMG signals and voice-recognition for adaptability. Low Cost: significantly cheaper than imported bionic hands (>5-10 lakhs). Lightweight Design: Just 600 -800 g with electronics. Custom Modularity: Uses 3D printed parts (Nylon-12) and modular PCB for easy upgrades and repairs |
| **Current Commercial applications** | Currently at prototype stage. Tested with patient volunteers for clinical validation. Intended include: Prosthetic rehabilitation for amputees. Assistive device for individuals with neuromuscular impairment. Potential use in military and civilian trauma care Applications |

## Product/Technology/Innovation Brief:

The developed Bionic Hand is a cost-effective, lightweight (360 g), multi-degree-of-freedom prosthetic hand designed using Indian anthropometric data. It integrates EMG-based muscle signal control and voice-recognition modules to provide intuitive actuation. The system achieves multiple grasp patterns (pinch, full grasp, point, etc.), supports loads up to 400 g, and enhances accessibility for upper-limb amputees by combining modular mechanical design with low-cost control electronics



# ADAPTIVE VIBRATION CONTROL DEVICES USING MAGNETO-RHEOLOGICAL ELASTOMERS (MRE)

## Key Facts:

| | |
|---|---|
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| **Product Maturity** | TRL-4 |
| **Product Discriminators** | Innovative MRE Tech: Leverages cutting-edge Magnetorheological Elastomers (MRE) for a unique advantage in vibration control. Adaptive Damping: Real-time adaptability to diverse operational conditions ensures optimal performance. Efficiency & Resilience: Enhances seismic resilience, energy efficiency, and cost savings for reliable pipeline vibration control. |
| **Current Commercial applications** | Strategic sector |

## Product/Technology/Innovation Brief:

Development of a vibration control device using MRE to reduce the dynamic vibrations Adaptive vibration isolation device using MRE for seismic and dynamic vibration protection of structures and non-structural components (NCs)



# AI-IOT ENABLED JUTE FIBER GRADING SYSTEM

## Key Facts:

| | |
|---|---|
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| **Product Maturity** | TRL-9 |
| **Product Discriminators** | The AI-IoT enabled jute fibre grading system measures all the parameters of the jute fibre and displays final grade with MSP of the grade of the fibre. |
| **Current Commercial applications** | Instrument is not under commercial use. This instrument can be used at Departmental jute purchase centre, market and jute mill to grade fibre. |

## Product/Technology/Innovation Brief:

The AI-IoT enabled Jute fibre Grading developed for rapid, accurate and transparent grading of jute fibre. Instrument consists of a sample tray, feed roller, conveyor, image capturing unit, color measurement unit, and bundle strength unit. The conveyor moves the fibre at a fixed distance under the image capturing unit, which uses Raspberry Pi camera with a rolling shutter, captures images as the fibre passes under it. The bundle strength measurement unit features a fibre breaking unit with a limit switch, motors, an S-type load cell with an amplifier, and an Arduino microcontroller. This unit employs three motors: one to exert a constant loading rate through the jaw base, and the other two to facilitate the jaws to-and-fro motion. Among the five physical parameters of jute fiber, three are measured using an Artificial intelligence models, while two are measured using sensor-based technology. For the machine learning model, approximately 4000 datasets were created, with 2000 used to test the model. The instrument can test fibers within five minutes with an accuracy of 90%, outperforming traditional grading methods. The same instrument can be used for grading of Mesta and Bimli also



# ANAEROBIC GAS LIFT REACTOR (AGR) FOR ORGANIC SOLID WASTE TREATMENT

## Key Facts:

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|---|---|
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| **Product Maturity** | TRL 9 |
| **Product Discriminators** | Advanced high rate digester design (Two stage AD) Ammonia/ sulfide inhibition control mechanism Continuous mixing without mechanical equipment (pressure difference across the reactor used for mixing) Three phase (solid/liquid/gas) separation mechanism No scum formation Smaller digester volume per unit weight of waste Lower food print area Scaled up to 10 tons/day (Design capacity available from 150 kg/day to 10,000 kg/day) Semi-automatic plant operation Higher methane/biogas yield Generation of nutrient (NPK) rich fertilizer Odorless and noiseless performance with little or no maintenance Very good aesthetics Robust process design: can handle waste fluctuations in terms of hydraulic and organic load (both, underfeeding and overfeeding scenarios) Selection of special seed culture for inoculation, rapid start up, acclimatization of microbial culture for work at broad temperature range and fostering high organic solids break-down efficiency. App based performance tracking and reporting |
| **Current Commercial applications** | The biogas generated from the waste using AGR technology can be utilized either for LPG replacement as a cooking fuel or to generate off-grid electricity. Further, the biogas can be purified and upgraded to CBG, for utilization as vehicular fuel. |

## Product/Technology/Innovation Brief:

The Anaerobic Gas Lift Reactor (AGR), developed and patented by CSIR-IICT (Patent No. 307102), is a novel high-rate biomethanation system for ing organic solid waste into biogas and nutrient-rich bio-manure. The technology integrates a three-phase separation system, grit removal, and ammonia/sulphide inhibition control, ensuring stable operation and high efficiency. This technology is superior in terms of biogas and bio-manure production as it incorporates novel pre and post processing technologies required for the biomethanation of organic solid waste as per its characteristics. In the high-rate anaerobic digestion systems, maintenance of all the important parameters such as pH, F/M Ratio, C/N Ratio, temperature, inlet slurry concentration etc., is essential apart from gentle mixing of the slurry for efficient organic matter degradation and enhanced methane rich biogas. Therefore, the core design of AGR is based on mixing of slurry in the reactor without the external mechanical mixer and centered on liquid and gaseous hydrodynamics through pressure management across the digester. 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-based plants for the treatment of organic wastes at waste generation sources based on "AGR" would ensure a cleaner environment.



# AUTONOMOUS UAV/DRONE SYSTEM FOR GPS DENIED ENVIRNMENTS AND PRECISION LANDING WITH EXCEPTIONAL STABILITY.

## Key Facts:

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| **Product Maturity** | The proposed UAV system has achieved Technology Readiness Level (TRL) 6-7. A prototype has been designed, developed, and successfully demonstrated in relevant real-world conditions during ISRO IROCU 2025. The quadcopter equipped with the vision-based localization and precision landing modules demonstrated robust autonomous navigation in GPS-denied environments, maintaining |
| **Product Discriminators** | GPS-Free Autonomy Operates reliably in GPS-denied or jammed environments. High-Rate Localization (~200 Hz) Faster than conventional SLAM/VO systems (30-60 Hz). Wide Fisheye Stereo Vision Dual fisheye cameras (~160° FOV) capture more features, robust in feature-poor areas. Precision Landing Centimeter-level accuracy on small/moving platforms without GPS. Proven Validation Successfully demonstrated at ISRO IROCU 2025. |
| **Current Commercial applications** | Defense & Security: Autonomous reconnaissance in GPS-jammed/denied zones. Industrial Inspections: Navigation inside warehouses, mines, tunnels, and oil/gas facilities without GPS. Disaster Response: Search-and-rescue in collapsed buildings or forests where GPS signals are weak or unavailable. Commercialization Status: At present, the system is in pre-commercial pilot stage, with readiness for adoption by defense agencies, industrial operators, and research institutions. |

## Product/Technology/Innovation Brief:

The proposed system is an autonomous UAV/drone platform designed for reliable operation in GPS-denied environments while ensuring precision landing and exceptional flight stability. Unlike conventional drones that depend on GPS for navigation, this system integrates a vision-based localization algorithm with stereoscopic fisheye cameras operating at high frame rates (~200 Hz). The algorithm extracts and tracks image features across consecutive frames, computes real-time pose estimation, and enables robust navigation without GPS support. To complement localization, the system incorporates sensor fusion with inertial measurement units (IMUs), providing stable and drift-resistant flight control during agile maneuvers. A precision landing module leverages computer vision markers, visual-inertial odometry, and adaptive control algorithms to achieve accurate landings on small or moving platforms, even under challenging environmental conditions such as poor lighting, turbulence, or feature-scarce surfaces. The system has been validated in real-world scenarios (ISRO IROCU 2025), where a quadcopter equipped with dual fisheye cameras successfully navigated in GPS-denied conditions with



# BUXIN AI HEALTH-ASSIST

## Key Facts:

| | |
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| **Product Maturity** | Technology Readiness Level (TRL) : Functional prototype tested in laboratory and limited pilot environments. |
| **Product Discriminators** | AI-driven conversational interface for patient intake. Integrated biometric and sensor modules for real-time vitals. Secure data transfer and remote doctor consultation. â€¢ Modular design for deployment in hospitals, pharmacies, and public spaces. |
| **Current Commercial applications** | Early trials in private clinics for patient check-in and remote monitoring. |

## Product/Technology/Innovation Brief:

A smart health-assist kiosk that integrates AI-driven patient interaction and real-time diagnostics. The system features a large touchscreen interface with dual biometric scanning modules (fingerprint/temperature/oxygen sensors) and camera-based facial recognition for patient identification. It can collect vital signs, provide initial health assessments, and securely transmit patient data to doctors for remote consultation. Designed for hospitals, clinics, and community health centers, the kiosk reduces wait times and improves healthcare accessibility.



# EMERGENCY RETRIEVAL SYSTEM FOR POWERLINES

## Key Facts:

| | |
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| **Product Maturity** | TRL-8 |
| **Product Discriminators** | Cost is 40% of the imported system. |
| **Current Commercial applications** | Transmission and Powerline companies |

## Product/Technology/Innovation Brief:

ERS is a lightweight modular system that is used as temporary support structure to restore power immediately after the collapse of transmission line towers during natural calamities such as cyclone/earthquake, or manmade disruptions. ERS can be assembled quickly at the disaster site for restoration of power in 2-3 days, whereas the permanent restoration may take several weeks. This development is very significant as failure of transmission lines severely impact lives of common people and causes huge monetary loss to the power companies. As the total losses/damages are directly proportional to the outage duration, time is a crucial factor in reinstating or remediating the damaged/fallen structures. At present the ERS systems are imported. There are very few manufacturers across the world and the cost is relatively high. This technological development will enable the manufacturing in India which will be an import substitute and will cost about 40% of imported systems.



# ENHANCED BIOHYDROGEN PRODUCTION BY COMBINING DARK FERMENTATION WITH MICROBIAL ELECTROLYSIS CELL

## Key Facts:

| | |
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| **Product Maturity** | TRL 4 |
| **Product Discriminators** | The integrated Dark Fermentation Microbial Electrolysis Cell (DF-MEC) system offers several distinguishing features that set it apart from conventional hydrogen production and competing biohydrogen technologies: Two-Stage Synergy Unlike standalone DF (low yields) or MEC (high energy demand), the DF-MEC system complements each stage, leading to significantly higher overall hydrogen recovery. Low Energy Input MEC operation requires only a small external voltage. |

## Product/Technology/Innovation Brief:

The proposed research focuses on enhanced biohydrogen production through an integrated two-stage process combining Dark Fermentation (DF) with a Microbial Electrolysis Cell (MEC). In the first stage, DF utilizes organic-rich substrates such as fruit and agro-wastes to generate hydrogen along with volatile fatty acids (VFAs) as by-products. These VFAs are subsequently channeled into the MEC, where electroactive microbes further oxidize them, releasing additional hydrogen under a small applied voltage. This synergistic DF-MEC configuration significantly improves overall hydrogen yield compared to standalone processes, while also ensuring better substrate utilization and waste minimization. The approach addresses the challenges of low hydrogen recovery in DF and high energy input in MEC, thereby offering a sustainable, cost-effective, and scalable biohydrogen production strategy. The technology has strong potential for deployment in decentralized renewable energy systems and integration into waste-to-energy frameworks.



# FARMEASY

## Key Facts:

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|---|---|
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| **Product Maturity** | Technology Readiness Level (TRL): 2 to 3 Beta Tested prototype available at: https://farmeasy-ch.netlify.app/login. Currently at Lab Prototype with market validation study done with target audience at ground level. |
| **Product Discriminators** | FarmEasy is unique and different in its own way than its competitors in the following ways: Unlike DeHaat, which is a medium to help farmers sell it to consumers we are a direct platform for the farmers to sell. We are also working along with government officials who already exist to help the farmers, requiring fewer capital investments in creating technology for soil testing, resource providing, unlike other companies who provide solutions on their own. Our differentiator is we aim to empower farmers, not just with opportunities, but also with knowledge and awareness. |

## Product/Technology/Innovation Brief:

Indias agricultural sector faces significant challenges, including outdated farming practices, limited access to scientific knowledge, and poor connectivity between farmers and agricultural institutions. FarmEasy addresses these issues by creating a digital platform that connects farmers with Krishi Vigyan Kendras (KVKs), government resources, suppliers, and markets. FarmEasy bridges the digital divide in rural India by providing real-time advisory services, training programs, and access to agricultural inputs, all through an easy to-use multilingual interface.



