GrowBIG

Title of the Technology: Dairy wastewater conversion into liquid biofertilizer

Intellectual Property associated: Bio-fertilizer production from bacterial consortium. 201731003023 dated 27th January 2017.

Application Number and Date of filing: 201731003023 dated 27th January 2017

Inventor: Shaon Ray Chaudhuri, Ashoke Ranjan Thakur, Lalit Mohan Gantayet

Categories of this invention: Wastewater conversion to value added product.

Innovation: 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, energy expenditure 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.

Technology

- Microbial biofertilizer production plant with sustained performance and little maintenance that converts the entire milk processing plant wastewater into liquid biofertilizer which replaces the use of fresh water and chemical fertilizer during agriculture.
- The biofertilizer enhances yield of economic crops. Tested for 16 types of crops. The quality of the food is found to be good. Safe for environment and health.
- Third party validation of biofertilizer trial completed.
- Reduces space (by 75%) and energy (90%) requirement resulting in 89.9% reduction in CO_2 equivalent emission.
- Makes expensive dairy effluent treatment a revenue earning
- NBA approval for commercialization. Results in dairy wastewater treatment with enhanced organic farming.
- Produces diet (low carb tubers).

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.

Applications in the field

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.

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

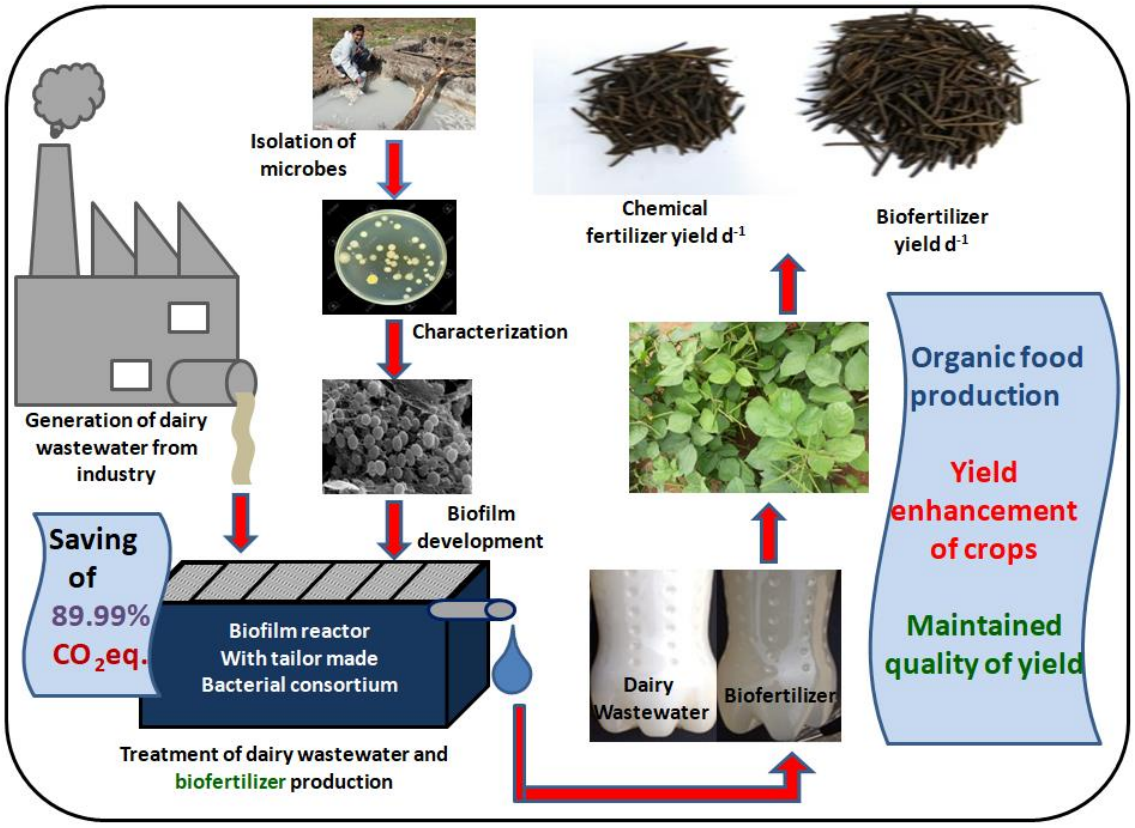
Potential market value (a comparison with an already present product)

