

# CSIR IN MEDIA



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CSIR

भारत का नवाचार इंजन

*The Innovation Engine of India*

## NEWS BULLETIN

06 TO 10 DECEMBER 2024





## CSIR to Partner with Government of Telangana and Recyclers to Advance Sustainable Recycling and Skill Development

CSIR-NIIST, IICT, NML, IMMT, CEERI, IIP, CECRI

10<sup>th</sup> December , 2024

The Ministry of Environment, Forest and Climate Change has facilitated the signing of a significant Memorandum of Understanding (MoU) between the Government of Telangana and the Council of Scientific and Industrial Research, New Delhi, alongside agreements between CSIR and leading recyclers. These initiatives underscore MoEFCC's pivotal role in driving India's transition to a circular economy while fostering sustainable waste management practices.



The MoU between the Government of Telangana and CSIR aims to develop a skilled workforce in the recycling and waste management sectors. Under this partnership, CSIR's laboratories and institutions will provide technical support for training programs in Telangana, equipping individuals with expertise in CSIR-developed waste management technologies. This collaboration will promote the adoption of circular economy principles and create new opportunities for green employment.

Simultaneously, Ministry of Environment, Forest and Climate Change enabled the signing of agreements between eight CSIR national laboratories and recyclers, focusing on fifteen innovative waste management and recycling technologies. The CSIR labs include, CSIR-NIIST, CSIR-IICT, CSIR-NML, CSIR-IMMT, CSIR-CEERI, CSIR-IIP and CSIR-CECRI. These technologies are designed to establish state-of-the-art recycling infrastructure, support domestic waste recycling, and secure critical mineral supplies through advanced recycling processes. These agreements also foster innovation, encouraging the development of new



recycling technologies and offering technical assistance for recyclers' existing operations.

The agreements and MoU were formalized in the presence of Ms Leena Nandan, Secretary, Ministry of Environment, Forest and Climate Change; Dr. N. Kalaiselvi, Director General, CSIR and Secretary, Department of Scientific and Industrial Research; Smt. A. Santhi Kumari, Chief Secretary, Government of Telangana; Shri Jayesh Ranjan, Special Chief Secretary, Government of Telangana; Shri Tanmay Kumar, Special Secretary, MoEFCC and Chairman, CPCB; Shri Naresh Pal Gangwar, Additional Secretary, MoEFCC; Dr Vibha Malhotra Sawhney, Head, Technology Management Directorate, CSIR; and Dr. K J Sreeram, Mission Director, Waste to Wealth Mission, CSIR. Senior scientists and officials from CSIR, MoEFCC, and the Government of Telangana also participated in the event.

These initiatives align with the Hon'ble Prime Minister's call for Mission Circular Economy, emphasized during his address on India's 75th Independence Day. The MoEFCC has been instrumental in formulating policies and regulations, including Extended Producer Responsibility (EPR) frameworks, that incentivize recyclers and integrate the informal sector into formal recycling systems. These initiatives aim to minimize waste, recover valuable materials, and reduce reliance on virgin resources. The Central Government is actively working with recyclers, refurbishers, and start-ups to establish recycling units under the EPR framework, aiming to minimize waste disposal, recover valuable materials, and reduce dependence on virgin resources.

By forging these collaborations, CSIR has demonstrated its dedication to driving India's transition to a circular economy, paving the way for sustainable development and a cleaner, greener future.



## Hyd co partners with CSIR to innovate sustainable bioplastics from agricultural waste

CSIR-IICT

10<sup>th</sup> December , 2024

Greenworksbio, a Hyderabad-based sustainable packaging solutions provider, has joined hands with the Council of Scientific and Industrial Research – Indian Institute of Chemical Technology (CSIR-IICT) to develop sustainable, high-performance bioplastics and their composites using agricultural waste.

The strategic collaboration leverages advanced research and innovation to harness nano-cellulose and starch-based compostable plastics derived from renewable resources, including agricultural residues and biomass, to offer eco-friendly alternatives to conventional single use plastics, said the company, which is promoted by the kin of Apollo Hospitals group promoters.

Through the joint development of advanced mechano-chemical processing techniques, renewable resources are transformed into reinforced thermoplastic starch (R-TPS) and cellulose-derived composites that exhibit exceptional mechanical strength, superior barrier properties, and enhanced thermal resistance, Greenworksbio managing director Rishika Reddy said.

