

Indian Labs Forge Path to Greener Future

Finding Sustainable Alternatives to Plastic

World population is projected to increase by over 2 billion in the next 30 years, reaching over 9.5 billion by 2050 and potentially 10.4 billion by the mid-2080s. This growth drives the need for more food and essentials. As middle-class incomes rise, lifestyles evolve towards luxury, with increased spending on ready-to-consume items like ready-to-eat food, necessitating efficient packaging for safety and convenience.

Plastic has been the most commonly used material for packaging. Today, due to its excessive use without evaluating the consequences, plastic pollution has reached at alarming levels, with staggering amounts of plastic waste polluting our oceans, rivers, and landfills. Single-use plastics, in particular, contribute significantly to this crisis, taking hundreds of years to decompose and releasing in ecosystem harmful toxins during the process. From packaging to household items, plastic has infiltrated nearly every aspect of modern life, exacerbating environmental degradation and endangering countless species.

Hence, Indian laboratories are conducting extensive research to reduce, recycle and reuse plastic products. A number of alternatives to plastic products have also been developed by the scientists. Explained below is a brief outline of R&D innovations made by laboratories of the Council of Scientific and Industrial Research (CSIR).



CSIR-NIIST's Initiatives

CSIR-National Institute for Interdisciplinary Science and Technology (NIIST) based in Thiruvananthapuram, Kerala, has developed remarkable eco-friendly products from biodegradable coir-based pellets made out of coconut husk. These products in the form of garden pots, decomposable core plugs for textile industry, and biodegradable drain cells, serve as an ultimate solution to conventional plastics. The institute has also made biodegradable cutlery out of agricultural waste as an alternative for single-use plastics.

Innovations of CSIR-CFTRI

Paper Alternatives for Processed Food Packaging: CSIR-Central Food Technological Research Institute (CFTRI), based in Mysore,

Kamataka, and the Indian Pulp and Paper Technical Association (IPPTA) have forged collaboration for developing paper alternatives to single-use plastics. CSIR-CFTRI's Food Packaging Technology Department has been working on various food processing techniques that include active, intelligent, and biodegradable packaging. The department conducts R&D projects in food packaging, and works on the food packaging materials' safety evaluation, and foods' shelf-life analysis. As part of the collaboration, CFTRI holds the responsibility of looking after the statutory requirements, product specifications, paper specifications, and forthcoming challenges. The IPPTA, on the other hand, will be implementing the initiatives undertaken by the CFTRI and challenges that might be encountered in achieving the objectives. The initiative aligns with the government's strategy to phase out single-use plastic.

Freshness Keeper Paper for Cut Flowers: The global floriculture market is a flourishing market, but fresh-cut flowers face challenges due to their perishable nature and limited shelf life, leading to post-harvest losses. Inefficient post-harvest facilities exacerbate these losses, including poor storage, lack of cold storage and pack house facilities, and inadequate transport options. While various technologies exist to extend shelf life, some are impractical for everyday use.

Transportation and export pose significant challenges for maintaining the quality and freshness of cut flowers. Therefore, CFTRI has developed the 'Freshness Keeper Paper' - a patented technology that is cost-effective, chemical-free, natural bioactive extract-based, specifically tailored for cut rose flowers. This innovation aims to preserve the freshness of cut roses during transportation, cold storage, logistics, and export without disrupting the standard protocols.

Leaf Cup Machine: Traditionally, forest and agricultural materials like leaves, leafy sheaths, and pseudostems were utilised for storing or serving food. Through physico-chemical studies, it was discovered that these materials, including banana, beata, baubinia, and areca nut sheaths, possess superior functional properties compared to paper. This paved the way for their conversion into small utility items like cups and trays, serving as eco-friendly alternatives to modern paper and plastic materials.

Initial market samples of dry banana and beata leaves revealed microbial loads, prompting the development of a solution: a brief treatment in a hypo-chlorite solution significantly reduced microbial contamination.

INTERVIEW

Dr. Sridevi Annapurna Singh,
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Q: Kindly elaborate on the Freshness Keeper Paper developed by CSIR-CFTRI and its significance in preserving cut rose flowers during transportation and storage?

A: The Freshness Keeper Paper is a breakthrough innovation aimed at maintaining the freshness of cut rose flowers during their journey from farm to market. This chemical-free paper, when wrapped around the flowers, creates a protective barrier that enhances their quality and extends their shelf life by up to twofold. By mitigating the effects of transportation and storage on the flowers, this technology indirectly improves the efficiency of the supply chain, particularly benefiting exporters.

Q: How does the Leaf Cup Machine developed by CSIR-CFTRI contribute to sustainable packaging solutions, and what are its key features?

A: The Leaf Cup Machine represents a significant stride towards sustainable packaging alternatives. It is a simple, pedal-operated device that minimises power consumption, requiring only 300 watts of electric power for its heating units. This machine can be easily operated on domestic power lines, making it accessible in rural areas where electricity is available. By utilising abundant leaf resources such as banana, beata, baubinia, and areca nut palm sheaths, it manufactures leaf cups and plates that boast superior hygiene standards. This not only reduces reliance on single-use plastics but also promotes the utilisation of biodegradable materials in packaging.

Q: How has CSIR-CFTRI's initiatives impacted employment generation, and what are the socioeconomic benefits associated with it?

A: CSIR-CFTRI's initiatives have had a remarkable impact on employment generation, providing livelihood opportunities for over 10 lakh families. Through sustainable packaging solutions like the Leaf Cup Machine, individuals can earn Rs. 500 per day for 200 days annually, amounting to an annual income of Rs. 1 lakh per family. To date, this cumulative income per family stands at an impressive Rs. 40 lakhs. Additionally, the socio-economic impact of these initiatives is substantial, with an estimated cumulative value of approximately Rs. 4 lakh crores. This underscores the transformative potential of sustainable technologies in fostering economic empowerment and environmental stewardship simultaneously.

Q: What efforts are being made to ensure the long-term success of these initiatives?

A: CSIR-CFTRI is continuously working on the development of various aspects to sustain the initiatives. This includes the ongoing refinement and advancement of biodegradable polymers-based food packaging materials and the exploration of paper as an alternative material. We are also engaged in the development of bioplastic food packaging materials, active and intelligent packaging solutions, and the synthesis of food-safe additives for bioplastics. Furthermore, we are innovating in the realm of sustainable utensils, such as edible-based spoons and cutlery made from millet and millet-processing wastes. Additionally, we are committed to developing new analytical techniques to ensure the safety evaluation of biodegradable plastic materials, thus ensuring the long-term success and effectiveness of these solutions.

CSIR-NEERI Initiatives

The CSIR-National Environmental Engineering Research Institute (NEERI) and other collaborating organisations have unveiled a comprehensive plan aimed at tackling India's plastic waste crisis. The National Circular Economy Roadmap outlines strategies to enhance the repair, re-use, and recycle of plastic waste, addressing a critical issue in one of the world's largest polymer-producing nations.

This roadmap envisions a future where, by 2035, around two-thirds of plastic waste will be recycled, leading to a gradual phasing out of single-use plastics. Instead of being discarded, plastic waste will be transformed into valuable resources, thereby reducing greenhouse gas

emissions and improving air quality.

The roadmap identifies seven key elements of a circular economy approach, including the development of supportive infrastructure, effective recycling processes, consistent regulatory compliance, promotion of sustainable consumption habits, fostering collaboration in production and design for circularity, raising awareness, and ensuring readiness for implementation. Together, these elements form a holistic strategy to address India's plastic waste challenges and transition towards a more sustainable future.

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Employment Generation by Leaf Cup Manufacturing