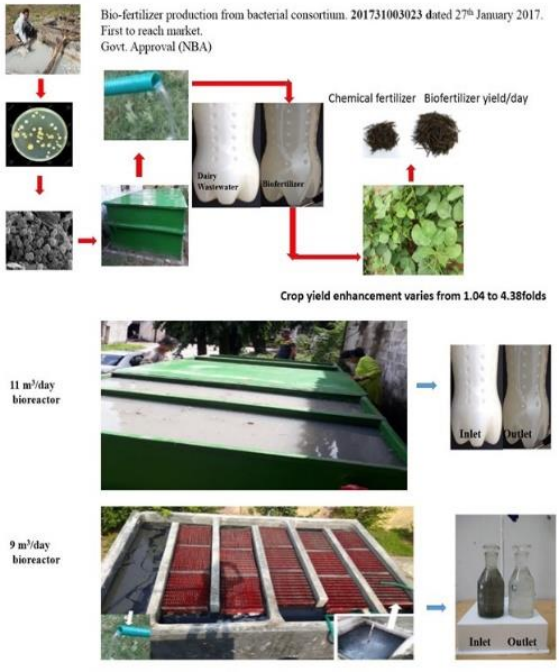
- Dairy industry
- Waste Management Companies
- Organic and hydroponic farms
- Land owners near Dairy wastewater treatment plant
- Sweet shop owners