The collaboration also successfully developed reinforced biocomposites, which are blends of biodegradable polymers such as polylactic acid (PLA), polyhydroxyalkanoates (PHA), polybutylene succinate (PBS), polybutylene adipate terephthalate (PBAT), and starch, and are further optimised with nano-cellulose reinforcements.

"These biocomposites demonstrate remarkable tensile strength, reduced sensitivity to moisture, and enhanced compostability. These properties make them ideal for applications such as packaging, carry bags, waste collection bags, agricultural films, and much more," she explained.



She said the products being developed as a result of this collaboration have a high load-bearing capacity but are thinner, reducing material usage, and have improved transparency.

"These products achieve over 90% biodegradation within 180 days under composting conditions, adhering to ISO/IS 17088 standards. They are licensed by the Central Pollution Control Board (CPCB), ensuring compliance with regulatory frameworks and can help reduce environmental waste significantly," she added.

Greenworksbio already set up a 1,000 metric tonnes per month facility at the medical devices park at Sultanpur where it will make compostable granules, eco-friendly tableware, sustainable hygiene solutions, among others, she said.



## Tidal ocean surface wave height rises up to 13.5 m during cyclones in Indian waters: NIO

CSIR-NIO

10<sup>th</sup> December , 2024

Tidal ocean surface waves generated by the tropical cyclones reach up to 8.1 to 13.5 m height, finds a study by CSIR-National Institute of Oceanography (NIO), which can hit the marine facilities of coastal States like Goa and also affect fishing activities since fishing vessels cannot operate during such high waves.

“We undertook this study as understanding ocean wave characteristics is important, particularly to ensure the safety of marine activities and assess risk management and preparedness. The marine structures have to withstand extreme waves. Tropical cyclones cause bad weather and high waves that can cause problems to maritime activities and damage to marine facilities,” Chief Scientist at CSIR-NIO, Department of Ocean Engineering division, V Sanil Kumar told O Herald.

The study titled High waves measured during tropical cyclones in the coastal waters of India, has been published in the Ocean Engineering Journal and co-authored by A Anusree.

Waves generated due to the cyclone also affect fishing activities since fishing vessels cannot operate during high waves. Hence, it is important to know how many days the high waves generated by the cyclone will be present at a location, Sanil Kumar said.

“This study was done to examine the wave characteristics during different cyclones. Generally, it is difficult to get the measured data using instruments close to the cyclone track. The wave measuring instruments are deployed in the Indian waters for different projects,” he said.

During the passage of the cyclone, the wave measuring instruments deployed under the projects - real-time data collection for ocean wave forecast funded by INCOIS, Hyderabad and studies related to the Integrated River Basin and Shoreline Management Plan for Goa funded



by NIOT, Chennai - recorded the wave data. “Data for three cyclones in the Bay of Bengal and two cyclones in the Arabian Sea have been discussed in our study. In the earlier publications, mostly the significant wave height information is provided and the data on the height of an individual wave is missing. Also, the ratio between the crest to trough height and the importance of the data collection interval have been assessed,” the CSIR-NIO chief scientist said.

According to the senior ocean scientist, high waves generated by the tropical cyclones will be there at a location for three days.

“During a cyclone, the wave heights reach up to 8.1 to 13.5 m and this value depends on the forward motion of the cyclone, central pressure, and the wind speed. The study also highlights the rate at which the wave height increases during a cyclone,” he said.

The data presented in the article and the study results can be used by all the agencies that are planning commercial activities and developing marine facilities. Keeping this data as a baseline, the design parameters can be evaluated. Also, these data can be used for validation of the numerical models used for arriving at the wave parameters.

Sanil Kumar urged the mariners to avoid the cyclone track and suggested that the marine operations be suspended by the operators during cyclone.

“The agencies who are operating or plan to operate the marine facilities, should evaluate the design parameters considering the recent cyclonic storms,” he said.



## Gene mutation likely cause for developing autism in early childhood: RGCB study

CSIR-IGIB

09<sup>th</sup> December , 2024

Autism, a developmental disorder that causes functional abnormalities in brain development, is caused by a combination of environmental and genetic factors with its symptoms manifesting in childhood as early as the age of two years. Complexities of ASD (Autism Spectrum Disorder) include single gene mutations in early development genes.