# FERTILITY PREDICTOR: A MACHINE LEARNING BASED WEB TOOL FOR THE PREDICTION OF ASSISTED REPRODUCTION OUTCOMES IN MEN WITH Y CHROMOSOME MICRODELETIONS

## Key Facts:

| | |
|---|---|
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|---|---|
| **Product Maturity** | The technology currently stands at Technology Readiness Level (TRL) 7, having successfully advanced from proof-of-concept and laboratory validation to a prototype that has been demonstrated in an operational environment. A PCR-based detection kit has been developed in collaboration with ICMR and is now market-ready, with robust validation supporting its clinical applicability. This positioning at TRL 7 reflects the maturity of the product for real-world deployment, while also allowing for continued optimization and scale-up to meet broader clinical and regulatory requirements. |
| **Product Discriminators** | AI-powered predictive modeling: Unlike conventional diagnostic kits, FertilitY Predictor incorporates supervised machine learning algorithms that enhance predictive accuracy. b. Integration of genomic and clinical data: The system uniquely combines Y chromosome microdeletion profiles with patient-specific clinical variables, ensuring context-driven predictions. c. User-friendly interface: Designed for clinical deployment, the interface is intuitive and compatible with standard laboratory workflows. d. Clinical impact: Provides evidence-based predictions that help clinicians counsel patients more effectively, reduce uncertainty, and tailor ART interventions. |

## Product/Technology/Innovation Brief:

FertilitY Predictor is a machine learning driven diagnostic and prognostic platform designed to predict assisted reproductive outcomes in men with Y chromosome microdeletions. This technology integrates genomic data with advanced predictive modeling to support clinicians in decision-making, optimize treatment strategies, and improve success rates of assisted reproductive technologies (ART). By providing personalized insights into fertility potential, the tool bridges the gap between genetic diagnostics and actionable clinical outcomes.



# FLAME RETARDANT COATING FOR FABRIC AND WOOD

## Key Facts:

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| **Innovator's Name** | Dr. Sudeshna Ray |
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| **Mobile No** | 7566416432 |

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| **Product Maturity** | TRL 3 |
| **Product Discriminators** | The fabrication process of our waterborne, non-toxic indigenous coating, is simple and can be prepared without any complex reaction. The process does not require any expensive chemical and is scalable in nature. The engineered coating has excellent flame retardancy due to the synergistic effect of the inorganic phosphate and the amorphous filler. The interplay between these ingredients makes a strong char layer during the burning and provides enhanced protection and insulation of the substrate from the heat and oxygen. The coating possesses a strong adhesion on cotton fabric, silk fabric and wood. Smoke supression is another significant aspect of this coating. |
| **Current Commercial applications** | under trial |

## Product/Technology/Innovation Brief:

Indigenous development of an improved waterborne non-toxic flame retardant coating formulation, which functionalizes the surface of a few porous substrates such as fabric and wood to impart the localized flame retardant property at the exterior of the substrates, has been carried out. In order to preserve the bulk properties of the substrate, minimum amount of this flame retardant additive was used to modify the surface of the substrates to exhibit the required performance. The low-cost, easily scalable flame retardant formulation comprises of a mixture of inorganic acid and phosphate reinforced with an amorphous filler, creating a char layer during burning. The formed char layer acting as a physical barrier between the substrate and the fire, insulates the substrate from heat and oxygen. The formulation is a non-toxic flame retardant and it does not contain any halogenated compounds. The formulation when coated on the surfaces of the porous substrates such as fabric and wood by a scalable technique such as Dip-coating or coating using roller, was found to be sufficiently effective to cut down the fire or even catching the fire from the flame of a candle. The significant attributes of the product are as follows: The coating process does not require any surface preparation except cleaning of dust and oil. It can protect from any mode of fire and sustains high temperature. Good adhesion of the coating on the porous substrates dries to the touch approximately 5-6 hours after application and cures thoroughly in 48 hours in ambient temperature.



# FLOATECH: A FLOATING FOUNDATION TECHNOLOGY FOR OFFSHORE RENEWABLE ENERGY STRUCTURES

## Key Facts:

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| **Innovator's Name** | Dr. K.Sathish Kumar |
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| **Product Maturity** | TRL-4 |
| **Product Discriminators** | 1.The hybrid platform combines solar panels and VAWTs to harness energy day and night. This dual-source setup ensures steadier power output and reduces grid supply fluctuations. 2. VAWTs can be placed closer together than HAWTs, filling unused gaps in offshore wind farms. This boosts power density and maximizes electricity generation per square kilometre. 3.VAWTs have a low center of gravity and base-mounted components, enhancing platform stability. Maintenance is safer and simpler, cutting costs and reducing downtime. 4.Floating platforms unlock deep-water wind potential, tapping stronger, steadier energy sources. They bypass shallow-water limits, reaching areas inaccessible to fixed-bottom turbines. 5.Offshore placement reduces visual and noise impact, preserving coastal aesthetics and tranquility. This addresses community concerns often raised with near-shore wind farms. |
| **Current Commercial applications** | Renewable Energy Sector |

## Product/Technology/Innovation Brief:

This technology is fundamentally a product, a fully integrated, tangible system designed for offshore renewable energy generation. It is a scalable and manufacturable platform composed of specific, engineered components: a truss structure, four cylindrical pontoons, and heave cylinders. This physical product is designed to be fabricated, assembled and deployed as a self-contained unit capable of capturing both wind and solar energy simultaneously.



# GREEN HYDROGEN PRODUCTION USING ELECTRICITY PRODUCED FROM WASTE-WATER

## Key Facts:

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| **Innovator's Name** | Dr. V. K. Jain |
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| **Address** | Amity University, Sector-125<br>Noida |
| **Email** | vkjain@amity.edu |
| **Mobile No** | 9818897783 |

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| **Product Maturity** | TRL 5 |
| **Product Discriminators** | We have developed a unique, self-sustained system that: *Requires only two specially designed electrodes *Generates electricity when immersed in wastewater. *Operates without any external power source. *Generated electricity used for production of Green Hydrogen. *System is also capable of self purification of waste water. *Designed for maximum efficiency with a specialized electrode configuration |

## Product/Technology/Innovation Brief:

Our innovative system generates electricity from wastewater, which is then utilized for highly cost-effective green hydrogen production.



# HIGH VELOCITY MULTI-HIT RESISTANT MOVABLE PROTECTIVE BOOTH/SHACK FOR SECURITY PERSONNEL

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. K. Sathish Kumar |
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| **Mobile No** | 9444054917 |

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| **Product Maturity** | TRL-4 |
| **Product Discriminators** | Multi-impact resistant (NIJ level-3) - Pre-engineered & pre solution - Easy to assemble and dismantle in about an hour - No need of heavy machinery for assembly - Easy to repair, reuse and replace - Fully indigenous modular construction - Better ricochet resistance - Mobility and positioning - Cost-effective - Aesthetic look |
| **Current Commercial applications** | CISF, CAPF, CRPF, BSF Defence agencies, Embassies, Airport authorities so on |

## Product/Technology/Innovation Brief:

CSIR-SERC has developed a booth/shack for military and security personnel. The security booth is modular type and made up of steel fibre reinforced cementitious composite panels fixed in steel frame. The developed booth has been designed for providing NIJ level-III protection against multiple hits of 7.62 AP projectiles as per NIJ standard.



# HNB9- TALAROMYCES ALBOBIVERTICILLIUS HNB9: A PATENTED NOVEL ROOT-COLONIZING, PHOSPHATE-SOLUBILIZING FUNGUS WITH PLANT GROWTH PROMOTION & YIELD ENHANCEMENT PROPERTIES

## Key Facts:

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| **Innovator's Name** | Prof. Amit Kharkwal |
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| **Product Maturity** | TRL 5 Technology validated in relevant environment (greenhouse / small field trials). (One non-exclusive technology transfer completed in 2022 to an industry partner for pilot scale-up and formulation.) |
| **Product Discriminators** | Root endophytism (internal colonization): persistent colonization delivering sustained nutrient transfer and root growth effects beyond rhizospheric interactions. Multi-nutrient solubilizer: demonstrable solubilization of phosphorus, zinc and silica addressing macro and micronutrient limitations simultaneously. Auxin production: biochemical enhancement of root architecture and elongation via auxin synthesis. Ammonia production (distinct): HNB9 produces ammonia, contributing to local nitrogen availability in the rhizosphere/endosphere and supporting early seedling nitrogen nutrition. Patented strain & characterized production: protected IP with characterized strain, standardized cultivation and QC methods. Consortium compatibility: forms effective consortia with selected Bacillus and Pseudomonas strains and ciliated protists (where tested), expanding functional use-cases (biofertility + bio-control). Field trial evidence: greenhouse and pilot-field data show consistent vigor and yield gains in target crops (vegetable and field crops). |
| **Current Commercial applications** | Pilot/commercialization status: One non-exclusive technology transfer was uted in 2022 for pilot scale-up and formulation development. Since transfer, licensee(s) have completed greenhouse validations and limited multi-location pilot field evaluations formal commercial roll-out depends on formulation, registration and scale-up completion. Use cases demonstrated: seed treatment and root dip for vegetables and select field crops increases in seedling vigor, root biomass and early growth metrics reported from greenhouse and pilot trials. |

## Product/Technology/Innovation Brief:

HNB9 is a patented, axenically-cultivated root-colonizing fungal endophyte (Talaromyces albobiverticillius HNB9) developed as a biofertilizer and plant growth promoter. HNB9 solubilizes phosphate, zinc and silica, produces ammonia and auxin (Indole-3-acetic acid) and other growth-modulating metabolites, and establishes an endophytic association with crop roots. Application (seed treatment, root dip, soil incorporation) increases root biomass, nutrient uptake efficiency and crop tolerance to selected biotic and abiotic stresses. HNB9 is compatible with select beneficial bacteria and can form part of microbial consortia for combined nutrient and pest management.



# HYBRIDIZATION OF TRUMPET WIND TURBINE AND ARCHIMEDES WIND TURBINE FOR MEDIUM WIND SPEED REGIONS

## Key Facts:

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| **Innovator's Name** | Dr. Anirbid Sircar |
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| **Product Maturity** | At present, the study has reached Technology Readiness Level (TRL) 8, indicating that the product has been fully developed, rigorously tested, and is ready for commercial adoption. Extensive laboratory validation has been complemented with near-operational demonstrations, ensuring reliability and reproducibility of results across diverse food samples. The analytical framework encompassing spectroscopic, chromatographic, and mass-based techniques has been standardized, and all performance benchmarks have been met. The product is therefore on the verge of commercialization, requiring only final regulatory approvals and scaling for routine deployment in food safety and quality assurance settings. |
| **Product Discriminators** | The distinguishing feature of this research is its multi-instrument, cross-validated methodology for opiate detection in food. Unlike conventional single-technique analyses, this approach integrates FTIR for functional group identification, UV-Vis for concentration profiling, NMR for structural confirmation, and multiple chromatographic tools for separation and quantification. Such triangulation improves accuracy and reliability. Additionally, systematic evaluation of seed dose, temperature effects, and processing conditions makes this methodology more robust compared to traditional food safety screening. |
| **Current Commercial applications** | At this stage, the methodology is not in commercial use. However, it has strong application potential in food quality assurance laboratories, drug regulatory authorities, and food processing industries. It can be adapted to establish safety standards for poppy seedâ€“based food products and ensure compliance with narcotic safety regulations. |

## Product/Technology/Innovation Brief:

The proposed research focuses on the detection and analysis of morphine and related opiate alkaloids in food samples containing poppy seeds collected from the Gandhinagar region. The methodology integrates advanced analytical techniques including FTIR, NMR, Mass Spectrometry, UV-Vis spectroscopy, and multiple chromatographic tools (GC-MS, HPTLC, LC-MS) to characterize and quantify morphine and codeine levels. Experimental studies examine the effects of dosage, processing, and temperature on morphine content, while also establishing correlations with external interferences. This integrated analytical approach not only aids in identifying opiate presence in food but also provides insights into safe consumption levels and quality standards.



