Technology Available for Transfer

Bacterial Biofertilizer:

Application: A live culture of nitrate and phosphate mobilizers which enhances growth of economic crops per unit of land with maintained nutrient quality. It prevents leaching of nutrients during agriculture and hence prevents eutrophication/environmental pollution along with improved production. The current technology is a one-time application of the liquid consortium, a combination of an anaerobic and an aerobic consortia, which can be applied during seed sowing/ 0 day of plantation. Requires no additional fertilizer application throughout the growth period. This ensures that the soil is ready for the next round of cultivation with minimum loss of fertility. This consortia provide measures to decrease hydrocarbon, oil and pesticide contamination of soil, and has applications in the field of: Organic farming, Hydroponics; Lands with oil spillage. Tested for mung bean, okhra, cassava, lemon grass and Ramie.

Problem Addressed:

There is a need for enhancing yield of crop to sustain the increasing population. Also, the available land for cultivation is declining over the years. This results in indiscriminate use of fertilizer for enhancing the yield of crop, which in turn results in the majority of the unutilized fertilizers (>70%) leaching into the environment damaging it further. Therefore, bio-fertilizers is to be viewed as the future of fertilizers, as they have the ability to solve the problems of salinity of the soil, chemical-run offs from the agricultural fields.

Advantage:

- Unlike the conventional biofertilizers available in the market, which compromise the yield, this biofertilizer enhances yield while maintaining the quality of the produce.
- One time application during sowing which maintains the soil fertility

IP Details:

Shaon Ray Chaudhuri. Microbial combination for environmental protection and agricultural sustenance. **347939** granted Indian Patent

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AquaClean: Bacterial Biofilm Based Ammonical Wastewater Treatment

Application: This technology consists of a stable, sludge free bacterial biofilm based process for removing ammonia, nitrate and nitrite from different types of waste water. The hydraulic retention time is based on the initial pollutant load. The system with sustained performance and minimal maintenance (if run as per standard operating procedure) can be used for aquaculture, food industry as well as refinery effluent treatment. The biofilm system remains stable if run as per standard procedure for years before requirement for replacement/maintenance. Moreover, it can be effectively used as a self-cleaning system in aquaria and ensures that the water does not need to be replaced despite normal fish feed addition. Repartour of microbes available for development of appropriate treatment system for ammonia, nitrite and nitrate. This technologycan be applied to the field of aquaculture waste water treatment, refinery waste water treatment and can also be used by ornamental fish industries that manufacture, sell and maintain aquaria for personal use and in public areas. It would save water and therefore makes it suitable for reuse in aquaculture/suitable for discharge (in refinery).

Problems addressed:
Aquaculture industry uses ~17m^3 of water per kg of fish production. It also generates large volume of effluent. There is a need to treat the effluent and also replacement the same in the aquaculture practice with fresh water. Sustaining this practice while ensuring environmental safety is of utmost importance for the industry. Currently, the treatment of water is cost intensive and availability of fresh water is scares. The existing treatment technology takes between 1 to 14 days of treatment. The aquarium water needs to be changed every 10 to 15 days in absence of which algal growth appears on the walls. This technology provides an innovative and environmental-friendly alternative to adequately treat the water and reuse the same, avoiding the need for fresh water replacement.

Advantages

- Sludge free system
- Stable for years if run as per SOP
- Needs one-time bacterial inoculation
- Fastest bacterial aquaculture wastewater treatment system using microbes from environmental origin till date.

PI Details: Shaon Ray Chaudhuri. A process and system for ammonia removal from wastewater. **424161** granted Indian patent