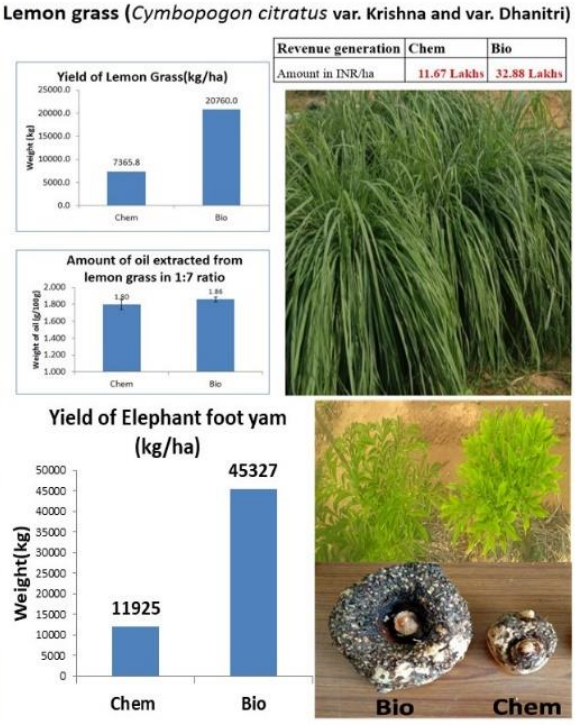
Publications to the Tech if any

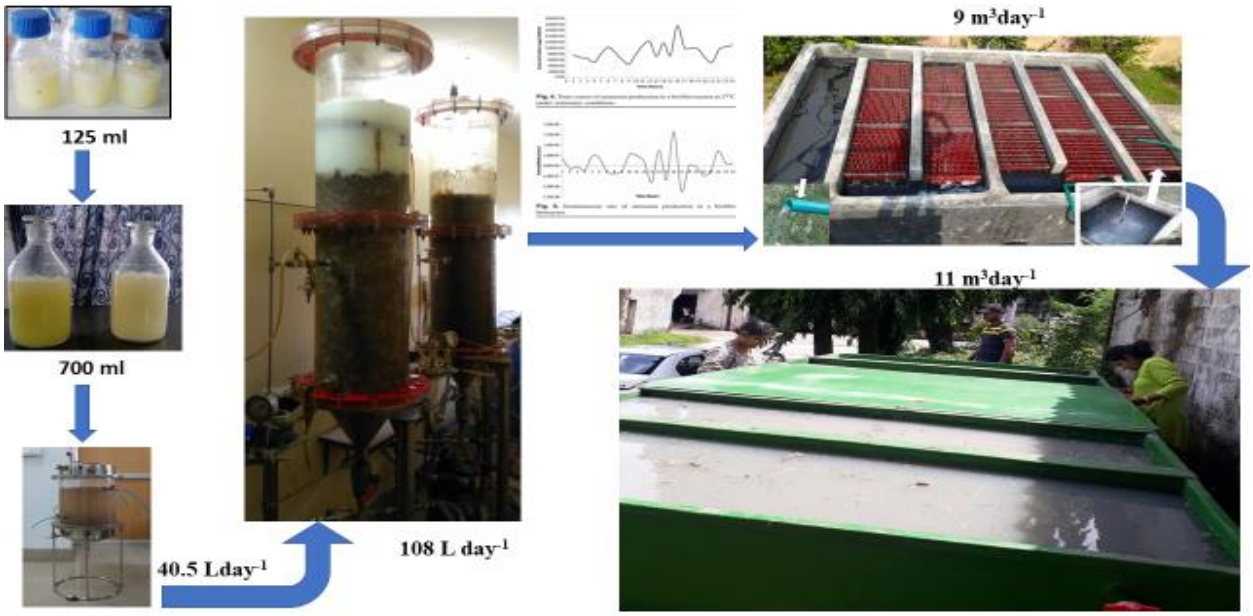
- Green Gold from Dairy Industry: a self-sustained eco-friendly Effluent Treatment Plant. **Shaon Ray Chaudhuri**. 2021. In New Advances in the Dairy Industry edited by Prof. Muhammad Subhan Qureshi. IntechOpen, London, UK. ISBN 978-1-83962-747-7. DOI: 10.5772/intechopen.101254.
- Nabanita Halder, Mandakini Gogoi, Jaweria Sharmin, Manjila Gupta, Srimoyee Banerjee, Tethi Biswas, Basant Kumar Agarwala, Lalit Mohan Gantayet, Mathummal Sudarshan, Indranil Mukherjee, Arindam Roy, **Shaon Ray Chaudhuri**. 2020. Microbial consortium-based conversion of dairy effluent into biofertilizer. Journal of Hazardous, toxic, and radioactive waste. 24(1):04019039-1to7. **(IF: 1.12)**
- Tethi Biswas, Debasmita Chatterjee, Sinchini Barman, Amrita Chakraborty, Nabanita Halder, Srimoyee Banerjee, **Shaon Ray Chaudhuri**. 2019. Cultivable bacterial community analysis of dairy activated sludge for value addition to dairy wastewater. Microbiology and Biotechnology Letters. 47(4):585-595 **(IF: 0.17)**
- Mandakini Gogoi, Tethi Biswas, Prasandeep Biswal, Tuhin Saha, Ajoy Modak, Lalit Mohan Gantayet, Rajib Nath, Indranil Mukherjee, Ashoke Ranjan Thakur, Mathumal Sudarshan, **Shaon Ray Chaudhuri** 2021. A novel strategy for microbial conversion of dairy wastewater into biofertilizer. Journal of Cleaner Production. 293: 126051 https://doi.org/10.1016/j.jclepro.2021.126051 **(IF: 9.297)**
- Tethi Biswas, Shashi Bhushan, Sanjeev Kumar Prajapati, Shaon **Ray Chaudhuri** 2021. An eco-friendly strategy for dairy wastewater remediation with high lipid microalgae-bacterial biomass production. Journal of Environmental Management. 286: 112196. https://doi.org/10.1016/j.jenvman.2021.112196. (**IF: 6.786**)
- Mandakini Gogoi, Somok Banerjee, Swatilekha Pati, **Shaon Ray Chaudhuri**. 2021. Microbial bioconversion of dairy wastewater in packed bed biofilm reactor into liquid biofertilizer. GeoMicrobiology. https://doi.org/10.1080/01490451.2021.1980921. (IF: 1.972)
- Shaon Ray Chaudhuri. 2021. Milk Processing Plant Wastewater: The Green Gold. Dairy Times (a bimonthly magazine devoted to Milk, Milk Products and allied sectors). Vol. 05, Issue 05, October- November 2021.