# HYBRIDIZATION OF TRUMPET WIND TURBINE AND ARCHIMEDES WIND TURBINE FOR MEDIUM WIND SPEED REGIONS

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. Anirbid Sircar |
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| **Mobile No** | 9924430525 |

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| **Product Maturity** | The technology is presently at a mid-level TRL (6). Numerical modelling and CFD analyses validate the aerodynamic efficiency of the hybrid design, and sensor-based instrumentation for wind speed, pressure, and temperature provides experimental feedback for optimization. Prototype-level validation is ongoing, but large-scale commercial deployment has yet to be demonstrated as the prototype is on verge of commercialization. |
| **Product Discriminators** | Unlike conventional horizontal-axis wind turbines, which are less effective in moderate wind regimes, this system combines aerodynamic funnelling with a high-efficiency spiral rotor. The 60Â° blade angle optimizes lift-to-drag ratio, and the integrated sensor system enables adaptive fine-tuning. Together, these features yield higher power density, quieter operation, and multi-directional wind capture compared to conventional turbines. |
| **Current Commercial applications** | Commercial deployment has not yet occurred however, the design has clear potential for residential rooftops, agricultural pumping systems, and small industrial units in medium wind speed zones like Gujarat. Pilot studies and scaled prototypes are envisioned as the next stage toward commercial use. |

## Product/Technology/Innovation Brief:

The hybrid wind energy system integrates a trumpet-shaped wind concentrator with an Archimedes spiral rotor to enhance power generation in medium wind speed regions. The trumpet section channels and accelerates incoming wind through a convergingâ€“diverging profile, while the Archimedes rotor, with optimally angled blades, ensures smooth, quiet, and efficient energy conversion. This configuration increases torque and power output while maintaining low turbulence, making it highly suitable for decentralized power generation.



# HYDROGEN BLENDING INTO THE NATURAL GAS {IPELINE INFRASTRUCTURE

## Key Facts:

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| **Product Maturity** | The technology is at Technology Readiness Level (TRL) 8 having advanced from laboratory experimentation to system demonstration in relevant operating environments. Repeated trials under varied hydrogen concentrations, controlled pressures, and real burner conditions have validated the stability and reliability of the blending process. The system is therefore considered ready for industrial adoption, requiring only scaling and regulatory clearance for utility-level deployment. |
| **Product Discriminators** | Key features that distinguish this technology from competing approaches include its incremental blending methodology (testing in 1% increments between 15%-30%), comprehensive thermal efficiency comparisons, and integration of real-time monitoring systems. Unlike conventional blending studies that rely on fixed ratios, this platform enables fine-tuned optimization depending on infrastructure resilience and safety standards. Observed advantages include faster heating times, bluish stable flame characteristics, and improved energy efficiency compared to pure methane combustion. |
| **Current Commercial applications** | While not yet in active commercial service, the technology has been successfully validated in controlled pilot setups, replicating real-world CGD operating conditions. Its immediate commercial potential lies in city gas distribution networks, industrial heat applications, and hydrogen economy demonstration projects, particularly in regions where emission reduction mandates align with blended gas adoption. |

## Product/Technology/Innovation Brief:

The developed technology demonstrates hydrogen blending into natural gas pipeline infrastructure as a near-commercial solution for decarbonizing the energy sector. Controlled experiments have been conducted across hydrogen blending ratios from 0% to 30%, with specific emphasis on operational testing at 26% H-HA,,. The system integrates blending reactors, mass flow controllers, and safety instrumentation to ensure consistent mixing and stable delivery. Experimental validations confirm significant thermal performance improvements and reduced greenhouse gas emissions. For instance, heating trials showed that 1 L of demineralized water could be raised from ambient (~32°C) to 70°C within ~196 s using a 26% hydrogen blend, compared to longer heating times with pure methane. This demonstrates not only efficiency gains but also direct applicability to India's city gas distribution (CGD) networks and industrial combustion systems.



# INDIGENIZED PROCESS FOR CARBOMER 971P AND CARBOMER 980

## Key Facts:

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| **Innovator's Name** | Dr. Arindam Chakrabarty |
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| **Product Maturity** | TRL 9 |
| **Product Discriminators** | Medium viscosity range (4000-10000cP at 0.5% concentration)- Carbomer 971P High viscosity range (40,000-60,000 cP at 0.5% concentration)- Carbomer 980 High carboxylic acid content (56-68%) Meets USP/NF pharmaceutical standards Low impurity levels (heavy metals. |
| **Current Commercial applications** | Carbomer 971P, being a pharmaceutical-grade polymer, is widely used in controlled drug delivery systems, oral suspensions, topical gels, and ophthalmic formulations due to its ability to swell in water, provide bio-adhesion, and control drug release, thereby improving therapeutic efficiency, patient compliance, and overall treatment outcomes. Its contribution is particularly important for pediatric and geriatric patients who rely on suspensions or slow-release medications, making it a key excipient in advancing modern healthcare and enhancing quality of life. On the other hand, Carbomer 980 finds its greatest utility in cosmetics, personal care products, and topical pharmaceuticals, where it serves as a thickening, stabilizing, and gelling agent in creams, lotions, facial gels, and hair products, providing clarity, smooth texture, and pleasant sensory properties. Its social impact became especially significant during the COVID-19 pandemic when it was a crucial component of hand sanitizers, thereby directly contributing to public hygiene and global health. Beyond this, Carbomer 980 supports the beauty and skincare industry, shaping cultural practices, consumer behavior, and individual confidence through the availability of affordable and effective products. Together, Carbomer 971P and Carbomer 980 highlight how advanced polymer chemistry plays a dual role in improving healthcare outcomes while also influencing social well-being, hygiene, and lifestyle practices. |

## Product/Technology/Innovation Brief:

Carbomer 971P and Carbomer 980 are both members of the carbomer family, which are high molecular weight, crosslinked polyacrylic acid polymers widely used as rheology modifiers, suspending agents, and thickening agents. It is a white, fluffy polymer powder that forms clear, high-viscosity gels upon neutralization. Although they belong to the same class of polymers, their applications and specifications vary depending on their grade and intended use. The carbomer family is commercially marketed under the brand name Carbopol, introduced by Lubrizol, the company that first pioneered this technology. Carbomer 971P is a pharmaceutical-grade carbomer, manufactured under strict practices, and complies with pharmaceutical standards. Carbomer 971P is particularly valuable in drug delivery systems. Carbomer 980, on the other hand, is more commonly applied in the cosmetic and personal care industry. Carbomer 980 is widely used in products like hand sanitizers, hair gels, facial creams, and lotions. It not only improves the texture and spreadability of formulations but also ensures the suspension of insoluble ingredients, leading to enhanced stability and user experience. In the preparation of Carbopol products, benzene, which is a Class 1 solvent, has traditionally been employed. However, due to its toxicity, associated health hazards, and strict regulatory restrictions in several countries, there is a growing need to replace it with Class 2 or Class 3 solvents, along with the development of suitable polymerization processes for Carbomer production. Therefore, we identified this as a potential scope for R&D and investigated the use of Class 2 solvents, such as cyclohexane, and Class 3 solvents, such as ethyl acetate, in combination with a suitable polymerization process. This effort successfully led to the development of a laboratory-scale process for the preparation of Carbomers, where low-toxic potential and less risky solvents were used.



# INDIGENOUS TECHNOLOGY DEVELOPMENT FOR THE SYNTHESIS OF HYDRAZINE HYDRATE FROM LAB SCALE TO COMMERCIAL SCALE.

## Key Facts:

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| **Innovator's Name** | Dr. Sreepriya Vedantam |
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| **Product Maturity** | TRL 9 |
| **Product Discriminators** | First-time production in India by peroxide route Innovative, novel, and patentable process >90% recovery and recycling (clean & green) Energy efficient operations Import substitution capability Foreign exchange savings Commercially viable technology |
| **Current Commercial applications** | Hydrazine Hydrate is used as a starting product in strategic sector as - Rocket fuel Agrochemical Pharmaceutical Automotive & Leisure industry |

## Product/Technology/Innovation Brief:

An innovative, novel process for producing hydrazine hydrate through peroxide route, representing Indias first indigenous production technology. CSIR-IICT has developed an indigenous technology, for 80% Hydrazine Hydrate and licensed it to GACL for a capacity of 10,000 TPA. Initial trials have been carried out for 40% Hydrazine Hydrate for 100g/h capacity at IICT facility. Later the pilot plant for 80% H.H for 12Kg/h capacity was established at GACL.



# INNOVATIVE FOUR STROKE ENGINE

## Key Facts:

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| **Innovator's Name** | Dr. Dinesh Kumar Soni |
| **Name of the Institution** | Rabindranath Tagore University, Raisen (MP) |
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| **Email** | dineshkumar.soni@rntu.ac.in |
| **Mobile No** | 9424412177, 8103814655 |

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| **Product Maturity** | It is a patented technology of Rabindranath Tagore University and ready to use in air compressor industries. Although, it requires pre testing before going to Automobile industries. The Technology Readiness Level (TRL) is 4-5. |
| **Product Discriminators** | Key Features: - 1. It can produce double power for same amount of fuel consumptions, therefore to achieve same amount of power, fuel consumption has to be reduced. 2. It will reduce environmental pollution due to less amount of fuel consumption. 3. It will reduce maintenance cost due to reduction in moving parts such as crank connecting rod, joints etc. 4. It will reduce electricity consumption in case of air compressors. 5. In case of multi cylinder engine, the numbers of engine will get half, which reduces material cost. |

## Product/Technology/Innovation Brief:

A Four stroke engine comprises Suction stroke, Compression stroke, Power Stroke and Exhaust stroke. One stroke takes 180° of the crank rotation, where crank rotates in circular motion. So, one cycle of four stroke engine uses 720° to cover all four strokes. An innovative Four Stroke Engine has been developed by Dr. Dinesh Kumar Soni, professor of Core Research and Innovation Group, and Mechanical Engineering Department of Rabindranath Tagore University, Raisen (MP). In the invented Engine, the piston covers ends (stroke) by taking only 90° rotation of the elliptical crank and complete all four strokes in 360° rotation of the elliptical crank. Therefore, the invented mechanism produces all four strokes in just half crank revolution (360°) than conventional engines (720°). Which helps to produce same amount of power in half crank revolution. It means, engine can produce double power during 720° revolution of crank. This resulted to make it more powerful engine than conventional engine. This mechanism is also helpful in air compressor technologies. For example, if an air compressor will take 1 hour to fill full tank, than the invented mechanism will take 30 - 40 minutes to fill the full tank. Thus, it saves time and electricity consumption of the customer.



# JUTE LEAF DRINK (A HERBAL DRINK FROM JUTE LEAF)

## Key Facts:

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| **Innovator's Name** | Dr. Deb Prasad Ray |
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| **Product Maturity** | TRL-7 |
| **Product Discriminators** | An antioxidant rich non-tannin, non-alcoholic beverage, commercialized as the brand AMATA |
| **Current Commercial applications** | It is licensed to three different entrepreneurs. However, it has been commercialized to Divulge, Kolkata as the Brand AMATA |

## Product/Technology/Innovation Brief:

Jute is a popular commercial crop cultivated in many eastern states of India. Around 40 lakh farm families are actively involved in jute cultivation system in India. The golden fibre plant, conventionally grown for preparation of ropes, bags, hessians, sacks etc. surges huge economic returns for the country. Jute sticks are used as fuel for domestic purpose while jute leaves are mostly wasted in the field itself or used as fodder. In many states of India jute leaves are consumed as leafy vegetable due to its high nutritional and medicinal value. The scientists of ICAR-NINFET have invented an herbal drink with the financial support of National Jute Board, Ministry of Textiles, Govt. of India using jute leaves and filed a patent on 'JUTE LEAF DRINK's (Patent application No. 202231008472) and the drink has also been registered at FSSAI (Registration No. 22821042000998). Several awareness programmes have been conducted on the 'Jute Leaf Drink's and the beverage has been appreciated at various fronts. MERITS OF JUTE LEAF DRINK: Jute leaf contains 3.9% of Protein, Vitamins (A, D, E, B-Complex) 35-40 mcg/100g, richin Beta-carotene and minerals. Jute leaf tea contains good amount of antioxidants which help to increase immunity (DPPH scavenging activity 95%, TPC 50 mg/g, FRAP 2.5 mg/g ascorbic acid equivalent, Tannic acid content 8.10 mg/g). Regular consumption of jute leaf drink helps to control the diseases like diabetes, high blood pressure and blood sugar. ECONOMIC BENEFITS: Around 500 kg of jute leaves per ha can be harvested. A farmer can earn additional income of Rs. 20000-25000 per ha of jute area. Jute leaves can be dried and preserved by using solar energy. It will create high potential of dried and preserved jute leaf in national and international market. Export of jute leaf-based products may open a new vista in the near future. Manufacturing process: The processing of jute leaf drink begins with plucking fresh green jute leaves, which are then cleaned thoroughly with water to remove dirt and impurities. The cleaned leaves are rinsed for about two hours to ensure proper washing before being dried in a semi-shaded area for two days, allowing them to retain their natural color and nutrients. Once dried, the leaves are processed under optimized conditions to preserve their quality and enhance flavor. They are then mechanically kneaded to achieve the desired size and texture. The prepared leaves are packed into tea bags along with selected additive supplements for improved taste and nutritional value. To prepare the drink, the tea bag is dipped in hot water, and finally, the pouch is rinsed in hot water to extract its essence, resulting in a refreshing and healthy jute leaf drink.