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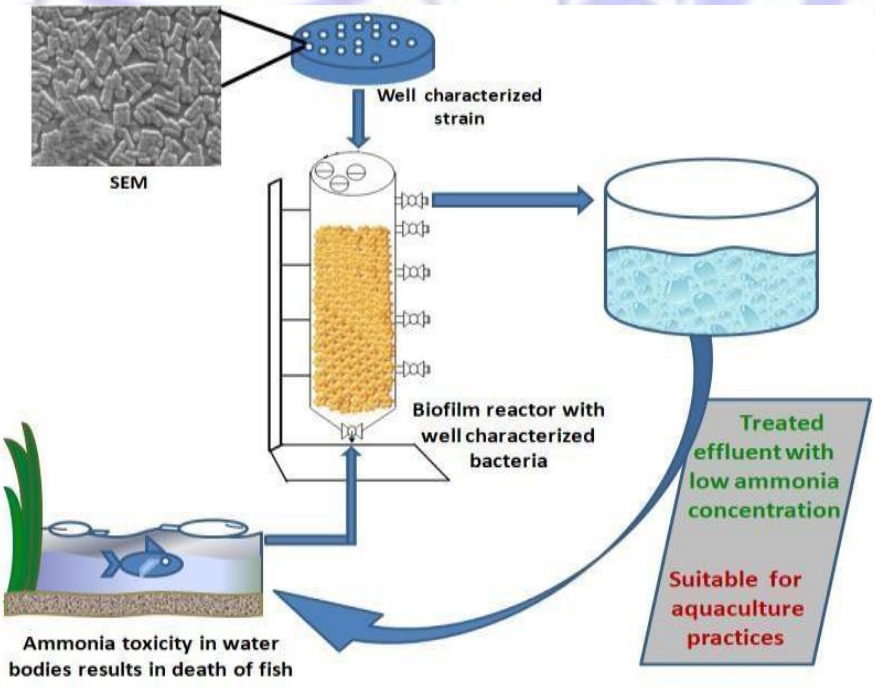

Green Fab: Microbial consortium and process for degumming of Ramie fiber

Application: It is a process for degumming of Ramie fiber. The fiber following adequate washing and partial chemical degumming was subjected to enzymatic degumming with bacterial consortium. Each reagent could be reused for making the process economically viable. Novel well characterized microbes combined in a definite proportion when grown under optimized condition produces extracellular enzyme mixture in a definite proportion. Partially chemically treated fibers upon biological treatment gives evenly and adequately degummed fibers which are soft, shiny and strong. These fibers could be used for spinning of threads with blending with cotton, viscous, wool, silk and lyocell. It could also be formed into thread without blending. They are stronger and improved in texture compared to chemically treated fibers. The process of natural degumming with reduced fiber strength has also been developed. This technology could expand the use of Ramie in natural fiber market. It would find use in textile and handicraft industry

Problems addressed

The degumming of the Ramie fiber is extremely polluting and water consuming after producing coarse fiber after chemical finishing. Through this approach the water retting and associated occupational hazards (also seen in jute retting) can be alleviated. The chemical use can be minimized and the final fiber can be made stronger, softer and lustrous giving better thread and textile. The availability of petroleum is decreasing and so is the risk of running out of resources for production of synthetic fibers. The production of cotton is decreasing and hence it is becoming expensive just like the flax which is imported from European countries. Hence, an alternative natural fiber is needed for the textile market which could be used with or without blending for variety of garment production.

Advantages (4-5 bullet points)

- Softer, lusturous and stronger fiber than chemical degumming.
- Uses less water and needs no retting step.
- No added pollution to the environment other than the effect of removed gum.

IP Details: Shaon Ray Chaudhuri. Microbial consortium and process for degumming of Ramie fiber. **474317** granted Indian patent

