

ALTERNATIVE TO SINGLE-USE PLASTICS

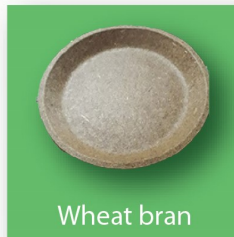
BIODEGRADABLE PLATES, TAKE AWAY CONTAINERS & CUTLERIES
FROM AGRO-RESIDUES AND BIOMASS



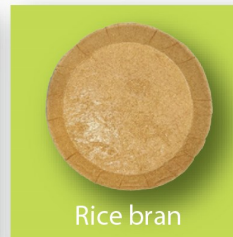
CSIR-NATIONAL INSTITUTE FOR INTERDISCIPLINARY
SCIENCE AND TECHNOLOGY (CSIR-NIIST)
THIRUVANANTHAPURAM

BIODEGRADABLE PRODUCTS FROM AGRO-RESIDUES (ALTERNATIVE TO SINGLE USE PLASTICS)

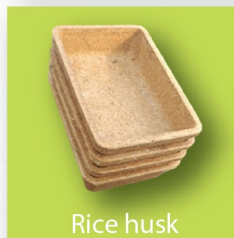
CSIR-NIIST has developed several biodegradable products like plates, cups, bowls, cutleries, straws etc. from different types of agro-residues for replacing single-use plastics in food packaging applications.



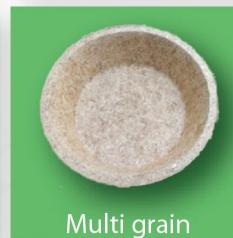
Wheat bran



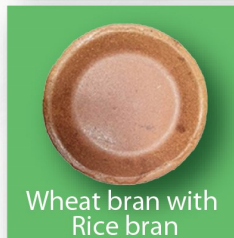
Rice bran



Rice husk



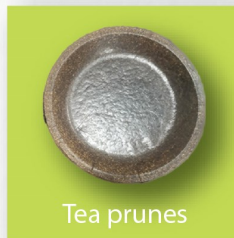
Multi grain



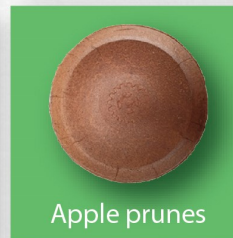
Wheat bran with
Rice bran



Coconut waste



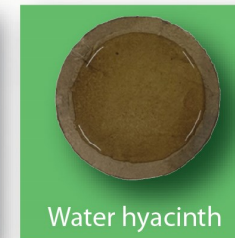
Tea prunes



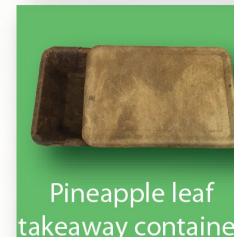
Apple prunes



Tea waste



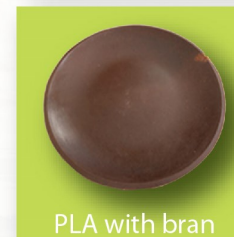
Water hyacinth



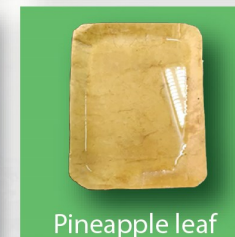
Pineapple leaf
takeaway container



PLA with prunes



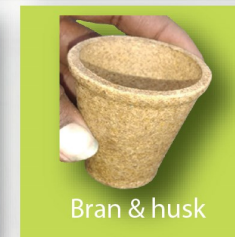
PLA with bran



Pineapple leaf



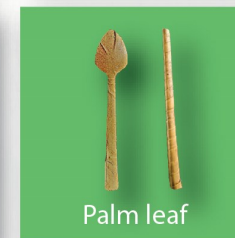
PBAT with husk



Bran & husk



Banana stem



Palm leaf

RAW MATERIALS

(Agro residues & Bio mass)