# JUTE-BASED INNOVATIVE APPAREL AND HOME TEXTILES

## Key Facts:

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| **Product Maturity** | TRL 5 |
| **Product Discriminators** | (i) Jute/acrylic fibres blended knitted fabrics are suitable for apparel and home textiles. (ii) Jute/cotton fibres blended woven textile is suitable for apparel garment. (iii) Jute/polyester fibres blended fabrics are suitable for Carpet and Dhurry |
| **Current Commercial applications** | The technology has been licensed to M/s Gloster Limited, Kolkata and they have produced initial products for the new market. |

## Product/Technology/Innovation Brief:

Jute, 2 nd important commercial natural fibre crop, is mainly used for packaging of foodgrains, sugar and as a shopping bag. Jute fabrics are not used in apparel and home textiles, due to its limitation of hard, rigid and heavyweight along with prickling effect. ICAR-NINFET, Kolkata has developed processes of modification of jute, jute-blended yarn (cotton, acrylic, polyester), and fabric for development of value-added apparel and home woven as well as knitted textiles.



# KAMDHENU NATURAL GAS MODEL: ESCALATING METHANIZATION IN OLD CONVENTIONAL BIOGAS UNITS USING IPOMOEA CARNEA (BESHARAM) AND PARTHENIUM HYSTEROPHORUS (GAJAR GHAS).

## Key Facts:

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| **Product Maturity** | TRL 3-4 (Validated in operational biogas units at Saiyadpur, Khandwa district, with small-scale pilot demonstrations and field trials.) |
| **Product Discriminators** | Utilizes invasive weed species (Ipomoea carnea and Parthenium hysterophorus) as biomass feedstock. Increases biogas yield by 20-30% compared to traditional cow dung digesters. Provides sustained methane production (18-20 hrs) with improved flame quality. Introduces a low-cost, portable storage system for rural/remote energy use. Reduces ecological damage caused by invasive species while addressing rural energy scarcity. Supports decentralized, community-driven renewable energy adoption |
| **Current Commercial applications** | Currently at pilot and demonstration stage, with trials conducted in Madhya Pradesh. Potential applications include: Household & community cooking fuel (replacement for LPG/firewood). Rural decentralized energy models. Organic manure generation from nutrient-rich slurry. Portable storage for off-grid clean energy supply. |

## Product/Technology/Innovation Brief:

The research focuses on enhancing biogas production from conventional cow dung based units by integrating invasive weeds Ipomoea carnea (Besharam) and Parthenium hysterophorus (Gajar Ghas). These plants, when co-digested with cow dung, improve methanogenesis efficiency, biogas yield, and methane concentration. The model also incorporates a portable biogas storage system using modified vehicle tire tubes, enabling decentralized and affordable energy access for rural households. The innovation transforms environmental pests into valuable renewable energy feedstock while supporting rural sustainability and circular economy.



# LOW COST, LIGHTWEIGHT SANDWICH SECROBUILT WALL PANEL FOR HOUSING

## Key Facts:

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| **Innovator's Name** | Dr. K. Sathish Kumar |
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| **Product Maturity** | TRL-5 |
| **Product Discriminators** | Fast, Durable and cost-effective pre building system produced in factories. Seismic resilience building system. Low cost and only experimentally proven system in India. Lightweight, thermally insulated energy efficient system. Readily available for deployment |
| **Current Commercial applications** | Housing for all |

## Product/Technology/Innovation Brief:

CSIR-SERC has developed a SECROBuilt technology in which. The lightweight panel is fabricated with ferrocement skins at the extreme surfaces and interfaced with composite connector system which ensured the structural efficiency of panel for both walls and roofs. The cost of construction is coming down compared to conventional building construction. CSIR-SERC has conducted numerous experimental and numerical investigations and improved the mental accessibility of engineers from MSME, entrepreneurs and pre industries. This developed technology from CSIR-SERC has a potential to deliver a housing at an affordable price.



# MCMG-270 SEMI-AUTOMATED MACHINE GUN WITH MEMS-AIMED SMART SYSTEM AND HIGH-TORQUE MULTI-AXISÂ ACTUATION

## Key Facts:

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| **Innovator's Name** | Mr. Mehul Sharma |
| **Name of the Institution** | Sharda University |
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| **Mobile No** | 7017689278 |

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| **Product Maturity** | The system is at TRL 4-5. Subsystems such as actuators and motion tracking are prototyped and tested in simulation. Hardware integration, firing mechanism validation, and field trials are in progress. Theoretical design for full operation is complete, and a functional prototype is expected within the next development cycle. |
| **Product Discriminators** | The process is microbe medicated and hence sustainable, environment friendly and not energy intensive |
| **Current Commercial applications** | Currently in prototype stage for frontline defence use. Designed for high-threat and hostile environments fast, survivable response against aerial & ground threats in active combat zones. Ideal for anti-drone engagements, perimeter denial during incursions, force protection at forward operating bases, and safeguarding critical infrastructure under direct attack. Also adaptable for paramilitary and tactical training in extreme operational conditions. |

## Product/Technology/Innovation Brief:

MCMG270 is a motion-controlled, multi-barrel automated turret system featuring MEMS-based orientation tracking, triggered firing, and high-torque load-bearing actuators. It combines lightweight modular design with advanced control algorithms to provide rapid, precise, and autonomous threat response in defense and surveillance applications.



# MICROBE MEDIATED KERATIN EXTRACTION FROM SHEEP WOOL AND ITS APPLICATION IN COSMETICS

## Key Facts:

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| **Innovator's Name** | Dr. Avijit Das |
| **Name of the Institution** | ICAR-National Institute of Natural Fibre Engineering and Technology |
| **Address** | ICAR-NINFET,12 REGENT PARK<br>KOLKATA 700040 |
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| **Mobile No** | 7059321946 |

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|---|---|
| **Product Maturity** | TRL-6 |
| **Product Discriminators** | The process is microbe medicated and hence sustainable, environment friendly and not energy intensive |

## Product/Technology/Innovation Brief:

An eco-friendly sustainable protocol has been developed for extraction of keratin from animal hair. Keratins have immense application in pharmaceutical and cosmetic industries. Wool contains about 95% keratin. Waste wool which includes coarse wool as well as trims from wool industry may serve as excellent source of keratin. Keratins are highly insoluble and needs harsh treatments for solubilisation. Such treatments sometimes result in degradation and or modification of the protein thus limiting its use. Keratins can also be solubilised by keratinase, a proteolytic enzyme abundantly present in microbes. Such protocols are energy economic and sustainable. We isolated a keratinase positive bacterial culture from poultry shop waste which when incubated with trimmed sheep wool under specified conditions results in about 56-70% solubilisation of keratin. Keratins so extracted are of high quality as evidenced by distinct bands formed on SDS-PAGE electropherogram. FTIR analysis showed that keratins thus produced gave peaks typical of polypeptide. MALDI TOF MS analysis of the extracted protein showed that the protein is indeed a keratin. Such keratins were utilized for preparing biofilm, body cream and hair nourishing oil.



# MICROBIAL DESALINATION CELL

## Key Facts:

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|---|---|
| **Innovator's Name** | Mr. Rahul Kumar Mishra |
| **Name of the Institution** | Sharda University |
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| **Product Maturity** | The current MDC design is at Technology Readiness Level (TRL) 4-5: laboratory-scale validation of integrated desalination and wastewater treatment has been demonstrated with successful desalination of synthetic saline water and removal of organic pollutants. Work is ongoing toward scale-up and pilot demonstration. |
| **Product Discriminators** | Triple function: simultaneous desalination, wastewater treatment, and electricity generation. Low energy demand compared to conventional desalination methods. Use of eco-friendly microbial catalysts instead of costly chemical/electrochemical agents. Scalability potential through stacking configurations for enhanced power and desalination performance. Adaptability to different water sources, including seawater, brackish water, and RO reject water. |
| **Current Commercial applications** | Currently, Microbial Desalination Cell (MDC) technology is in the pre-commercial stage and has not yet been widely deployed at an industrial scale. However, it is being actively explored for potential applications such as desalination of seawater and brackish water, treatment of reverse osmosis (RO) reject water from desalination plants, and sustainable wastewater treatment with concurrent electricity generation. Pilot-scale demonstrations and laboratory studies have validated its multifunctional performance, and there is growing commercial interest in integrating MDCs into decentralized water treatment facilities where energy efficiency, low operational costs, and combined water-energy recovery are critical. |

## Product/Technology/Innovation Brief:

The Microbial Desalination Cell (MDC) is an innovative bio-electrochemical system that integrates wastewater treatment, desalination, and bioelectricity generation into a single process. By utilizing electroactive bacteria at the anode, MDCs organic pollutants in wastewater into electricity, which drives ion migration through ion-exchange membranes, simultaneously removing salts from saline water sources such as seawater and RO reject water. This multifunctional system addresses the global challenges of water scarcity, high desalination costs, and the need for sustainable energy production.



# NANOFLUID BASED ANTI-VIBRATION MOUNTS

## Key Facts:

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| **Innovator's Name** | Dr. Rahul Cadambi |
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| **Mobile No** | 918884871261 |

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| **Product Maturity** | The maturity level of our product is TRL 7. Successfully the product has completed functional and compliance tests. Currently, the product prototype development of anti-vibration mounts is in progress. |
| **Product Discriminators** | This product offers a unique capability with no direct competition in the market and is exceptionally well-suited for stealth applications in Naval, Army and Aviation platforms. It has demonstrated performance that outperforms Russian OEM solutions, including Hex, Wire Rope and K-type AKCC anti-vibration mounts. |
| **Current Commercial applications** | Yes, it could be useful for commercial applications Automobile, Ship Building and Heavy Engineering Industrial application. |

## Product/Technology/Innovation Brief:

A shear thickening nanofluid anti-vibration mount is an adaptive damping device that employs a non-Newtonian fluid containing nanoparticles to suppress vibrations and absorb shocks. Under low loads, the nanofluid behaves like a liquid, allowing flexibility, while under high strain or impact it rapidly increases in viscosity, providing stiff resistance and effective energy dissipation. The addition of nanoparticles enhances rheological stability, thermal resistance and damping efficiency compared to conventional mounts. This dual-response behaviour makes nanofluid mounts highly suitable for aerospace, automotive, defence and precision equipment where both comfort and protection are critical. Their performance can be tuned by adjusting nanoparticle type, concentration, and fluid composition to meet specific application demands. Key Features and Novelty: Enhanced vibration damping due to nanofluid energy dissipation. Improved thermal stability and durability compared to conventional mounts. Tunable performance by using nanoparticle type and concentration. Suitable for high-performance and sensitive equipment



# NOVEL APPROACH OF AMINO ACIDS RECOVERY FROM HUMAN HAIR WASTE FOR SUSTAINABLE BIOFERTILIZERS DEVELOPMENT.

## Key Facts:

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| **Innovator's Name** | Ms. Samiksha Patidar |
| **Name of the Institution** | Dr. C.V. Raman University, Khandwa |
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| **Email** | sameekshapatidar@cvrump.ac.in |
| **Mobile No** | 62652000249 |

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| **Product Maturity** | Approximate Technology Readiness Level (TRL): 2-3 (Laboratory validation and small-scale field trials have been conducted on tomato, brinjal, and okra under controlled research conditions.) |
| **Product Discriminators** | Human hair waste into high-value amino acid rich biofertilizers. Provides slow-release organic nitrogen and micronutrients. Eco-friendly and sustainable native to chemical fertilizers. Adds value by extracting melanin for cosmetic/biotech applications. Supports waste management and circular economy principles. |
| **Current Commercial applications** | Currently at research stage. Potential applications: Organic farming as amino acid-based biofertilizers. Eco-friendly waste management for salons/municipalities. Melanin for cosmetic and biomedical industries. |

## Product/Technology/Innovation Brief:

This research focuses on ing waste human hair into value-added biofertilizers through alkaline hydrolysis to recover amino acids (tyrosine, lysine, etc.) and melanin. The amino acid rich hydrolysate promotes plant growth, enhances yield and stress tolerance, while melanin offers additional applications in cosmetics and biotechnology. The process provides a dual solution: sustainable disposal of hair waste and development of eco-friendly biofertilizers for agriculture



# NOVEL APPROACH TO DECREASE CALCIUM OXALATE IN TARO (COLOCASIA ESCULENTA) FLOUR PROCESSING AS AN INTERMEDIARY PRODUCT

## Key Facts:

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| **Innovator's Name** | Dr. Ganesh Malgaya |
| **Name of the Institution** | Dr. C.V. Raman University, Khandwa |
| **Address** | Dr. C.V. Raman University Village: Balkhandsura Post: Chhaigaon Makhan Dist.: Khandwa Pin Code: 450 771 Madhya Pradesh, India |
| **Email** | gnshmalgaya@gmail.com |
| **Mobile No** | 8770954471 |