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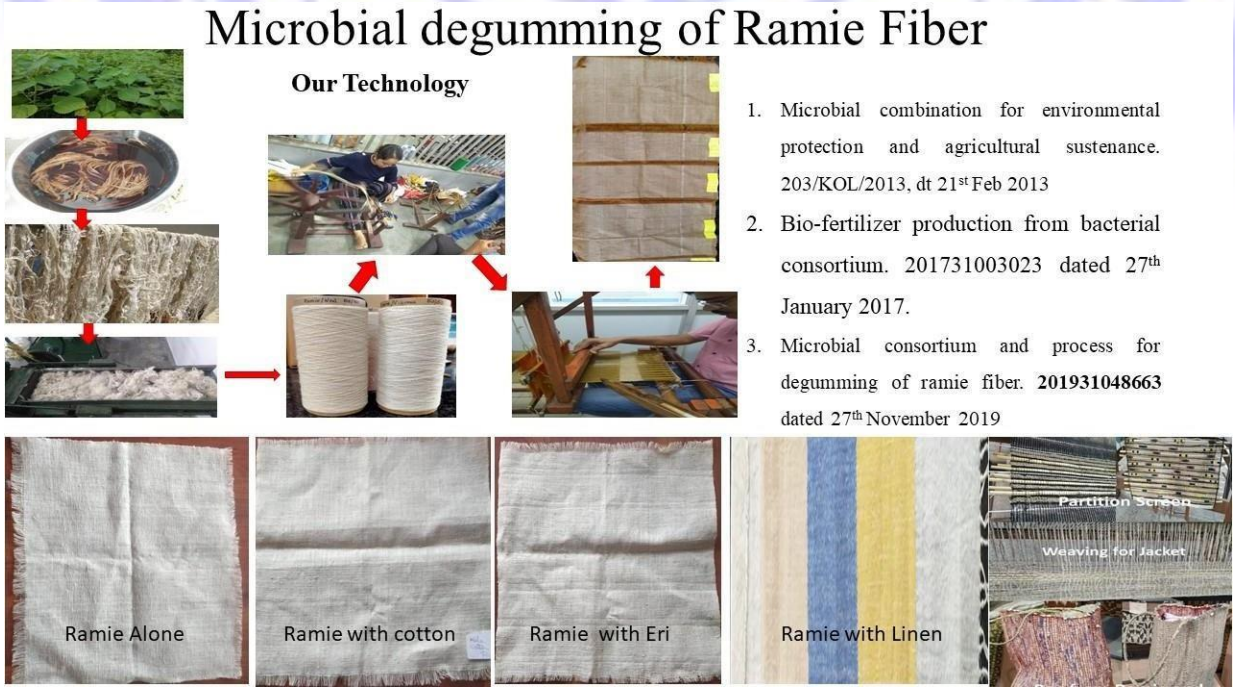

GrowBIG: Dairy wastewater conversion into liquid biofertilizer

Application: It's a technology for converting dairy wastewater into liquid biofertilizer using microbial biofilm under ambient condition. The stable system reduces protein and lipid from wastewater; convert the nitrogenous pollutants to ammonia, a plant favourable form and phosphate into polyphosphate and phosphatase enzyme. The biotreatment plant functions continuously upon installation with little maintenance. The cost of the system considering space requirement, energyexpenditure and CO_2 equivalent gas emission is substantially reduced making it affordable for all scaled of dairy farm. The liquid biofertilizer can replace the use of fresh water and chemical fertilizer for agriculture. It has been tried for 17 different types of crops. The process can replace the existing labor intense wastewater treatment process for milk processing plant producing a by-product of economic value (liquid biofertilizer). Existing treatment plant can be used with minor modification, enhancing the processing capacity which utilizing 90% less energy. If run as per SOP, the process is scum free. The produced biofertilizer can be applied for organic farming, hydroponics, replacing use of chemical fertilizer and fresh water during farming. When used for tuber cultivation it produces diet tuber with low carbohydrate content.

Problems addressed

Dairy industry generates 10 liter of wastewater (DWW) per liter of milk processed which is extremely detrimental to environment if improperly treated and discharged.

Existing technologies for treating DWW are labor intense, elaborate and expensive, making them crippling for the small and middle segment industries. Fresh water crisis is a global problem.

Agriculture adds to the problem by accounting for 89% of the fresh water consumed everyday. In addition, the ever increasing population calls for higher yield of crop per unit land. This in turn results in extensive use of chemical fertilizer. More than 70% of the applied fertilizer is leached into environment polluting existing fresh water reserves.

Advantages (4-5 bullet points)

Properties	Our Technology	Conventional Technology
Simple one/two step operation	√	X (7 steps)
Retention time only 4-16 hrs	√	X (120hrs)
Energy consumption 3-6kW for 500m^3/day treatment	√	X (70kW)
Water Discharge	X	√
Scum to be processes	X	√
Value added product	√	X
Zero Discharge Technology	√	X
Agricultural Sustenance	√	X
Yield Increase	√ (1.04 - 4.38)	X

IP Details: Shaon Ray Chaudhuri, Lalit Mohan Gantayet, Ashoke Ranjan Thakur. Bio-fertilizer production from bacterial consortium. 201731003023 dated 27th January 2017.