A recent RGCB study linked a novel mutation in the *Tlx3* gene with abnormal development of the cerebellum (a major region of the hindbrain that controls balance, motor movement, and other complex functions) and autism.

The study, conducted by Dr. Jackson James and his team from BRIC-Rajiv Gandhi Centre for Biotechnology (RGCB) here, has been published in the prestigious journal *iScience*.

Deleting *Tlx3* gene from the cerebellum of a transgenic mouse (a mouse with its DNA altered through genetic engineering techniques) embryo potentially affects the coordination of cerebellum function.

When these mice embryos were allowed to grow until adulthood, they developed hallmarks of autistic behaviour, including abnormalities in social skills, repetitive behaviour, and motor/movement function.

The RGCB team, in collaboration with CSIR-IGIB (Council Of Scientific And Industrial Research–Institute Of Genomics And Integrative Biology (CSIR–IGIB), New Delhi, also assessed the potential for this mutation to occur in the human population and identified *TLX3* mutation variants that are linked to nine ASD cases and other co-morbid neurodevelopmental conditions.



Dr. James, however, stated that a genome-wide global cohort analysis is necessary to assess the frequency of this TLX3 mutation and the extent to which the variation is linked to specific populations, such as Indians and others. Together, these results indicate how erroneous regulation of this early embryonic gene manifests into ASDs during early childhood.

RGCB Director Prof. Chandrabhas Narayana said, “Autism is a serious childhood problem across the world. In India also, it has emerged as a significant challenge for researchers and the medical fraternity as autism has wide social and medical ramifications. The RGCB study will offer new insights into this behavioural disorder.”

ASDs lead to behavioural deficits, including a lack of social cognition and restricted/repetitive behaviours, desires, communication, or actions in individuals.



## Indo-UK project on anti-microbial resistance begins at Mafsu

CSIR-NEERI

08<sup>th</sup> December , 2024

The Maharashtra Animal and Fishery Sciences University (MAFSU), Nagpur, recently launched the Indo-UK Joint Farmed Animal Diseases and Health project entitled 'A Comparative One-Health Approach: Tackling AMR Infections in UK and Indian Livestock'. This programme, approved under the Indo-UK Joint Call on Farmed Animal Diseases and Health (FADH) by the department of biotechnology (DBT), extends MAFSU's



research on antimicrobial resistance (AMR) and includes collaborative work from several esteemed institutions across India and the UK.

Dr NV Kurkure, research director at MAFSU, underscored the vital importance of this joint initiative in addressing the escalating AMR challenge. He noted that AMR presents a substantial risk to both human and animal health worldwide, requiring coordinated efforts across institutions and disciplines. He expressed satisfaction with MAFSU's sustained dedication to AMR research and stressed the significance of implementing a one-health strategy, incorporating human, animal, and environmental health aspects.

The research director acknowledged the project's thorough structure, which enhances the university's existing work whilst uniting prominent institutions and specialists. The collaboration includes Nagpur Veterinary College, Mafsu; Central India Institute of Medical Sciences (CIIMS), CSIR-National Environmental Engineering Research Institute (Neeri), Acharya Narendra Dev College, University of Delhi; and researchers from the University of Nottingham, UK. Each institution received specific assignments to fulfil the project's goals



effectively. The initiative seeks to determine AMR prevalence and investigate how resistance genes transfer amongst humans, animals, and the environment.

Attendees at the launch included Dr NV Patil, vice-chancellor, MAFSU; Dr Lokendra Singh, director, CIIMS; Dr Atul N Vaidya, director, CSIR-Neeri; Dr NV Kurkure, director of research, Mafsu; Dr SV Upadhye, DI & dean, veterinary faculty, Mafsu; Dr AU Bhikane, director of extension education, Mafsu; Dr Rajpal Kashyap, director of research, CIIMS; Dr Kannan Krishnamurthi, head of division, CSIR-NEERI; and Dr Urmi Bajpai, professor, Acharya Narendra Dev College, New Delhi.

Scientists from the University of Nottingham, UK, including Dr Robert Joseph Atterbury, Dr Adam Mark Blanchard, Dr Tanya Marie Monaghan, Dr Adriano Marcelo Dos Santos Gigante, Dr Virginia Elizabeth Sherwin, Dr Malcolm Bennett and Dr Emily Kate Rousham also attended the launch event.