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| **Product Maturity** | TRL 6-8 (Laboratory validated and tested in controlled environment) Process developed and validated in lab experiments at Dr. C.V. Raman University, Khandwa. Requires pilot-scale trials and industry-level validation for scaling. |
| **Product Discriminators** | Novelty: First low-cost, scalable method combining chemical ($CaCl_2$, soak) + physical (oven drying) processing for taro flour. Effectiveness: Achieves 63% reduction in calcium oxalates without major nutrient loss. Food Safety & Nutrition: Enhances bioavailability of minerals, reduces kidney stone risks. Sustainability: Utilizes simple, widely available chemicals and equipment suitable for rural/agro-industrial setups. Versatility: Can be extended to other tuber crops containing anti-nutritional factors |
| **Current Commercial applications** | Yes commercial applications. Potential in: Taro-based flour products (chapati mixes, bakery items, snacks). Gluten-free foods for health-conscious consumers. Nutraceutical & functional food industries. |

## Product/Technology/Innovation Brief:

This research introduces a scientifically validated process to significantly reduce calcium oxalate content in taro flour, an anti-nutritional factor linked to kidney stones and mineral absorption issues. The process involves soaking freshly harvested taro cubes in 5% calcium chloride solution for varying durations (60, 75, 90 minutes) followed by controlled drying techniques (sun, solar, oven drying). Among treatments, 90 minutes soaking in 5% $CaCl_2$, followed by oven drying (T9) showed the most effective result, reducing oxalate levels by 63.67% compared to untreated flour. Calcium oxalate levels were quantitatively estimated using $KMnO_4$ titration. The innovation ensures safer, nutritionally enhanced taro flour for food formulations while maintaining affordability and scalability.



# PALMPAY

## Key Facts:

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| **Innovator's Name** | Mr. Ashutosh Nagpal |
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| **Mobile No** | 7988193676 |

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| **Product Maturity** | Minimum Viable Product (MVP) development stage. The core palm vein recognition technology is mature and proven in high-security commercial applications. We have established a functional prototype architecture using a Raspberry Pi and NIR camera components, demonstrating the viability of our low-cost hardware approach. |
| **Product Discriminators** | Proprietary Academic Rewards Engine: Our system is a special tool for colleges to promote academic excellence because we are the only payment platform that directly connects financial rewards to a students CGPA. Superior Contactless Biometric Security: We employ cutting-edge palm vein recognition, which is completely contactless and virtually impervious to impersonation. Compared to more conventional techniques like fingerprints, which have known accuracy and hygiene problems, this provides better security and hygiene. Unified Campus Commerce Ecosystem: The whole campus financial ecosystem is unified by our platform. We offer transparent, automated transaction management that lowers operational overhead and fraud, with a dedicated admin panel for university administration and vendors. |
| **Current Commercial applications** | The product is a new idea and is not currently in commercial use. However, the core technology it is built upon, palm vein recognition,which is a proven technology that is already used in commercial applications such as banking and hospitals. |

## Product/Technology/Innovation Brief:

PalmPay is an innovative Fintech platform that revolutionizes campus transactions. We replace outdated cash, card, and UPI systems with a seamless, secure, and hygienic biometric payment solution built for the modern university. Our platform features a digital wallet for students and uniquely integrates academic achievement with financial rewards through a CGPA-linked points system. PalmPay provides a unified commerce ecosystem, offering transparent, real-time financial management for university administration, faster checkouts for campus vendors, and a rewarding, frictionless experience for students.



# PARA TERTIARY BUTYL TOLUENE

## Key Facts:

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| **Innovator's Name** | Dr. T. Prathap Kumar |
| **Name of the Institution** | CSIR-Indian Institute of Chemical Technology |
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| **Email** | prathap.iict@csir.res.in |
| **Mobile No** | 9849467684 |

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| **Product Maturity** | TRL 8-9 |
| **Product Discriminators** | Continuous production process Environmentally friendly catalyst system avoiding strong mineral acids Reduced formation of undesired isomers Technology transferred to Vinati Organics Limited |
| **Current Commercial applications** | Raw material for paratertbutylbenzoic acid and paratertbutyl benzaldehyde production, alkylated resin modifiers, fragrances, pharmaceuticals, polymerization regulators |

## Product/Technology/Innovation Brief:

Alkylation process for producing para-tertbutyl toluene using various alkylating agents in liquid phase with improved catalyst system.



# PETROLEUM CRUDE OIL TANK CLEANING ROBOT

## Key Facts:

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|---|---|
| **Innovator's Name** | Mr. D Chandrasekhar |
| **Name of the Institution** | IIT Guwahati TIC incubated start up - Beta Tank Robotics Pvt Ltd |
| **Address** | IIT Technology Incubation Centre Guwahati |
| **Email** | captdcsekhar@gmail.com |
| **Mobile No** | 9980222870 |

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| **Product Maturity** | TRL 8 |
| **Product Discriminators** | This is the only Generation 2 (with pump) crude tank cleaning IECEx zone 0 certified robot in the world. |
| **Current Commercial applications** | Ready for commercial application worldwide - certified to IECEx Zone 0 |

## Product/Technology/Innovation Brief:

This robot is a specialized hydraulically powered and controlled robot that eliminates need for man entry into petroleum crude oil tanks to clean sludge. This is the only robot in the world that uses a pump to remove the sludge. Other 4 players in the world use suction method which is a weak 1st generation technology. This is because suction is limited by nature to one bar. This robot uses a pump discharge pressure of 10 Bar and solves the main weakness of the 1st generation robots. These robots are tested and certified to operate in a highly explosive zone - IECEx Zone 0 international standard.



# PORTABLE, LOW COST, REUSABLE WATER PURIFIER

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. Nitesh Kumar |
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| **Address** | Amity University, Sector-125<br>Noida |
| **Email** | nkumar10@amity.edu |
| **Mobile No** | 9818213734 |

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| **Product Maturity** | TRL 8 |
| **Product Discriminators** | * Pocket friendly * 100% removal of microbial contamination * Economical & reusable besides being user friendly * No leaking of nanomaterials or any toxic chemicals * Does not require any source of energy/ voltage or UV light * Can be modified in any form i.e, continuous system or water treatment tanks * Can also be merged with already available treatment system in the market * Works even in high TDS range * An native to plastic bottles. Prevents environmental pollution by plastics |

## Product/Technology/Innovation Brief:

Developed a reusable, economical and easy-to- carry first of its kind water purifier based on nano embedded porous concrete pebbles. The present product, in the form of a small portable dip-dip container, is likely to be priced at an unimaginably low cost as compared to other products in the segment. The eco-friendly purifier provides around 100% decontamination of microbial load in the treated water.



# ROOTONIC PIRIFORMOSPORA INDICA (SERENDIPITA INDICA) BASED BIOFERTILIZER / PLANT ROOT ENDOPHYTE INOCULANT

## Key Facts:

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| **Innovator's Name** | Prof. Amit Kharkwal |
| **Name of the Institution** | Amity Institute of Microbial Technology, Amity University Uttar Pradesh |
| **Address** | E2 404, Amity Campus Sector 125, Noida, 201313 |
| **Email** | ackharkwal@amity.edu |
| **Mobile No** | 9350266595 |

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| **Product Maturity** | TRL 9 Commercially proven system / in operational use. (Technology has been scaled, demonstrated in farmer fields and transferred to industry partners for manufacturing and commercial distribution.) |
| **Product Discriminators** | Key differentiators of Rootonic vs. standard biofertilizers: Endophytic mode of action: Rootonic colonizes roots internally and establishes a persistent symbiosis (not only rhizospheric), delivering sustained growth promotion and stress tolerance. Axenic, characterized strain: Industry-grade, axenically-cultivated strain with defined identity and safety profile. Broad host range & field-proven: Demonstrated efficacy across multiple crop species in greenhouse and farmer-field trials. Compatibility in consortia: Proven compatibility with select beneficial bacteria and entomopathogenic fungi in consortium formulations (enables combined biofertilizer + biocontrol products). Technology transfer & IP protection: Patented/TA-protected strain and production process with technology transfer agreements in place (industrial partners). Scalable production & formulation: Amenable to standard fermentation and carrier formulation processes for stable shelf life under recommended storage. |
| **Current Commercial applications** | Rootonic has been transferred to multiple commercial partners (06 including on in Taiwan) for manufacture and distribution and has been showcased at national exhibitions. It is currently being used in commercial demonstrations and farmer-field trials across several crops (vegetables, cereals and oilseeds) for seed treatment, root dip and soil application, where increases in germination vigour, root biomass and yield parameters have been recorded. (https://www.khetighar.com/products/kriya-dmf) |

## Product/Technology/Innovation Brief:

Rootonic is an axenically cultivated, endophytic fungal biofertilizer based on Piriformospora indica that colonizes plant roots and promotes plant growth, nutrient acquisition and tolerance to biotic and abiotic stresses. Delivered as a stable carrier formulation for seed-coating, root-dip and soil application, Rootonic forms a symbiotic association with a broad range of crops, enhances root development (auxin-mediated), improves uptake of macro- and micro-nutrients, and increases crop resilience under drought/salinity and some pest pressures. Field, greenhouse and farmer-field trials have demonstrated consistent yield increases and improved crop vigor across multiple crops. Rootonic has been developed to industrial scale and transferred for commercial manufacture.



# SAFLUFENACIL PROCESS KNOWHOW

## Key Facts:

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| **Innovator's Name** | Dr. A. Krishnaiah |
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| **Mobile No** | 9492038846 |

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| **Product Maturity** | TRL 5-6 |
| **Product Discriminators** | Inhibits PPO enzyme, causing rapid foliar burn down. Novel intermediates and efficient synthesis routes developed. |
| **Current Commercial applications** | Soybean, corn, cereals, tree fruits. |

## Product/Technology/Innovation Brief:

A pyrimidinedione herbicide used for broadleaf weed control.



# SUSTAINABLE ADVANCED BIO-NANOCOMPOSITES FOR ANTIMICROBIAL FOOD PACKAGING

## Key Facts:

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| **Innovator's Name** | Dr. Prachi Tadge |
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| **Email** | prachi.tadge@rntu.ac.in |
| **Mobile No** | 7999942552 |

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| **Product Maturity** | The project has been completed to the TRL 6 level. |
| **Product Discriminators** | Advanced bio-nanocomposites serve as edible coatings produced from biopolymers that incorporate nano-fillers, resulting in extremely thin, consumable layers applied to food surfaces. These coatings effectively prevent microbial and fungal growth while enhancing shelf life, freshness, safety, and quality. This innovative approach addresses the limitations of traditional plastics and chemical coatings currently available in the market. Additionally, it improves mechanical strength and barrier properties while enabling active and intelligent packaging features, such as controlled release and spoilage indicators. Biodegradable nano-bio-coatings can be derived from renewable resources, leading to a diminished carbon footprint. By adopting these coatings, the food industry can contribute to a more sustainable future, reducing its reliance on non-renewable resources and helping to combat climate change. |
| **Current Commercial applications** | The commercial application of antimicrobial bio-nanocomposite food packaging is still in its early stages, with ongoing research and development aimed at integrating antimicrobial agents such as metal nanoparticles and natural substances into biodegradable polymers. This approach seeks to produce materials that prolong the shelf life of food and improve safety. Although these applications are not yet common, they are beginning to appear in certain products such as fruits vegetable, packaged food, bread, cheese, and carrots, indicating considerable potential for active packaging solutions in the future. However, challenges related to scalability and cost-effectiveness continue to be significant obstacles. |

## Product/Technology/Innovation Brief:

Advanced Bio-nanocomposites are emerging as a crucial innovation in sustainable food packaging, utilizing the advantages of biopolymers augmented with nanoparticles to enhance functionality. The antimicrobial packaging system is designed to safeguard packaged food items from various microorganisms through both chemical and physical mechanisms. This is focussed for release of the active biocidal substances to enhance food quality, prolong shelf life, and prevent or delay spoilage. Advanced biopolymer composites, which involve the reinforcement of biopolymers with nano-sized materials, offer distinct benefits for sustainable food packaging. Bio-nanocomposites can produce edible coatings for active food packaging, providing improved antimicrobial, barrier, and mechanical properties. Metal nanoparticles such as



magnesium oxide, zinc oxide, silica, and titanium dioxide exhibit antimicrobial characteristics and can improve barrier performance against gases and moisture. Certain natural polymers sourced from renewable materials, including poly(lactic acid), gelatin, starch, cellulose, or proteins, confirm the biodegradability and biocompatibility, rendering them appropriate for coatings. These coatings can prolong the shelf life of food items by inhibiting microbial proliferation and averting spoilage. The incorporation of nanomaterial-based biopolymers renders the packaging biodegradable, addressing the environmental issues linked to traditional plastics. The advantages of bio-nanocomposites, also referred to as green composites, bio-composites, or nano-bio-composites, demonstrate exceptional moisture and gas barrier capabilities, mechanical strength, fire resistance, thermal properties, optical characteristics, and biodegradability, thereby enhancing shelf life and minimizing environmental impact. Bio-nanocomposites often exhibit superior tensile strength and flexibility compared to conventional biopolymers. Better barrier performance for nanoparticles (e.g., nano-clays, nano-cellulose) significantly reduce permeability to gases like oxygen and moisture. Thermal stability is increased resistance to temperature changes during storage or transport. The antimicrobial and antifungal activity may be obtained by releasing the biocide directly into the food. Edible coatings made from biopolymers incorporated in nano-filler to make a very thin, consumable layers that are applied to the surfaces of food to enhance shelf life, safety, and quality, all while being environmentally friendly. This method addresses the shortcomings of conventional plastics and basic biopolymers, while simultaneously enhancing mechanical strength, barrier properties, and facilitating active/intelligent packaging functionalities such as controlled release and spoilage indicators.