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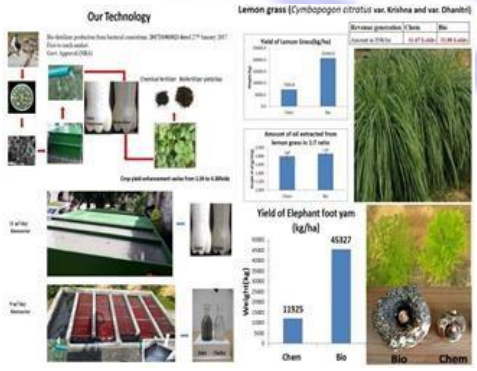

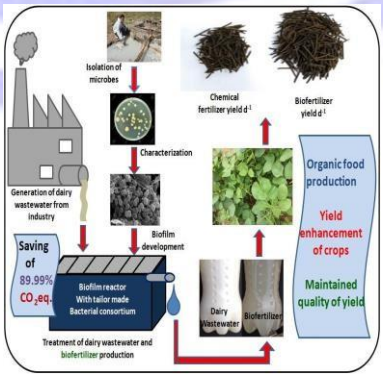

Title of the Technology: MBBR Based Petrochemical Wastewater Treatment

Application: This is a microbial process which can replace the conventional activated sludge based treatment of petrochemical wastewater. The desired reduction in COD and BOD is achieved within 18 hours of HRT in the moving bed biofilm reactor with the microbial consortium placed as biofilm on the career. The system remains stable if run as per standard operating procedure for years before requirement for a recharging. It is a sludge free process requiring substantially less amount of energy. All the microbes used in the consortium are from the environmental origin. The process has been scaled up to 12m^3/day processing capacity at an Industry. It could be applied for petrochemical wastewater treatment at the effluent treatment plants. It is meant to replace the biological treatment in the total system leading to a sludge free treatment within 18 hours of HRT with stable and sustained performance.

Problems addressed
The petrochemical effluent is tough to treat using biological means inspite of taking long time and generating sludge that itself needs labour intense treatment. Being CPCB compliant is a major problem for such industries due to the refractory nature of its pollutants. The available solutions are elaborate with enormous sludge generation, yet not satisfying the CPCB norms and hence room for further improvement through development of sludge free efficient systems.

Advantages
Sludge free system
Stable for years if run as per SOP Needs one-time bacterialinoculation.
Till date the fastest petrochemical wastewater treatment system using microbes from environmental origin.

IP Details: Shaon Ray Chaudhuri, Lalit Mohan Gantayet, Ashoke Ranjan Thakur. Formulation of bacterial consortium for bioremediation of petrochemical wastewater. **431629** granted Indian patent