Provide Images/Flowchart

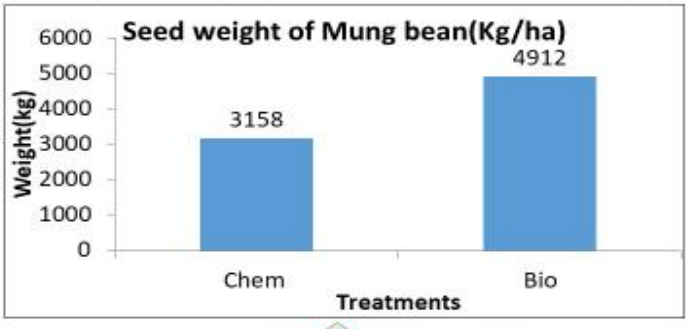




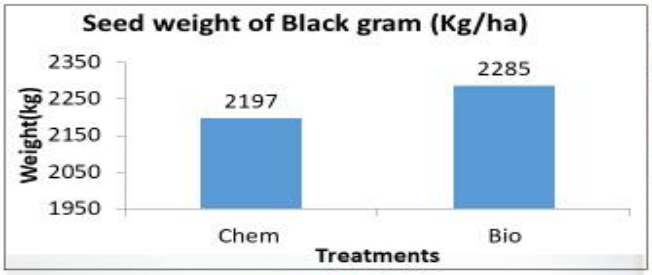




Mung Bean (*Vigna radiata* var. MEHA)



Black gram (*Vigna mungo* var. Pant-U-31)



Maize (*Zea mays* var. Vijay)

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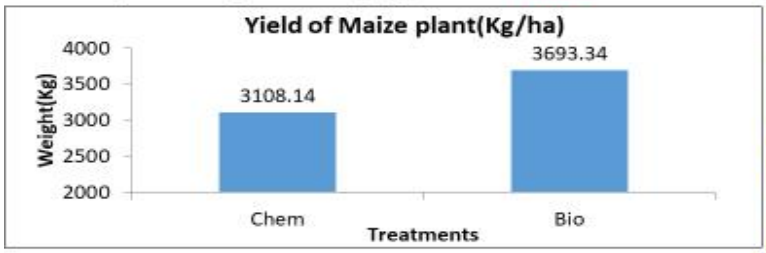
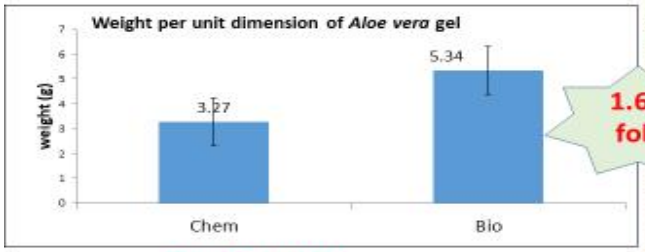


Aloe vera



1.63 fold

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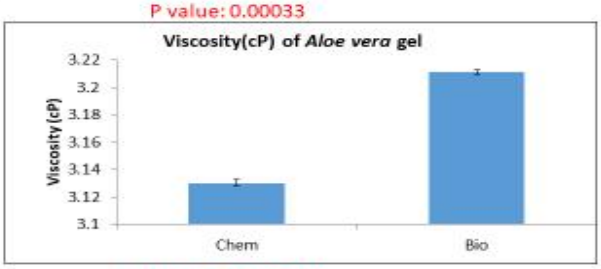