# TISSUE OXYGEN SATURATION MONITORING DEVICE

## Key Facts:

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| **Innovator's Name** | Mr. Parikshith Narayana Mallya |
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| **Email** | parikshith.tce@msruas.ac.in |
| **Mobile No** | 9886830296 |

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| **Product Maturity** | TRL 5: Prototype developed and tested in lab environment subsystem integration validated ready for clinical trials. |
| **Product Discriminators** | Non-invasive flap viability monitoring without bone reflection. Portable, lightweight, and battery-operated with Wi-Fi/cloud integration. Real-time alerts to doctors/nursing staff via mobile and remote dashboard. Multi-parameter monitoring (SpO2 HR, Temperature, BP estimation) from a single patch. GPS-enabled patient tracking in the mobile-linked version. |
| **Current Commercial applications** | Currently in prototype stage and tested in collaboration with Ramaiah Medical College. Intended application: monitoring free flaps and grafts post-surgery to ensure tissue viability and reduce failure rate. |

## Product/Technology/Innovation Brief:

The device is designed for continuous monitoring of tissue flap viability in reconstructive surgery by measuring oxygen saturation (SpO2), heart rate, temperature, and estimated blood pressure. It consists of an on-patient patch with optical sensors (MAX30102) and a strap-on module with ESP32-S3, display, and battery. Data is transmitted in real time to a remote Wi-Fi display unit and to caregivers /surgeons mobile devices. The novelty lies in its ability of algorithm to monitor oxygen saturation using body fat as the reflecting medium (instead of bone), enabling effective non-invasive monitoring.



# VALLIO

## Key Facts:

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| **Innovator's Name** | Ms. Kanak Sharma |
| **Name of the Institution** | Sharda University |
| **Address** | Knowledge Park 3, Greater Noida<br>Uttar Pradesh |
| **Email** | kairaaa166@gmail.com |
| **Mobile No** | 9310540372 |

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| **Product Maturity** | Technology Readiness Level (TRL): 3 A dummy prototype has been developed to simulate core workflows and UI structure. Real-time field surveys are underway with property dealers and institutional stakeholders to validate user needs and refine backend logic for Phase 1 (Institutional Document Verification). |
| **Product Discriminators** | Remote-first architecture enabling land registration and document verification without physical office visits - Rule-based verification engine planned to support Indian institutional document formats - Dummy prototype with real-time field validation, built through surveys with property dealers and stakeholders - Inclusive UI planned for low-literacy, mobile-first users across rural, urban, and peri-urban regions - Modular backend intended to adapt to diverse state-level workflows and document types |
| **Current Commercial applications** | Not yet commercially deployed. Phase 1 pilot is being prepared with institutional partners for document verification. Future phases will expand to land registration and citizen-facing workflows. |

## Product/Technology/Innovation Brief:

Vallio is a civictech platform that enables remote land registration and land document verification through rule-based workflows and institutional dashboards. It digitizes fragmented processes, reduces dependency on intermediaries.



# VEGAN LEATHER

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. Santanu Basak |
| **Name of the Institution** | ICAR-National Institute of Natural Fibre Engineering and Technology |
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| **Email** | shantanubasak@gmail.com |
| **Mobile No** | 9643297075 |

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| **Product Maturity** | TRL6 |
| **Product Discriminators** | Most of the marketing Vegan leather products have been made by PVC and PU and not biodegradable. Natural fibre based leather is prepared by following sustainable process and product is also biodegradable. |
| **Current Commercial applications** | Yes. Licensed industry have started production from last 5-6 months and they are selling Vegan Leather sheets to various companies. |

## Product/Technology/Innovation Brief:

Natural Fibre Based Biodegradable Vegan Leather



# VIBRATING TABLET GRANULE DRYER

## Key Facts:

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| **Innovator's Name** | Mr. Piyush Singhal |
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| **Mobile No** | 8076631315 |

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| **Product Maturity** | TRL 5 |
| **Product Discriminators** | The Vibrating Tablet Granule Dryer is a novel prototype for pharmaceutical manufacturing that dries granules using a heating coil and fan to generate hot air. Its key innovation is a vibrating element that ensures uniform distribution of granules, promoting consistent exposure to heat and improving drying efficiency. The design also features a dedicated collection mechanism to minimize manual handling, which reduces the risk of contamination and enhances hygiene. This approach results in a more efficient, safer, and reliable process compared to conventional methods, leading to superior product quality and improved batch consistency. |

## Product/Technology/Innovation Brief:

The Vibrating Tablet Granule Dryer is a prototype for pharmaceutical manufacturing that dries granules by using a heating coil and fan to generate hot air. Its key innovation is a vibrating element that ensures uniform distribution of granules, promoting consistent exposure to heat and improving drying efficiency. The design also features a dedicated collection mechanism to minimize manual handling, which reduces the risk of contamination and enhances hygiene. This approach results in a more efficient, safer, and reliable process compared to conventional methods, leading to superior product quality and improved batch consistency


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# Addendum



# BIODEGRADABLE MULCH FILM

## Key Facts:

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| **Product Maturity** | Currently at Technology Readiness Level 4, the technology has been validated in a laboratory environment. The core formulation is developed, and key performance characteristics (mechanical properties, water absorption, and thermal stability) have been successfully validated through standardized laboratory tests (e.g., ASTM D882, ASTM D570). While the manufacturing process has been demonstrated at a lab or small pilot scale, testing in a relevant agricultural environment and scaling for commercial production are pending. |
| **Product Discriminators** | This product distinguishes itself through: Primary Advantage: Exceptional mechanical flexibility and rapid biodegradability. With an elongation at break of 666.5%, the film surpasses both generic biodegradable and conventional polyethylene films in tear resistance during installation. It also achieves complete soil degradation within 2 years , balancing robust in-use performance with environmentally sound disposal. Secondary Advantage: A waste-valorization feedstock model. Utilizing agricultural waste and post-consumer recycled plastic ensures a stable and economical cost structure compared to films based on virgin fossil fuels or first-generation biopolymers.Further enhancing its appeal is the films versatility across diverse applications, including agricultural mulching, flexible packaging, and compostable bags. Its adaptability is matched by its sustainability, reducing reliance on finite resources and promoting a circular economy. Independent lifecycle assessments confirm a significantly lower carbon footprint compared to incumbent film technologies, solidifying its position as a leader in sustainable material science. The product not only meets stringent performance benchmarks but also addresses pressing environmental concerns, offering a tangible pathway towards a more responsible and resource-efficient future for the plastics industry. |
| **Current Commercial applications** | This specific technology is a pre-commercial invention and is not currently in use for any commercial applications. However, it is designed to enter the established and growing global market for biodegradable mulch films, which are widely used in agriculture and horticulture to improve crop yield and quality by suppressing weeds, conserving soil moisture, and regulating soil temperature. |

## Product/Technology/Innovation Brief:

This technology manufactures biodegradable mulch films from a blend of agricultural waste polymers, recycled plastics, and modified polysaccharides from legume seeds. This cost-effective, eco-friendly native to polyethylene films reduces microplastic pollution by creating a durable film that maintains optimal growing conditions, is mechanically applicable, and fully biodegrades in soil after use, leaving no environmental harm.The innovative blend ensures the films strength and flexibility, allowing for standard mechanical application without tearing or compromising its integrity. Furthermore, the incorporation of modified polysaccharides enhances the films biodegradability, accelerating the decomposition process in soil. Field tests have demonstrated complete degradation within a single growing season, effectively eliminating the accumulation of plastic waste in agricultural lands and promoting a circular economy. This mulch film not only addresses environmental concerns but also offers economic benefits to farmers by reducing the need for plastic removal and disposal, contributing to a more sustainable and profitable agricultural practice.



# CARBON CAPTURE AND BIO MITIGATION OF FLUE GASES VIA CHEMOLITHOTROPHS

## Key Facts:

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| **Innovator's Name** | Dr. Smita Raghuvanshi |
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| **Product Maturity** | TRL - 3 & TRL - 4 |
| **Product Discriminators** | The Process/ Product discriminator has been : Innovation in the design of Reactor Chemolithotrophs isolated & identified from Extreme conditions Mitigation efficiencies of 96 93 and 98% for CO2 SO2 NO , respectively with the bacterial biomass of 274 g cultivated in a 20 L integrated bioreactor. |
| **Current Commercial applications** | The Commercial Applications include the Installation of the developed Bioreactor & testing them with the actual flue gas stack gas emissions from Cement Industries & Coal based Power Industries . |

## Product/Technology/Innovation Brief:

The Research & Technology developed is 20 L Bioreactor for the mitigation of Flue gases (CO2+SO2+NO) via Chemolithotrophs . The Reactor can be configured as Suspended/Bubble Column/ Packed bed Reactor. The mitigation efficiencies are obtained as more than 95%. The concept is successfully proven from the Shake flask (250 mL) to 20 L Reactor. The novelty of Research is the development of a sustainable integrated pilot plant for the CO2 capture and utilization from industry flue gas emission utilizing wastewater as a source of nutrients and energy by Chemolithotrophs.



# CHICKEN FEET LEATHER AND LEATHER PRODUCTS

## Key Facts:

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| **Innovator's Name** | Dr. Sreeram K J |
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| **Product Maturity** | TRL-9 Commercialized |
| **Product Discriminators** | Salient Features / Highlights / AdvantagesProcessing does not involve use of sodium sulphide, and there is no sludge formation during the beam house process. Processing does not involve any machinery operations except processing drums and there is no solid waste generation. Requires only mild finishing so as not to mask the natural exotic grain pattern. Panel and product making requires only small cutting & stitching machines and the technology can be easily adopted by artisans. Cost effectiveness, availability and exotic pattern similar to that of baby alligator with good strength properties are the uniqueness of the product. |

## Product/Technology/Innovation Brief:

Technology Outline Chicken feet skin has been identified and screened as potential raw materials for the leather industry to make exotic leather and products. The raw material is a by-product of poultry and is cost effective. CSIR-CLRI has developed technology to process leathers from chicken feet skins with required properties, and consequently to panels and products from chicken feet leathers.