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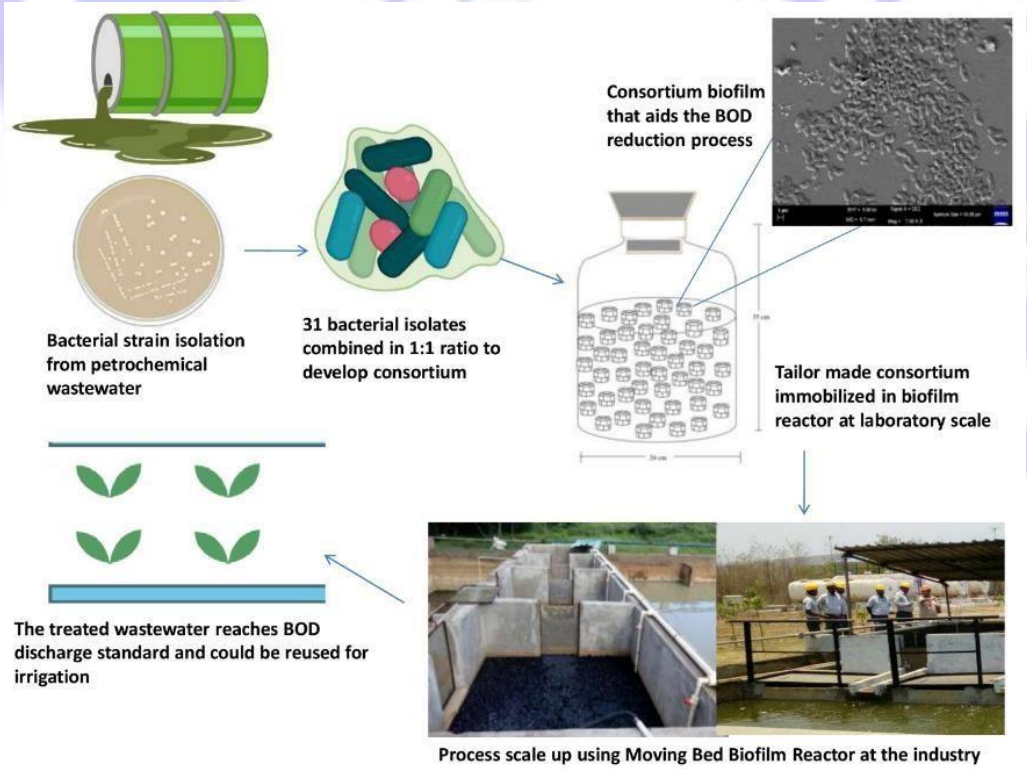

Process scale up using Moving Bed Biofilm Reactor at the industry

Microbial Biofilm Reactors for liquid sewage conversion to non-potable grade reusable water

Applications: This technology could replace the existing process for liquid sewage treatment. It could also be implemented in existing effluent treatment plants with modifications, enhancing its performance capacity. This would work for all nitrate and phosphate containing wastewater. The retention time would be 5 hours in a single unit operation. It could also be used for agricultural runoff. The immobilized bacteria within the reactor (which can be designed as per the available information on water quality, space and climate of the region of installation) can perform the function without sludge generation. These are thick biofilm former with plant growth nutrients accumulated in the biomass.

Problems addressed: There is a huge gap between the amount of the wastewater/sewage generated and the available treatment capacity. The main reason behind this gap is the expenditure and land requirement for installation and maintenance of the existing treatment technology. The requirement of land, energy, labour and sludge handling facility make the adoption of the conventional technology crippling for the middle and small scale installation. Hence they often discard untreated or improperly treated wastewater into the natural water bodies further polluting the limited available resources of fresh water.

Advantages:

- Rapid process with minimum sludge generation, 45% less space requirement and 80% less energy requirement.
- Stable system with one time inoculation.
- Treated water suitable for non-potable application.
- Sludge free process

IP Details: Shaon Ray Chaudhuri, Indranil Mukherjee, Ashoke Ranjan Thakur. Microbial Consortium for nitrate and phosphate sequestration for environmental sustenance**. 351564** granted on 13th Nov 2020 (India); **1005753** granted on 24th Oct 2017 (Bangladesh)