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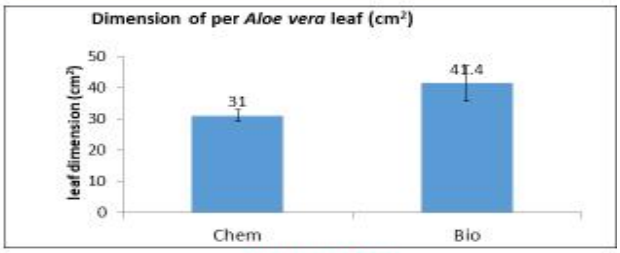

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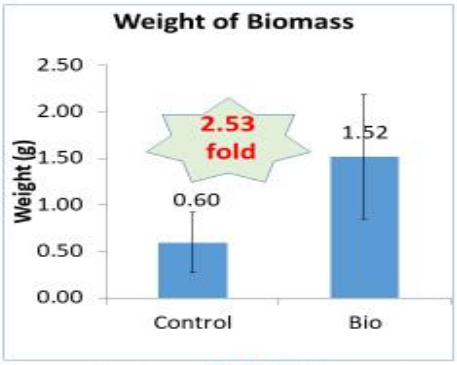
Sorghum Sudan Grass
(Sorghum sudanense)



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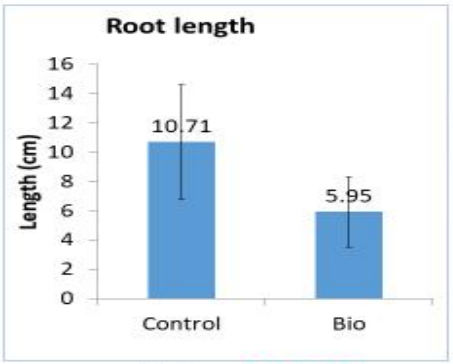
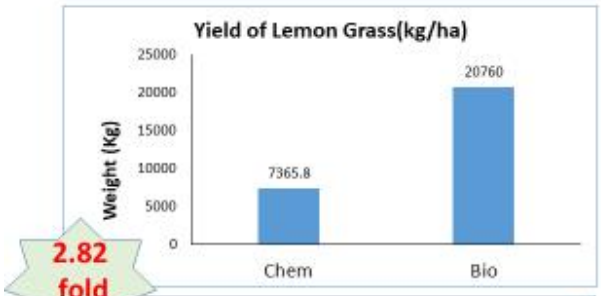
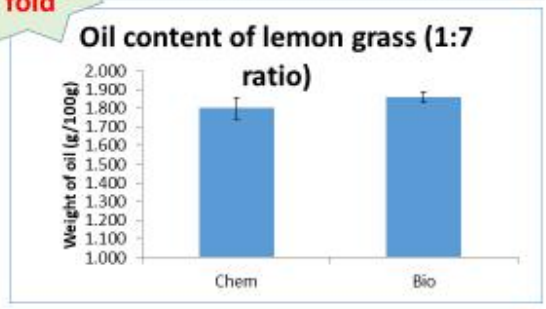


P value: 1.44E-17

Lemon grass (*Cymbopogon citratus* var. Krishna and var. Dhanitri)