# DIVYA DRISHTI

## Key Facts:

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| **Innovator's Name** | Dr. Shivani Verma |
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| **Product Maturity** | TRL- 8 |
| **Product Discriminators** | - Patented, unique AI -based Intelligent human recognition system using physiological parameters like gait, skeleton and movement. - Occluded/ masked face recognition for accurate identification. - Recognition accuracy of at least 95% under any conditions. - Suitable for Defense, Paramilitary, and law enforcement agencies. |

## Product/Technology/Innovation Brief:

AI Based Detection of a Person using Physiological Parameters



# FIBERDERMAM: ANTIMICROBIAL, MICROFIBER-REINFORCED ARTIFICIAL SKIN GRAFT FOR WOUND REGENERATION

## Key Facts:

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| **Innovator's Name** | Dr. Surojeet Das |
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| **Product Maturity** | TRL-4 (India/DBT/BIRAC scale): Functional prototype validated in laboratory/simulated conditions with in-vitro performance/biocompatibility tests completed moving toward TRL-5 via relevant-environment/animal data. |
| **Product Discriminators** | 1. Fibroblast-supportive microfibers (ECM mimic): The cellulose micro architecture promotes human dermal fibroblast adhesion and proliferation supporting granulation and re-epithelialization. 2. Tough, tear-resistant hydrogel: Banana pseudostem derived cellulose fibers/nanocellulose significantly reinforce hydrogels/aerogels, improving tensile strength and wet-handling versus unreinforced gels. Built-in, plant-derived antimicrobial: Saraca asoca (Ashoka) leaf actives (e.g., catechins) deliver broad antibacterial effects against Gram-positive and Gram-negative organisms reducing reliance on silver/antibiotics. 3. Moisture-balanced exudate control: Hydrogel matrix maintains a moist wound milieu associated with pain reduction and enhanced healing outcomes across burns and traumatic wounds. 4. Sustainable by design: Uses agri-waste banana pseudostem fiber and biodegradable polymers aligning with circular, lower-impact material streams. 5. Value-led pricing vs incumbents: Targeted to undercut premium silver dressings (e.g., Aquacel Ag Extra listings in India ~â‚¹4,961-â‚¹6,581 for 10Ã—10 cm packs) and approach basic film dressings on a per-piece basis. |
| **Current Commercial applications** | Pre-commercial. Laboratory prototypes only. Intended applications include acute traumatic/surgical wounds, burns, and chronic ulcers (diabetic/venous), to be validated via performance and biocompatibility test series per standards. |

## Product/Technology/Innovation Brief:

FiberDermAM is a dual-biopolymer hydrogel dermal graft mechanically reinforced with banana microfibers and biofunctionalized with Saraca asoca (Ashoka) leaf extract for broad antimicrobial effect. The microfibrous architecture mimics ECM and supports dermal fibroblast adhesion/proliferation, while the fibers also improve tensile/tear resistance and wet-handling versus unreinforced gels. The hydrogel regulates moisture and absorbs exudate to help maintain a balanced, moist environment conducive to healing. Planned use: burns, chronic ulcers (e.g., diabetic), and traumatic/surgical wounds.



# LEATHERS AND PRODUCTS FROM FISH SKIN

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. Sreeram K J |
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| **Product Maturity** | TRL-4 |
| **Product Discriminators** | Salient Features / Highlights / Advantages: Optimized process technology for ing different types of fish skins in to leather. The surface morphology/character of the fish skins are retained providing an exotic look to the final leathers. The strength properties of the fish leathers are on par with those of the conventional ovine leathers.The leathers developed from fish skins can be ed in to smaller leather goods such as wallets, belts, watch straps and shoes. |

## Product/Technology/Innovation Brief:

Technology Outline The process of ing fish skins in to leather majorly differs from the existing technology in the beamhouse stage, choice of metal free tanning agents, choice of chemicals used in post tanning and finishing processes. Fish leathers are stitched after clicking process and leather mats /panels are made either seam or seamless. Panels are finished by applying top coating. Panel development uniqueness would be applicable for mass production.



# LIGHT WEIGHT AND COLD RESISTANT LEATHERS

## Key Facts:

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|---|---|
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| **Product Maturity** | TRL-4 |
| **Product Discriminators** | Salient Features / Highlights / Advantages: Optimized process recipe with commercially available chemicals for making light weight cold resistance glove leathers. Easy to adopt process. The resultant leathers has cold resistance (up to -30oC) and light weight character (450-100 gsm). Leathers pass all the physical and chemical requirements for glove and garment leathers. Leathers effectively ed into gloves and characterized. |

## Product/Technology/Innovation Brief:

Technology Outline: Gloves and clothing are essential for civilians and army personnel operating in high-altitude areas like the Siachen Glacier and for living in icy conditions. A leather-making process with a judicious selection of fatliquors, retanning, and tanning agents, along with precise control of process parameters is standardized. Developed leather is resilient to temperatures ranging from 30°C to 10°C and has lightweight property of 450-100 GSM. Invention holds significant potential for immediate application in the leather and leather products industries suitable for products such as gloves and garments.



# MOBILAB

## Key Facts:

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| **Product Maturity** | TRL 9 |
| **Product Discriminators** | 1. Comprehensive Multi-Parameter Testing: Unlike most point-of-care devices that handle only one or two parameters (e.g., glucose or hemoglobin), Mobilab can perform 25+ blood tests (Heart, Liver, Kidney, Diabetes, Anemia profiles) on a single compact device. 2. Portability & Field Readiness: Mobilab is battery-operated, lightweight, and smartphone-sized, with capacity for over 1000 tests per charge. Competitors typically require stable lab infrastructure or bulky analyzers. 3. AI & IoT-Enabled Smart Diagnostics: Integrated AI/ML algorithms improve accuracy and reduce errors, while real-time cloud connectivity supports data sharing, disease trend mapping, and digital health records â€“ features not standard in most POC devices. 4. Affordability & Low Per-Test Cost: Mobilab is priced at a fraction of conventional analyzers, with minimal consumables and lower per-test costs, making it more accessible to NGOs, CSR programs, and rural health initiatives. 5. Validated & Certified Made-in-India Innovation: Mobilab is CDSCO-approved, ISO-certified, clinically validated at AIIMS Delhi, IIT Guwahati, and Guwahati Medical College, and indigenously developed ensuring credibility and adaptability to Indian healthcare needs. |
| **Current Commercial applications** | Yes, Mobilab is currently in use for commercial applications across multiple states in India. The device has been deployed in partnership with CSR initiatives, NGOs, healthcare foundations, diagnostic centers, and hospitals. Commercial applications include: Primary Healthcare & Rural Outreach: Used in health camps and PHC/CHC centers for mass screening of anemia, diabetes, kidney, liver, and cardiac conditions. CSR & Foundation Projects: Deployed under initiatives by Piramal Foundation, SELCO Foundation, Safexpress, and others for preventive health programs in underserved communities. Private Hospitals & Clinics: Integrated into diagnostic workflows for rapid, affordable point-of-care testing. Micro-Entrepreneurship Models: Empowering trained rural women and health workers to provide diagnostic services, generating both livelihood and healthcare access. |

## Product/Technology/Innovation Brief:

Mobilab is a first-of-its-kind, Made in India portable diagnostic device designed to deliver rapid, affordable, and reliable blood tests at the point of care. Compact and battery-operated, it performs over 25 critical tests, including heart, liver, kidney, diabetes, and anemia profiles, with instant digital reporting. Supported by ICMR, developed by IIT Guwahati, clinically validated by AIIMS Delhi, and certified by CDSCO and ISO, Mobilab has already been deployed across 12+ states, screening over 50,000 individuals and demonstrating measurable impact in preventive healthcare. The device works on the principle of photometric and electrochemical detection methods, combined with AI-enabled algorithms. By analyzing biochemical reactions in small blood samples, Mobilab ensures accuracy equivalent to gold-standard laboratory machines validated by AIIMS Delhi, while eliminating the need for large equipment, specialized infrastructure, or extensive technical expertise.



# PROCURIX: AI ASSITED PROCUREMENT PLATFORM

## Key Facts:

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| **Product Maturity** | TRL 7-8: Functional prototype demonstrated and validated in operational environments approaching large-scale commercial adoption. |
| **Product Discriminators** | AI-powered engine for specification drafting & bid evaluation Full-cycle automation (tender to PO) Seamless ERP/P2P integration with no workflow disruption Compliance-ready modules aligned with GeM and Indian procurement standards Scalable modular architecture for diverse industries |
| **Current Commercial applications** | Alpha release at Numaligarh Refinery Limited for procurement automation. Adopted in digital procurement transformation initiatives in India. Suitable for public-sector and government procurement processes. |

## Product/Technology/Innovation Brief:

Procurix is an AI-driven procurement automation platform that modernizes sourcing and supply processes. It automates the end-to-end procurement cycle, from specification drafting, bid analysis, vendor identification, and tender generation to purchase order processing and compliance management. The platform integrates seamlessly with ERP and P2P systems, allowing organizations to adopt autonomous procurement without disrupting existing workflows.



# RED FLUORESCENT CARBON DOTS AND PROSTATE CANCER DIAGNOSIS KIT

## Key Facts:

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| **Product Maturity** | TRL 5 |
| **Product Discriminators** | The uniqueness is using plant-based material which are environmentally friendly and non-toxic, and the diagnosis kit give both qualitative and quantitative results as compared to other kits which only give qualitative results. We are using plant-based material (idea of waste to wealth generation) to synthesize novel fluorescent carbon-based material. The prostate cancer diagnosis kit will give both qualitative and quantitative results, and the stage of the cancer. |
| **Current Commercial applications** | We are using are red fluorescent carbon dots for developing prostate cancer diagnosis kit. In addition we have recieved interest from SPLAT and Toyo ink for the purchase of our red fluorescent carbon dots |

## Product/Technology/Innovation Brief:

We have two products: 1. Carbon based fluorescent nanoparticles and 2. Prostate cancer diagnosis kit.



# SUSTAINABLE NANOSORBENTS FOR OIL SPILL MANAGEMENT AND LIQUID-FREE FUEL STORAGE/TRANSPORTATION

## Key Facts:

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| **Product Maturity** | TRL 6 with demonstration using industrial effluent from BPCL India, and demonstration for liquid-free state storage and transportation of fuel at Dehradun 2-para SF Army command. |
| **Product Discriminators** | Complete Sustainable Biodegradable Solution Fully IDDM (Indigenously Designed, Developed & Manufactured) compliant Sorbs any type of oil (Crude Oil, Diesel, Petrol, Kerosene, Edible Oil) and other hydrocarbons Supports decentralized cleaning set-up for wastewater effluent Oil recovery with simple mechanical compression 95%-97% oil recovery without ing the purity of oil Reusable product with more than 50 reusable cycles Oil-locking feature prevents leaching of sorbed oil |
| **Current Commercial applications** | The products designed for the Indian armed forces use case include the compact Fuel Manpack (5L/10L) Compact Fuel Drone pack (25L/100L). We have been receiving product acquisition interest from more than 20 commands from Army. Already given a successful demo at 2paraSF unit at Dehradun. |

## Product/Technology/Innovation Brief:

There are two major products developed: 1. Sustainable nanoporous sponge (Nanocubes) prepared using biopolymers and natural micro- and nano- fillers with high surface area that allows large volumes of oil sorption ranging from 11 L/kg (for heavy oils) to 20 L/kg (for light oil). These sponges are highly selective to oil and water repelling and remain buoyant even when completely soaked in oil without leaching any oil. These sorbents can remove 70%to 95% oil molecules fron nano to micro emlusions (the normal form of industrial oily effluent). Can be effectively used in harsh environments, including broad pH from 4 to 12 temperatures from -20C to +60C and turbulent water. The product is reusable upto 50 cycles making it highly cost-effective. 2. Ultra-high-capacity disposable nanosheets are nanofibrous biodegradle polymers with natural micro fillers enhancing the oleophilicity of the material. These are most suited for managing large volumes of oil spills in resource-free areas. These super-lightweight products can sorb 46 L/kg (heavy oil) and 60 L/kg (light oil) without leaching the oil molecules. Can be effectively used in broad pH ranges of water from 4 to 9 and temperatures varying from -20C to +40C. 3. Usecases include oily industrial effluent treatment for oil & gas refineries and automotive and petrochemical industries AND Marine oil spill management. 4. We also introduce a game-changing, state-of-the-art solution that redefines how the Indian Armed Force, specifically The Indian Army can store and transport fuel in a â€œLiquid-Freeâ€ & â€œHazard-Freeâ€ State. By ing volatile liquid fuels like diesel, petrol, and kerosene and edible oil as well into a stable, liquid-free state, this process eliminates the risks of spills, leaks, evaporation, and fire hazards. The sorbed fuel remains stable in a â€œLiquid-Freeâ€™ State that are fully extractable at the time of use, ensuring no compromise in energy availability during operations and upto 97-98% of extraction efficacy. This innovation supports safe, portable, and environmentally responsible logisticsâ€”vital for remote deployments and harsh environments. The products designed for the Indian armed forces usecase include - compact Fuel Manpack (5L/10L) Compact Fuel Drone pack (25L/100L)

# THREE-PASSENGER E-VEHICLE FOR DIFFERENTLY ABLED INDIVIDUALS FOR EMPOWERING MOBILITY

## Key Facts:

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| **Product Maturity** | TRL level is 6, System/subsystem prototype demonstrated in a relevant environment (e.g., EV prototype tested on tracks, not yet commercial). |
| **Product Discriminators** | No licensing requirement. So it is a hassle-free purchase for any person, even for persons without any disabilities. The product is simple to use, comfortable, and comparatively inexpensive. For any mobility within the city/village in the range of 75 KM. This product can be used for job mobility, family outings, etc., where the person with a disability will not feel deprived and, on the other hand, will gain societal respect. With minor changes in the design, it can even be customized for doing business on wheels. It can also be used by persons without disabilities. Smart and innovative solution for the mobility of disabled people to move along with their family members to any place. Public transport for disabled people is a big issue hence, by using this product, they can commute easily without any load on hand. A family vehicle for a person with leg disability is unique in its design. The product is designed keeping in mind the challenges, which are faced by persons with such members. This E-vehicle can carry up to 3 person. It has 48 V battery with 30 Ampere capacity with compatible controller with sufficient torque. Can handle up to 250 KG of payload. The top speed of this E-vehicle is 32 Km/Hr. Motor of 750 W running at 48 V capacity Can be used as toy vehicle for childrens and for domestic usage by normal persons Disabled persons gain respect in the society. It is environment friendly. Two seats one in front and another on back, Better Visibility, Enhanced Comfort, Easier Entry and Exit, Increased Legroom, Better Ride Comfort, Enhanced Road Clearance.Â |
| **Current Commercial applications** | Product is ready for mass scale production, but currently not sold any unit. The prototype is in testing phase. |

## Product/Technology/Innovation Brief:

Commuting with pride and societal respect for disabled people is a big issue in country. Using a handle with hands to move the vehicle is a traditional way of transport for persons with leg disabilities. Using this E-vehicle, such members would be empowered to simply use it like a scotter and using the throttle these members can control the speed of this E-vehicle. Also, currently not many public transport systems are designed for convenience of persons with disabilities. This E-vehicle, which has three cycle-type wheels, is lighter in weight and easy to carry to all places. It could conveniently be used for going to the job place, or to move in the city for domestic needs, and that too with their family members. It empowers them to have a respectful life in society, and these members would feel privileged by owning such an E-vehicle. This vehicle is designed to have a carrying capacity up to 250 KG payload, it has a 48 V battery with 30 Ampere current. A single charged battery can travel up to 75 KM. Comfort and stability provided for the disabled people is unique, with better visibility and legroom space. Entry and exit in the E-vehicle can be from both sides of the vehicle. Road Clearance is enhanced in the vehicle such that this e-vehicle can run in waterlogged areas up to 2 ft. height.