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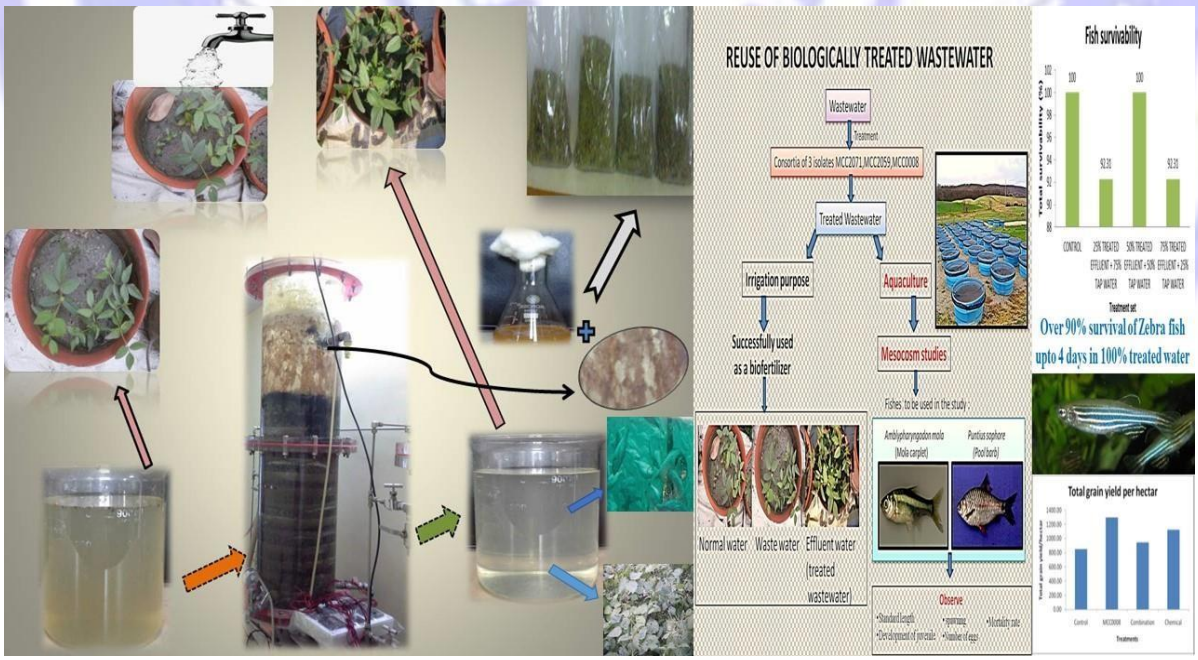

Rapid detection of blood infection and screening of suitable antimicrobial agent/drug molecule

Application: The solution is a process to detection bacterial and fungal infection inside the body within 3 to hours of infection and also testing the suitable antibiotic for treating the infection inside the body (invivo) within 3 hours for bacterial and 4 hours for fungal infection. The same assay can be used for screening new drug molecules against different kinds of pathogens invivo and is as rapid as 4 hours of administration. In case the antibiotic does not work, the drug can be changed/replaced without wasting any time by the physician while treating a patient.

Problem Addressed: The mortality (in mother, child, elderly and immunocompromised people) for Septicaemia or septic shock is stated to be upto 50%. This is due to delayed detection of infection and administration of the suitable antibiotics. The detection of infection by culture sensitivity testing takes about 48 to 72 hours and so does the antibiotic screening. The mortality can be drastically reduced by detecting the infection within 5 hours with immediate administration of the suitable antibiotics. In addition, the dose at which antibiotic works invivo and invitro is substantially different and the current assay detects the invitro concentration required for the treatment

Advantage:

This technology offers accurate and rapid cost effective detection of blood infection, antibiotic sensitivity and screening of new antimicrobial compound.

The process is simple and can be replicated without the need for sophisticated instrumentation.

Can be used in realtime for antibiotic sensitivity detection and for screening of new drug molecules through invivo studies, hence more accurate.

Business Potential of the Proposed Innovation:
It will have immense impact in the pharmaceutical market for screening of new drug molecules and determining their dose in vivo per kg of body weight. The method will be immensely effective for rapid detection of blood infection and the prognosis of the antibiotic therapy from the first three hours administration. However, the inventor is interested in transferring the technology to concerned hospitals and drug discovering industry so that this technology gets utilized at its full capacity

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Technology Available for Transfer

OPTICAL FIBRE BASED BENDING ANGLE DETECTION SYSTEM

About the technology:
The proposed invention relates to the field of optical fiber-based sensing systems. More specifically, the invention pertains to a system and method for detecting and measuring the bending angle of optical fibers by analyzing optical power loss due to fiber deformation. The invention employs both single-mode fiber (SMF) and multi-mode fiber (MMF) arranged within a controlled bending structure, a laser light source, and an optical power meter, along with temperature-independent fiber materials and a calibration-processing module to ensure accurate and real-time angular measurements. The invention is applicable in structural health monitoring, industrial automation, optical communication diagnostics, and precision sensing applications where reliable fiber deformation measurement is essential.