## NEERI tech to help Sanskrit University recycle wastewater & develop garden

CSIR-NEERI

08<sup>th</sup> December , 2024

The Kavikulguru Kalidas Sanskrit University (KKSU) is likely the first university in the region to initiate recycling wastewater and use it to develop a beautiful garden on its 10-acre campus in Ramtek. In association with CSIR-NEERI, the university will set up a compact faecal sludge separation and treatment (CFSST) plant using the premier research technology already implemented at the nearby Gau Vigyan Anusandhan Kendra in Deolapar.



The move followed KKSU's search for a solution to its wastewater management, water conservation and ensuring a clean campus. Vice-chancellor Hareram Tripathi told TOI that they grappled with a poor sewage network, causing wastewater choking close to the campus giving out a foul stench. "Our initiative is in line with PM Modi's Swachh Bharat campaign as well as being part of a green revolution. During a visit to Deolapar, I was impressed with the work of Neeri senior scientist Ritesh Vijay and his team. I realised Neeri could help us, and we approached its director Abhay Vaidya, who readily extended support," he said.

The project has been funded by the govt, Tripathi said, adding that additional funds would be provided by the university.

The university has two hostels housing 100 boys and 100 girls, besides PhD scholars on the campus. The wastewater from these hostels used to accumulate near the campus wall and pose a health hazard. "We used to flush out the water using a motor. Then we realised it would be better to recycle it," Tripathi said.



The plant's fabrication work will be done at Neeri's campus in Nagpur and later installed at Ramtek. It will encompass a specialised plant for manufacturing beneficial fertilisers through sewage and solid waste management.

The recycled wastewater will be utilised for gardening, floriculture, fodder production, and reservoir maintenance, while the solid waste will be transformed into compost to enrich soil fertility and develop gardens.

The bhoomi puja for the plant was performed by NEERI director Vaidya. Ritesh Vijay, senior principal scientist, Waste Water Management Division, Neeri, and his team, alongside Manoj Tatwawadi, chief executive officer of Gau Vigyan Anusandhan Kendra, Deolapar, attended the ceremony.



## Millet Excellence and Incubation Centre opens at CFTRI in Mysuru

CSIR-CFTRI

07<sup>th</sup> December , 2024

The Centre of Excellence for Millets and Incubation Centre was launched at the CSIR-CFTRI here. Minister for Agriculture N. Cheluvarayaswamy inaugurated the facility on the CFTRI campus on Friday. The facility has come up with the support from the State government. CSIR-CFTRI director Sridevi Annapurna Singh, Ramesh Bandisidde Gowda, K. Harish Gowda, MLAs, former council chairman V.R. Sudarshan, Commissioner for Agriculture Y.S. Patil, and scientists from the institute were present.



After the launch, the Minister went around the facility and got the details from the scientists on the millet-based products and the technologies developed by the institute over the years that can be transferred for commercial production.

The scientists explained the initiatives taken up for promoting millets, especially after the year 2023 was declared as the International Year of Millets.

Established at a cost of ₹20 crore with funding from the Karnataka government, the CFTRI, which has been working on millets since past 17 years, developing over 60 technologies till date, aims to reach out or transfer its technologies to farmers, entrepreneurs, women SHGs and others to market the products, focussing on the longer shelf life of the products without compromising on the taste and nutritional value. With India being the one the world's largest producers of millets, contributing 19 percent of the global production, the institute aims to help reach out the millet products to the global markets, addressing the issues concerning the



shelf life. Three units have come up at the centre under the initiative with the combined production capacity ranging from 500 kilos to one tonne.

More than 50 farmers had accompanied the Minister as the CFTRI aims to train farmers and others in millet processing, and make them entrepreneurs.

The CFTRI last year developed 12 new technologies. The new technologies include ragi-based malt hydrolysate, malted ragi-based ready-to-eat weaning food, a process for the production of multigrain waffles, and multigrain pizza base. The focus of the technologies was on millets since 2023 was the International Year of Millets.

Other technologies are finger-millet semolina, instant finger-millet ragi rava idli mix, instant finger-millet halwa mix, instant finger-millet upma mix, millet and multi millet puttu podi mix, cleaner process for biotechnological production of spirulina, and ready-to-use multigrain idli and dosa batter in retail packs

The ready-to-eat malted ragi-based weaning food that was also developed is suitable for children of the age group of six months to three. Notably, fruits like apples, mangoes, oranges, and vegetables like carrots or tomatoes can be incorporated in the food, the scientists said.