# VALUE ADDED PRODUCTS FROM CHROME SHAVINGS

## Key Facts:

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| **Product Maturity** | TRL-7 |
| **Product Discriminators** | Salient Features / Highlights / Advantages: Better utilisation of leather industry solid waste.Protein based syntan can act as replacement for acrylic resin and protein filler.Compatible with conventional post tanning chemicals like syntans, vegetable tannins and fatliquors. The leathers have improved touch and dyeing properties. 50% reduction in the TDS load. |

## Product/Technology/Innovation Brief:

Technology Outline: Safe and environmental friendly separation of collagen hydrolysate from chrome shaving waste by alkali treatment. Modification of collagen hydrolysate with polymers and polysaccharides through simple polymerisation. Syntan will be utilised during the post tanning as a filling agent for upper and lining leathers.Crust leather made out of developed syntan showed good tight grain and better fullness.



# WATERLESS CHROME TANNING TECHNOLOGY

## Key Facts:

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| **Innovator's Name** | Dr. Sreeram K J |
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| **Product Maturity** | TRL-9 Licensed to more than 185 clients in PAN India and to an overseas client (Egypt). |
| **Product Discriminators** | Salient Features / Highlights / Advantages: Complete elimination of salt and sulphuric acid. Complete elimination of inorganic acids. Reduction of Total Dissolved Solids (TDS) in wastewater. No discharge of chrome containing wastewater. Wet blue leathers on par with the conventionally tanned leathers. |

## Product/Technology/Innovation Brief:

In order to address the challenge of cleaner chrome tanning process which is considered as a huge burden to the leather industry, the Council of Scientific and Industrial Research (CSIR)- Central Leather Research Institute (CLRI) has developed a Waterless Chrome Tanning Technology (WCTT) that provides complete solution for the pollution that is caused due to chromium. According to this process, chrome tanning is carried out without water and addition of any new chemicals/products with two operations, pickling and basification, being averted. Apart from addressing the issue of chromium discharge, it also brings about the benefits of reduction in total dissolved solids load without compromising the quality of leathers. The technology enables 20% savings in energy, time and water ina edition to the economic benefit. So far more than 125 leather manufacturers have obtained the license to adopt this technology and enrolling of another 40 tanners is in progress. Due to this technology, nearly 100 million litres of water resource is saved annually. Apart from this, the process also prohibits the emission of 1200 tons of chromium and 4500 tons of salt reaching the waterbodies.



# N-DOPED CARBON NANOSHEET-BASED HYDROGEL COMPOSITE FOR WOUND HEALING

## Key Facts:

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| **Product Maturity** | TRL4 |
| **Product Discriminators** | Can control wound moisture, absorb inflammatory cytokines and dead cells from the wound, and form a barrier to the microbes. Facilitate quicker proliferation and migration of epithelial cells, fibroblasts, and keratinocytes to the wound bed leading to faster wound healing. |

## Product/Technology/Innovation Brief:

Hydrogel nanocomposite for biomedical and/or pharmaceutical applications of polymeric hydrogels containing antimicrobial two-dimensional (2D) carbon nanosheets (CNS) as fillers. Provide pH-responsive composite composition of material in which nanosized 2D carbon sheets are uniformly dispersed in a polymer matrix The composite may be used as carrier for therapeutic agent for a long duration and as a dressing for topical wounds, cuts, etc. on the human body and accelerates diabetic wound healing. Increased mechanical strength, good viscoelastic properties, and could slowly release the therapeutic payload at a particular pH in a controlled fashion.



# BIOGENIC CARBON QUANTUM DOTS IN STEM CELL BIOLOGY FOR DIRECTING CHONDROGENESIS

## Key Facts:

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|---|---|
| **Innovator's Name** | Dr. Monalisa Mukherjee |
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| **Product Maturity** | TRL4 |
| **Product Discriminators** | Exhibit unique photoluminescence property for bioimaging. Facilitate Stem cell migration, imaging and simultaneously directing chondrogenesis. This was orchestrated without the use of chondrogenic induction factors. This technology has immense potential in stem cell biology and regenerative medicine. |

## Product/Technology/Innovation Brief:

Carbon Quantum Dots (CQDs) are synthesized from biowaste using simple hydrothermal one pot and rapid process. Exceptional biocompatibility, in-vitro and in-vivo. The development method of CQDs are eco-friendly, and cost-effective Improved therapeutic efficacy of Mesenchymal Stem Cells (MSCs) in a non invasive domain of administration. Extend the period of safe tracking of the MSCs in the body to cognize the pharmacological characteristics.



# BIOGENIC CARBON QUANTUM DOTS IN STEM CELL BIOLOGY FOR DIRECTING CHONDROGENESIS

## Key Facts:

| | |
|---|---|
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| **Email** | mmukherjee@amity.edu |
| **Mobile No** | 9873279964 |

| | |
|---|---|
| **Product Maturity** | TRL4 |
| **Product Discriminators** | Comparison between market available inducers and CQDs Parameter Cost (for 100 mL) Inducers ~15000-20000 CQDs ~1000 Production requirement: Inducers- Many expensive equipment required CQDs- Very cheap and easily available equipment are required Storage (after reconstitution): Inducers-20 ËšC CQD- Room temperature Sterility: Inducer- Filter unit required CQD-Autoclave Liquid to powder transition: Inducer- Not possible CQD- Possible Transportation: Inducer - At Specific temperature CQD- At any temperature |
| **Current Commercial applications** | Use in our group for differentiation of stem cells to chondrocytes. |

## Product/Technology/Innovation Brief:

This present invention relates to a novel method of inducing chondrogenesis from mesenchymal stem cells utilizing biogenic N,S- co-doped carbon quantum dots in lieu of conventional chondrogenic growth factors. Furthermore, it constitutes a neoteric trident in the realm of stem cell biology, serving to facilitate stem cell migration and stem cell imaging simultaneously directing chondrogenesis. We present a neoteric perspective of exploring biogenic carbon quantum dots as a trident in stem cell biology to image hWJ-MSCs, concomitantly facilitate cell migration and induce chondrogenesis without the use of chondroinductive factors. The hydrothermal preparation of CQDs from garlic peels was an experimental approach of demonstrating waste-to-wonder strategy in the avenue of stem cells. As a result of the excellent photoluminescent characteristics of CQDs attributed to their broad excitation spectra, we were able to exhibit vivid imaging of MSCs using the biogenic CQDs. Further characterizations showed these biogenic CQDs to be biocompatible enough to infiltrate into the mitochondria of the MSCs to generate appropriate amounts of ROS in lieu of NADPH oxidase or in conjugation to activate cell signaling to abet in MSC migration and chondrogenesis. Scratch assay revealed complete wound closure within 72 h in the garlic-peel derived CQDs induced cells in contrast to control cells. Interestingly, chondroinductive investigations revealed these biogenic CQDs to induce chondrogenesis without the use of chondroinductive factor. It could be comprehended that the generation of ROS was vital for these two cell responses in corroboration with prior investigations. Thence, we postulate the introduction of garlic-peel derived CQDs into the mitochondria, regulated ROS production to activate TGF- Î², which is an imperative for the initiation of SMAD phosphorylation via MAPK pathway to induce chondrogenesis, which is confirmed from chondrocyte markers (Col II, Col X, ACAN). Therefore, we believe garlic-peel derived CQDs to be of paramount importance in the field of materiobiology and a promising advancement in stem cell biology



# MICROPLASTIC-FREE SEA SALT PRODUCTION TECHNOLOGY

## Key Facts:

| | |
|---|---|
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| **Mobile No** | 9945213864 |

| | |
|---|---|
| **Product Maturity** | Lab-scale validation completed. Technology at TRL 3â€“4. |
| **Product Discriminators** | Use of ceramic UF membrane (20 nm pores) with high efficiency (97.21% removal). Optimized crystallization process minimizing microplastic trapping. Sequential continuous crystallization, eliminating microplastics after 4 batches. Advanced analytics (fluorescence microscopy + MATLAB automation) for precise quantification. Cost-effective, only 10â€“25% higher than conventional sea salt production. |
| **Current Commercial applications** | Potential Market Applications: Edible Salt Industry: Integration with coastal solar salt works and mechanical crystallizers to produce microplastic-free table salt. Premium Health & Wellness Products: Growing demand for contaminant-free, organic, and sustainable products provides a niche market for premium-grade sea salt. Food Export Industry: Exporters of Indian sea salt to Europe, Japan, and the U.S. require compliance with strict food safety regulations microplastic-free salt offers a strong competitive advantage. Pharmaceutical & Specialty Applications: Salt used in intravenous solutions and drug formulations must meet high purity standards. This technology ensures compliance with pharma-grade salt requirements. Government Procurement & Public Health Programs: Can be adapted for large-scale supply of safe iodized salt in government nutrition schemes. Commercial Pathway: Pilot-scale demonstrations can be implemented in partnership with salt producers in Gujarat, Tamil Nadu, and Andhra Pradesh, followed by industrial-scale deployment through licensing and technology transfer. |

## Product/Technology/Innovation Brief:

This invention introduces a novel process to produce microplastic-free sea salt. Seawater is first passed through a ceramic ultrafiltration (UF) membrane with 20 nm pore size, achieving 97.21% removal of microplastics. The filtered seawater undergoes a controlled crystallization process that minimizes microplastic retention in salt crystals. A vacuum filtration system and hot air dryer ensure clean separation and drying. Verification is performed using fluorescence microscopy combined with MATLAB-based image analysis to detect and quantify microplastics. The final product is sea salt entirely free of microplastics, safer for human consumption and the environment.


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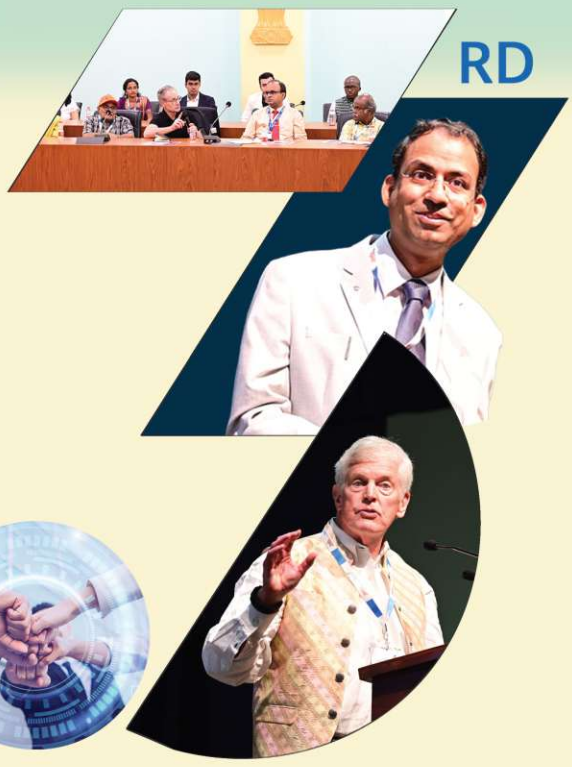
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# NOTES




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