1. Salient features with photograph:

The Salient features of the proposed invention are states below

i. It provides a temperature-resilient optical fiber sensing system by incorporating temperature-independent optical fibers, which substantially eliminates temperature-induced measurement errors and ensures consistent performance across varying environmental conditions.
ii. It provides a real-time bending angle detection mechanism that enables immediate and continuous monitoring of fiber deformation through the correlation of optical power loss with angular displacement.
iii. It provides a dual-fiber configuration utilizing both singlemode fiber (SMF) and multimode fiber (MMF), thereby enhancing the system's adaptability and accuracy across a wide range of applications and operational settings.
iv. It provides high precision and repeatability in bending angle measurements by using a controlled and measurable bending structure in conjunction with a calibration and data processing module.
v. It provides a simplified and cost-effective system architecture based on optical power attenuation measurement, thereby eliminating the need for complex interferometric or wavelength shift-based techniques, which are expensive and difficult to implement in the field.
vi. It provides a compact and low-power solution suitable for deployment in portable sensing devices, embedded systems, and field-based monitoring units where size, weight, and energy efficiency are critical factors.
vii. It provides a sensing platform with broad applicability, including but not limited to structural health monitoring, optical communication fault diagnostics, industrial process control, smart infrastructure, and precision engineering, thus enhancing its practical and commercial utility

Technology Available for Transfer

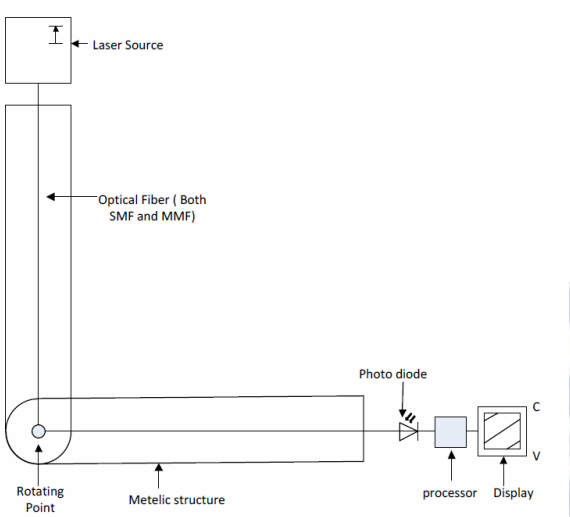

Fig: Block diagram of optical bending sensor

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IP number (if any): Application No.202531055752 A

Water Purification System

A modular water purification technology comprising an influent interface configured to accept an aqueous feed of spatially and temporally variable quality, a sensing subsystem operatively associated with said influent interface and adapted to generate real-time signal outputs representative of one or more physicochemical attributes including total dissolved solids, and a plurality of selectively addressable treatment pathways arranged downstream thereof. The technology of the preceding paragraph, wherein said treatment pathways comprise at least a first membrane-based separation train and a second membrane-based separation train, each incorporating combinations of particulate filtration, adsorptive conditioning, and pressure-driven membrane elements selected from ultrafiltration and reverse osmosis, said combinations being configurable as modular subassemblies suitable for independent manufacture, replacement, and scale-up. The technology of any preceding paragraph, further comprising a valve-mediated flow management architecture operatively governed by a control logic layer, said architecture being configured to dynamically allocate all, substantially all, or fractional volumes of said influent across said treatment pathways in response to comparisons between sensed attribute values and predefined operational thresholds. The technology of any preceding paragraph, further comprising a reversible hydraulic configuration enabling counter-flow cleaning cycles to mitigate fouling and extend component service life, thereby reducing operational cost and maintenance intensity in transferred deployments. The technology of any preceding paragraph, further comprising a hybrid power interface compatible with photovoltaic input, electrochemical energy storage, and external alternating-current sources, said interface enabling infrastructure-independent operation and facilitating adaptation across diverse deployment geographies.

The foregoing technology being embodied as a portable, licensable, and field-deployable system suitable for commercialization, manufacturing transfer, and multi-sectoral adoption.

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Indian Patent Number 438227 dt 11/07/2023