## New CCMB study throws fresh light on origin of Nicobarese

CSIR-CCMB

06<sup>th</sup> December , 2024

The population genetic researchers from Hyderabad-based Centre for Cellular and Molecular Biology (CCMB) and Banaras Hindu University (BHU), Varanasi in a recent study have thrown a new light on the genetic origins of Nicobarese people.

It was earlier believed that linguistic ancestors of Nicobarese had settled in Nicobar archipelago during the early Holocene, about 11, 700 years ago.

However, new genetic study of the Nicobarese population taken up by CCMB and BHU researchers indicates a significant ancestral connection of Nicobarese shared with Austroasiatic populations across South and Southeast Asia. The study also suggests that the Nicobar islanders settled there about 5000 years ago.

Austroasiatic is spoken in southern parts of Asia including Vietnam and Cambodia as the main official languages and in India, Bangladesh, Nepal, Burma, Laos, Thailand, and Malaysia as the first language of many minority groups that are isolated from each other by other language speakers.

Two major extant branches of the Austroasiatic language tree are Munda in eastern, northeastern, and central India and Khasi-Aslian, which stretches from the Meghalaya in the northeast of the subcontinent to the Nicobars, Malay Peninsula, and Mekong delta in southeast Asia.

The group of researchers from nine institutions co-led by Dr Kumarasamy Thangaraj from CCMB and Prof. Gyaneshwer Chaubey, BHU, Varanasi conducted a detailed genetic analysis, using DNA markers that are inherited exclusively from mothers and fathers respectively, and those from both the parents.



This helped them to explore the ancestry and genetic affinities of the Nicobarese with South and Southeast Asian populations. Findings of this pioneering study has been recently published in the European Journal of Human Genetics.

The study notably highlighted the common genetic affinity of the Htin Mal with Nicobarese. Htin Mal is a population in the mainland of Southeast Asian, who speak an Austroasiatic language. The Htin Mal community has maintained remarkable ethnic distinctness over time, exhibiting a pronounced genetic drift from the Nicobarese.

“Our new genetic research on Nicobarese, involving 1,559 individuals from South and Southeast Asia, indicates a significant ancestral connection of Nicobarese shared with Austroasiatic populations across South and Southeast Asia. Our studies also suggest that the Nicobar islanders settled there approximately only 5000 years ago,” says Dr Thangaraj

The lead author of the study, Prof. Gyaneshwer Chaubey said that the Genomic regions, shared across linguistic groups, suggest an ancient distribution of Austroasiatic populations in Southeast Asia. “Our findings compellingly argue that the Nicobarese and the Htin Mal represent valuable genetic proxies for understanding ancient Austroasiatic heritage,” he said.

Dr Vinay K. Nandicoori, Director of CSIR-CCMB, said, “This research opens up new avenues for understanding the rich tapestry of genetic diversity in Southeast Asia and highlights the importance of preserving the cultural and genetic heritage of Indigenous populations”.



## 43rd batch of flour milling students pass out from CSIR-CFTRI

CSIR-CFTRI

06<sup>th</sup> December , 2024

International School of Milling Technology (ISMT), which was established as a joint Indo-Swiss venture and Roller Flour Millers' Federation of India project during 1981 at the CSIR-Central Food Technological Research Institute (CFTRI) in Mysuru, has been serving the needs of flour milling industry in India and other developing countries with regard to training in flour milling technology.



On Friday, the candidates of the 43rd batch of ISMT course successfully passed out from the international school, completing the training in the flour milling technology.

CSIR-CFTRI director Sridevi Annapurna Singh presided over the function where the students received their course certificates. Phaneendra K., operations manager, Manikchand Group was the chief guest. Ashutosh A. Inamdar, senior principal scientist, CFTRI gave a brief introduction of the ISMT course.

On the occasion, the meritorious students of the ISMT course received gold and silver medals from the dignitaries. The course is aimed at bringing out the best technical personnel cum Managers equipped with the necessary skills and capabilities to take up the challenges of managing modern roller flour mills, said Dr. Sridevi, in her speech.