- Rice (Straw, Bran, Husk)
- Wheat (Straw, Bran, Flake)
- Coconut (Coir, De oiled cake, Milk residue, coconut leaf)
- Sugar cane (Bagasse)
- Tea (Prunes & Waste)
- Eucalyptus Prunes
- Pineapple (Leaves, Peel)
- Banana (Pseudo stem)
- Sea food (Prawn shell, Crabshell)
- Water hyacinth
- Fruits and Vegetable peels
- Palm leaf and plant fibers
- Apple (Prunes, Peel)
- Corn (Husk, Straw)



PRODUCTS DEVELOPED

- Plates (Various Sizes)
- Small bowls (250 - 1000 ml)
- Spoon, fork and knives
- Take away containers (350 - 1000 ml)
- Chopsticks
- Tumbler glasses (75 - 250 ml)
- Ice cream cups and Jam cups
- Trays and boards
- Straws
- Packaging containers/boxes
- Egg trays



PRODUCT FEATURES

- Completely biodegradable
- Can be used for hot & cold food
- Coated with plant oil based bio-resins
- Hydrophobicity & moisture resistant
- Single use item
- Microwave friendly
- Convertable to cattle/poultry/fish feed after use
- Sufficient strength to hold food
- Safe to use at any place or occasion
- Shelf life up to one year



SCIENTIFIC STUDIES CONDUCTED

- Biodegradable Test (ISO 14855-2:2018) and eco-toxicity analysis (ASTMD3987-12)
- Shelf-life studies (yeast, mold, fungi) (ISO 16779:2015)
- Toxicology studies (in-vitro and in-vivo)
- Colour (ISO 16779:2015)
- Surface chemical composition, morphology, wetting properties (SEM, TEM, XPS,)
- Water retention and heat retention test
- Wetting studies (contact angle goniometry, water & oil)
- Mechanical properties of finished product (ISO 13061-5:2020)
- Fractography analysis
- Leakage proof, bursting and tearing properties
- Sensory properties of food packed in the developed container at different conditions (ISO 16779:2015)

TECHNICAL DETAILS

REQUIREMENT	AUTOMATIC PROCESS	SEMI AUTOMATIC/MANUAL PROCESS
Electricity consumption	~50 to 70 kWh	~30 to 50 kWh
Investment requirement	~ 60 to 80 lakhs	~40 to 50 lakhs ~25 to 30 lakhs
Manpower	~2 to 3	~4 to 5
Production capacity per day	10000 plates	7000/2500 plates
Area required	1000-1500 Sq. feet for setting up of a 500kg processing plant	
Cost of a final product *	~Rs 1.5-2.0 for a 10 inch plate of weighing 20 to 30 grams	

* Conditions applicable : depends upon raw materials selected/type of process/type of product

RECOGNIZATION/AWARDS

- 'CSIR Award for S&T Innovations for Rural Development (CAIRD)' for the year 2020.
- Recognized as Societially relevant Rural Technology by Unnath Bharath Abhiyan, Govt. of India

ADVANTAGES OF NIIST KNOWHOW

- Less unit operations
- Easy to set-up the production unit
- Minimum production cost
- Environment friendly production with less/zero effluents
- Reusable as animal feed / compost manure

SOCIETAL BENEFITS OF TECHNOLOGY

- Replacement of single use plastic
- Rural & Women empowerment
- Sustainable through remanufacturing, reuse & recycling
- Waste utilization
- Additional income for farmers
- Boosting to the farmers for enhancing the production and cost of agri crops
- Highly relevant to the "Atmanirbhar Bharat", "Make in India", "Innovate in India", "Swatch Bharat Mission"
- In line with the mission of "doubling the farmer's income by 2022"

MARKET POTENTIAL

For serving & take away food items in

- Railway Stations & in Trains
- Air Ports & Airways
- Food Courts at Shopping Malls, IT Parks, Amusement Parks, Mega/giga Factory Canteen etc.
- Fast Food Restaurants, Hotels, Premium Resorts, Picnic Spots, Bakeries
- Street Vendors
- Canteens and Cafeterias of Offices, Educational Institutions, Companies, Factories, Hospitals
- Tourist/Pilgrim Centres

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