Revenue generation	Chem	Bio
Amount in USD/ha	7430.81	15604.70



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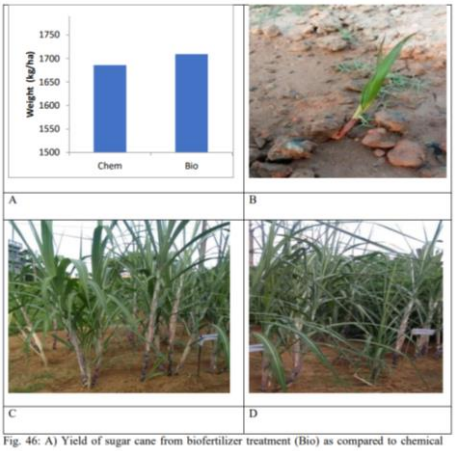
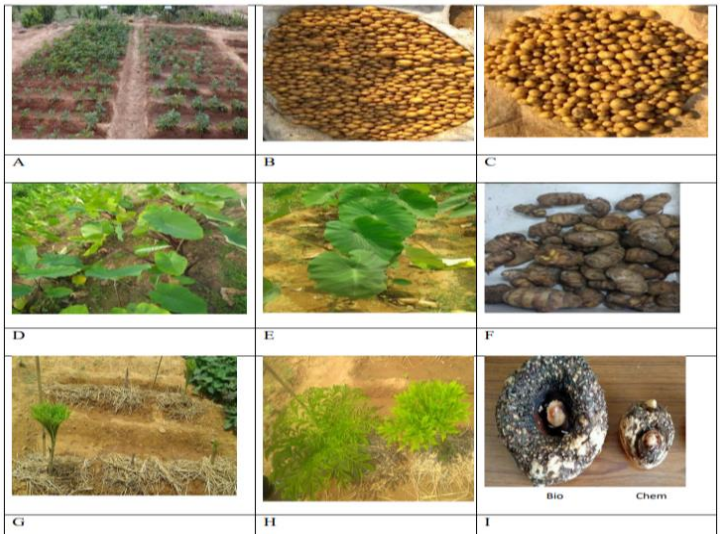
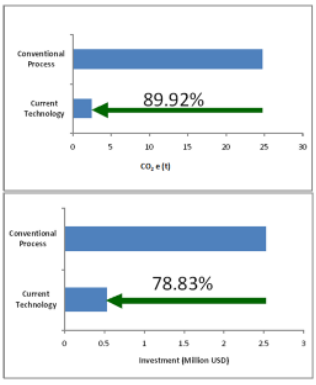


Fig. 46: A) Yield of sugar cane from biofertilizer treatment (Bio) as compared to chemical fertilizer treatment (Chem), B) Two leaves stage of sugar cane plant after sprouting, C) Image of field trial of sugar cane plant from chemical fertilizer application, D) Image of field trial of sugar cane plant from biofertilizer application.



Climate Impact



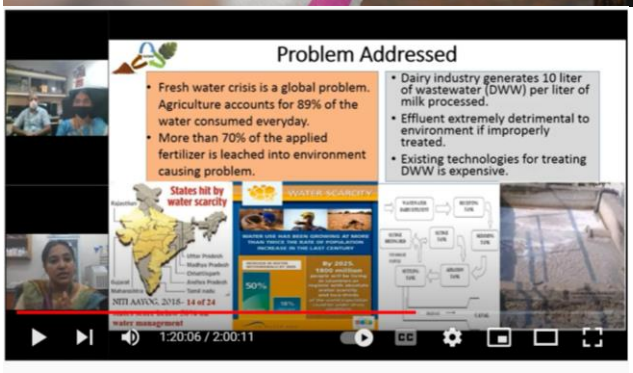
- Fresh water and energy saving per day (agriculture and chemical fertilizer production)
- No N_2O production, environmental protection.
- Annual global production of dairy wastewater is $7.47x10^8 m^3$.
- Annual CO_2e savings in beachhead market **55231.06MT.**

Resource used for calculation:
http://www.co2list.org/files/carbon.htm ;
https://www.statista.com/statistics/263952/production-of-milk-worldwide/

Recognition/Award

This technology won the Visitor's Award in Technology Category in 2019. It bagged the 1st price in the Regional Climate Launch Pad (Odisha) in 2019 and

represented India as one of the 1 technologies at the Global Grand Finale of Climate Launch Pad at Te Netherlands in November 2019. This was funded by BIRAC and led to the formation of the first startup of Tripura University (Waste to Wealth Innovative Technologies LLP) in 2019. This technology was demonstrated at the National Level on 1st October (one out of 9 technologies) in the demosntration of waste-to-vale technologies and on 8th October 2020 (one out of 5 Technologies) on the occasion of Launch of the DBT-BIRAC Clean Tech Demo Park at Barapulla Drain site in Delhi.



INDIA
Showcasing Demonstrated Waste To Value Technologies

Launch of DBT-BIRAC's Clean Tech Demo Park

Launch of DBT-BIRAC's Clean Tech Demo Park

Technology Commercialization Contact: Prof Shaon Ray Chaudhuri