She said the course includes in-plant training at a modernised ISMT Mill (20 tons/day capacity) automatic mill with the latest machinery for cleaning, milling, flour fortification, automatic flour handling and packing system, and practical classes. Different guest lectures



are arranged on related topics to provide the latest information in the field, Dr. Singh added. Including this batch, so far 43 courses in flour milling technology have been completed. In all, to date, more than 900 participants, including 120 from some of the developing countries such as Bangladesh, Cambodia, Ethiopia, Ghana, Guyana, Jordan, Kazakhstan, Kenya, Liberia, Mongolia, Nepal, Nigeria, Oman, Pakistan, Philippines, Sri Lanka, Syria, Suriname, Uganda, United Arab Emirates, Vietnam, West Indies, Yemen, and Zambia, have been trained.

The CFTRI director said there has been qualitative changes in the working of these mills based on the feedback received from the milling industry. “Many of the students passed out of this course are managing the flour mills not only in India but also in several other nations,” she informed.

The ISMT was established under the leadership of the then director of CFTRI, B.L. Amla, and it is a collaboration between the Indian government and Switzerland. The course has been continuously updated, making it effective and responsive to the needs of the milling industry, especially in developing countries or tropical areas, according to the scientists handling the course.



## Industry-led research and collaborations key to boosting India's innovation ecosystem

CSIR-NIIST

06<sup>th</sup> December , 2024

Promoting research collaborations among top-tier institutions such as CSIR and Higher Education Institutions (HEIs), increasing industry-led research can significantly boost research, says C Anandharamakrishnan, director, CSIR National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram, on the sidelines of the India International Science Festival (IISF) 2024, organised by the institute.



Will collaborations between top-tier institutions such as CSIR and HEIs, including state universities, help democratise R&D?

We are partnering with AIIMS New Delhi to validate our products, as external validation is essential. While collaborations between research institutes and higher education institutions (HEIs) are improving, they remain limited. Greater visibility and integration are needed to foster impactful research outcomes; a gap needs to be bridged. India's innovation ecosystem is changing. For instance, the number of unicorns has grown from 42 in 2017 to 111 in 2024. Many young entrepreneurs aim to turn their ideas into business models rather than just seeking jobs. This is evident in the rise of new coffee shop brands and startups. However, more support is needed for scientists to commercialise their inventions.

What are the key challenges in fostering innovation and establishing India as a global R&D hub?

Currently, manufacturing contributes only 26% to India's GDP. Industries need to double their



production to grow, and true innovation is essential. However, research contributions are still limited. Industry should define the problem statements, and research institutes should collaborate to address them.

There is also a gap in scientists' soft skills, which hampers their ability to promote their innovations. Events like the IISF are crucial to showcasing research products and enabling industries to adopt them. Scaling research products is another challenge. Private enterprises excel at scaling because they invest money and act quickly, while scientists often need more marketing skills to bring innovations to market. Collaborations with marketing teams could bridge this gap.

What are the key research focus areas of CSIR that address climate change?

We have expanded our focus beyond Environmental Science and have recently started an Energy Division. In Biotechnology, one of our recent successes is vegan leather. We have developed a method to convert cactus fibres into leather, offering an alternative to traditional leather, which is a significant driver of animal slaughter. Our goal is to increase the value of agricultural commodities while reducing the environmental impact. Vegan leather has a 100% profit margin, and our technology surpasses others in this field. We have also developed a machine that converts rice husk into cutlery, and this technology has already been transferred to more than 20 companies. Another area of focus is energy conversion. We are developing technology to harness indoor light and convert it into energy, aiming for applications such as powering devices at airports.

How will the industry integration boost innovation?

NIIST, previously focused on basic science, has now successfully linked research and industry, operating as a business model. For example, we are working on biomedical waste conversion. Currently, biomedical waste from hospitals is incinerated, with hospitals incurring costs of Rs 10 per bed, contributing to a larger carbon footprint. Our solution converts biomedical waste into soil additives. All India Institute of Medical Science (AIIMS) will validate this technology before we present it to the government. The technology is fully automated,



requiring no human intervention. We are in the testing phase and monitoring the machine's performance, with interest from three to four countries to purchase this technology.

What innovative solutions have you developed as a chemical engineer and food technologist?  
I have developed a 3D food printer capable of printing snacks. Additionally, I created an artificial human digestive system that can test low-GI biscuits without the need for human trials. This system simulates the stomach and intestine, allowing researchers to observe the impact of foods on blood sugar levels.

We are also working on fortified low-GI rice that helps control blood sugar by enabling the body to adjust naturally. I was selected for this year's Tata Transformation Prize and plan to use the prize money to further research on low-GI rice.



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